Phytocoenologia Vol. 43 (2013), Issue 1-2, 67–100
Stuttgart, June 2013

Article

Wetland vegetation of the class Phragmito-Magno-Caricetea in central Italy

by Flavia LANDUCCI, Perugia, Italy and Brno, Czech Republic, Daniela GIGANTE, Roberto VENANZONI, Perugia, Italy & Milan CHYTRÝ, Brno, Czech Republic

with 5 figures, 5 tables and 2 electronic appendices

Abstract: A survey and a formalized phytosociological classification of the marsh vegetation of the class Phragmito-Magno-Caricetea in central Italy is presented. Formal definitions of the majority of wetland associations recorded from the Italian territory were defined using the Cocktail method and applied to a large data set of vegetation plots extracted from the database VegItaly (hosted by the web database system "anArchive"). A total of 43 associations belonging to seven alliances and four orders were recognized. Detrended correspondence analysis (DCA), species indicator values and altitude were used to visualize ecological differences between the associations. Altitude, nutrient status and soil reaction were identified as the main environmental gradients responsible for diversification and distribution of the Phragmito-Magno-Caricetea communities in central Italy.

Keywords: Cocktail method, distribution, ecology, formalized classification, marsh vegetation, phytosociology, syntaxonomy, vegetation database

Introduction

Wetland vegetation is a constant component of landscapes in the temperate zones (BRINSON & MALVÁREZ 2002). Many wetland plants have very broad geographical ranges and, as a result, the physiognomy and structure of wetland vegetation is similar in different parts of the world. However, regional distribution and local zonation of wetland vegetation types depend on many factors including climate, geology, hydrogeology, topography and human impact (KEDDY 2000). Both macro- and microclimate affect, directly or indirectly, the water regime, decomposition of organic matter and the amount of minerals and nutrients in water and soil. Anthropogenic factors also influence all components of the wetland ecosystems including the structure of the distribution pattern of vegetation. Bedrock and topography influence chemical and physical characteristics of soils, groundwater levels and runoff patterns.

Although often severely fragmented, wetlands are rather common in the Italian landscape, particularly in the lowlands, but also in hilly and mountainous areas. A large part of Italian wetland vegetation is represented by the phytosociological class Phragmito-Magno-Caricetea. This class includes species-poor stands of various-sized, emergent, perennial grasses or sedges, growing both in fresh and brackish water and occurring in marshes, on riverbanks, the shores of natural and artificial lakes and in pools. It is usually classified according to the physiognomy determined by the size and life forms of dominant species. Several local studies of this vegetation have been published in Italy, including proposals for different vegetation types (e.g. BUCHWALD 1994; VENANZONI & GIGANTE 2000; BIONDI et al. 2002; LASTRUCCI et al. 2007; 2010a), or descriptions of the diversity and ecology of lakes (e.g. GRANETTI 1965; ORSOMANDO & PEDROTTI 1986; AVENA & SCOPPOLA 1987; SCOPPOLA et al. 1990; IBERITE et al. 1995; VENANZONI et al. 2003) and streams (e.g. CORBETTA & PIRONE 1989; BALDONI & BIONDI 1993; BIONDI et al. 1997, 1999; ANGIOLINI et al. 2005; LASTRUCCI et al. 2010b; CESCHIN & SALERNO 2008). Specific wetland systems such as the karst plains have also been studied, though in less detail (CORTINI PEDROTTI et al. 1973; PEDROTTI 1976, 1992; 1982; PEDROTTI & CORTINI PEDROTTI 1982; PIRONE 1987; VENANZONI 1992). Complex climatic and geologic patterns and a strong human impact in Italy determine the presence of very diversified wet environments, whose peculiar zonation has often given rise to discordant syntaxonomical interpretations.

Phytosociological classification of vegetation has a long tradition in Italy, but only recently have large electronic databases of vegetation plots from this country become available (VENANZONI et al. 2012). This makes it possible to synthesize data and concepts from numerous local studies and develop national schemes of vegetation classification based on the formal analysis of real data. For practical reasons, such studies should as far as possible preserve the elements of the established traditional vegetation classification as much as possible, but at the same time they should reject or adjust those vegetation units that are not supported by the data, or propose new units if there is evidence for them. Commonly used unsupervised multivariate statistical methods often fail to

DOI: 10.1127/0340-269X/2013/0043-0545
www.borntraeger-cramer.de
0340-269X/2013/0043-0545 $ 15.30

serve this purpose (Kočí et al. 2003; De Cáceres et al. 2009; Schmidtlein et al. 2010). Therefore we used the Cocktail method (Bruelheide 1995, 2000), which is capable of producing a formalized vegetation classification corresponding to the traditional expert-based classification of the Braun-Blanquet approach. In the present paper we apply this method in the modified version proposed by Kočí et al. (2003) to a large data set of vegetation plots extracted from the national database VegItaly (Venanzoni et al. 2012).

Based on the main national and European literature and a considerable amount of unpublished data, the purposes of this work are (1) to summarize the knowledge about emergent perennial wetland vegetation in central Italy and (2) to create a formalized classification of this vegetation and develop formal definitions for individual vegetation types. This study is the first attempt in Italy to develop a fully formalized vegetation classification for a broad vegetation type and across a large area.

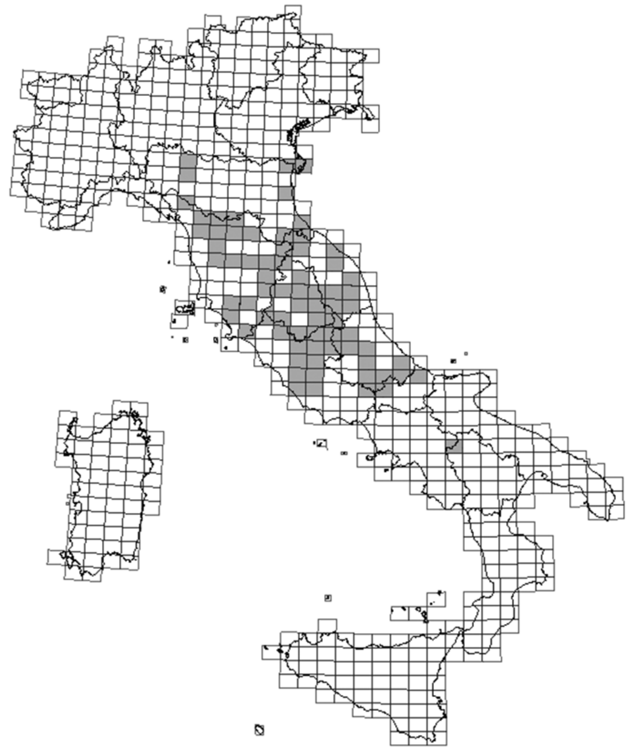

Fig. 1. Distribution map of the relevés of wetland vegetation used. The cells in the grid are of 20' longitude and 12' latitude, i.e. approximately 27×22 km (corresponding to the 1:50 000 UTM-ED50 map).

Material and methods

Data set

For this work a data set of 6,543 relevés (vegetation plots), including different vegetation types (herbaceous and forest vegetation, not only marsh vegetation) of central Italy, were taken from the web archive VegItaly (Venanzoni et al. 2012), hosted in the database system "anArchive" (www.anarchive.it; Panfili et al. 2004), with the aim of producing formal definitions of the associations of Phragmito-Magno-Caricetea using the Cocktail method. All the relevés, which originated from both published and unpublished sources, were made by different authors by applying the classical Braun-Blanquet approach or its modern extensions (Braun-Blanquet 1964; Dengler et al. 2008). This data set included 1,600 relevés of wetland vegetation, which are the object of this study. The remaining relevés of other vegetation types were used to calculate the fidelity of species to the associations, giving the results more general validity. 70% of these relevés have been published in 39 papers in national or international journals over the last 30 years, while the remaining 30% are unpublished relevés. The complete list of relevés used and the database identification numbers are reported in App. 1.

The data set includes relevés from the area between the Po River Plain and Basilicata Region (40°57'–44°00' N; 10°00'–15°36' E; Fig. 1, App. 2). The area covers diverse, both carbonate and silicate bedrocks. According to the global bioclimatic classification system there are two distinct macrobioclimates, Mediterranean and Temperate, and different bioclimatic belts from thermomediterranean to subalpine (Rivas-Martínez 2004; Blasi & Frondoni 2011).

Data resampling based on geographical distribution and vegetation types was necessary to reduce the effects on the analyses of uneven distribution of relevés across the study area. In fact, some well-known localities and widespread plant communities were represented by many relevés, while rare vegetation types were documented by only a few relevés. The resampling was performed using the Heterogeneity-Constrained Random (HCR) resampling algorithm (Lengyel et al. 2011) with Euclidean distance on square-root transformed percentage covers to measure dissimilarity in species composition between relevés. The resampling was applied after stratifying the data set based on bibliographical sources, geographical location and assignment of relevés to syntaxa by their authors. We used "macro-locality", defined as geographical district identified by similar geomorphological characteristics, as the geographical unit for resampling. For example, rivers were divided into at least three macro-localities (headwaters and upper course; middle course; lower course and delta). A maximum of 10 relevés per vegetation type (as indicated by the authors) and per macro-locality were resampled. After resampling the data set contained 6,083 relevés.

Table 1. Sociological species groups used in the Cocktail classification of the class Phragmito-Magno-Caricetea. The phi coefficient (in brackets) is calculated on the resampled data set of 6,083 relevés including all vegetation types; it expresses the fidelity of each species of the group to the relevés that contain this group.

Group name	Species (phi value)	No. of relevés
Alopecurus rendlei	*Alopecurus rendlei* (0.79), *Trifolium fragiferum* (0.73), *Hordeum secalinum* (0.71), *Ranunculus velutinus* (0.67)	120
Cynosurus cristatus	*Cynosurus cristatus* (0.79), *Trifolium pratense* (0.77), *T. repens* (0.71), *Lolium perenne* (0.69)	330
Eleocharis palustris	*Eleocharis palustris* (0.63), *Persicaria amphibia* f. *terrestris* (0.46), *Alisma plantago-aquatica* (0.42)	155
Helosciadium nodiflorum	*Veronica anagallis-aquatica* (0.69), *Helosciadium nodiflorum* (0.60), *Nasturtium officinale* (0.52), *Glyceria notata* f. *terrestris* (0.52)	305
Mentha aquatica	*Lycopus europaeus* (0.65), *Mentha aquatica* (0.58), *Carex pseudocyperus* (0.50)	288
Persicaria lapathifolia	*Persicaria lapathifolia* (0.56), *Bidens tripartitus* (0.52), *Echinochloa crus-galli* (0.52), *Xanthium orientale* subsp. *italicum* (0.49), *Bidens frondosus* (0.39), *Persicaria dubia* (0.36)	167
Ranunculus flammula	*Ranunculus flammula* (0.78), *Veronica scutellata* (0.76), *Carex acuta* (0.56)	81
Ranunculus sardous	*Mentha pulegium* (0.75), *Ranunculus sardous* (0.61), *Oenanthe fistulosa* (0.41)	63
Tetragonolobus maritimus	*Tetragonolobus maritimus* (0.80), *Epipactis palustris* (0.63), *Typha minima* (0.53)	19
Urtica dioica	*Urtica dioica* (0.70), *Calystegia sepium* (0.54), *Galium aparinae* (0.50), *Eupatorium cannabinum* (0.41)	525

Data analysis

The resampled data set was analysed using the Cocktail method (Bruelheide 1995, 2000) in the modified version proposed by Kočí et al. (2003), with the aim of producing a formalized version of the traditional expert-based vegetation classification (Bruelheide & Chytrý 2000). All the resampling procedures and analyses were performed using the JUICE 7.0 software (Tichý 2002). The work was organized in four steps. In the first step sociological species groups (Table 1) were defined, composed of species with the statistical tendency to occur together in relevés (Bruelheide 1995, 2000; Kočí et al. 2003). These species were proposed based on our field knowledge and the strengths of their statistical associations with other species were quantified using the *phi* coefficient (Sokal & Rohlf 1995; Chytrý et al. 2002). In the second step formal definitions of phytosociological associations were created by combining species cover values and species groups using the logical operators AND, OR and NOT (Bruelheide 1997). Sociological species groups were considered to be present in a relevé only if the relevé included at least half of the species contained in that group. In the third step, formal definitions of associations deriving from the second step were applied to the relevé data set in order to classify it. In the fourth step, diagnostic, constant and dominant species were determined for each defined association. Diagnostic species of the associations were determined using the *phi* coefficient, measuring the fidelity of species to a particular association (Sokal & Rohlf 1995; Chytrý et al. 2002). Only species with a *phi* coefficient higher than 0.30 and a probability of the observed pattern of species occurrence under random expectation lower than 0.01 (Fisher's exact test) were considered to be diagnostic for each association. During this step the number of relevés for each association was virtually standardized to 5% of the total data set, to remove the dependency of the *phi* coefficient values on the proportion of relevés belonging to particular associations (Tichý & Chytrý 2006). Constant species were defined as those with a frequency > 30% inside the vegetation unit. Dominant species were defined as those occurring in at least 10% of relevés of a vegetation unit with a cover value > 25%.

Finally the Cocktail classification was summarized in a computer expert system using the complete data set of 6,543 relevés in order to classify the relevés excluded by the resampling. Relevés corresponding to none or more than one formal definition (and vegetation unit), were compared with the groups of relevés already assigned using the Frequency-Positive Fidelity Index (FPFI) (Tichý 2005).

Detrended correspondence analysis (DCA; Hill & Gauch 1980), applying the square-root transformed percentage cover values was performed using the R program, library "vegan", operated through the JUICE program to visualize environmental similarities among the analysed plant communities. The associations were compared with respect to their altitudinal distribution and indicator values (Ellenberg-type indicator values for Italian species compiled by Pignatti 2005).

The results obtained were compared with the main national and international vegetation classifications. The bibliographic search was based on the LISY database (www.scienzadellavegetazione.it/sisv/lisy/index.jsp – Biondi et al. 1996, 1997; Bracco 2001; Bracco et al. 2007), integrated with the most recent literature. In addition, a list of associations of the class Phragmito-Magno-Caricetea reported in the literature from all the remaining parts of Italy (Table 3) was compiled with the aim of placing the classification obtained for central Italy within the national framework and to facilitate future work on both a national and international scale.

Nomenclature

Species taxonomy and nomenclature were unified according to the check-list of Italian vascular plants (Conti et al. 2005). Obvious cases of species misidentifications occurring in the published relevés were corrected in accordance with the most recent taxonomic revisions (e.g. in some cases *Carex cuprina* was corrected to *C. vulpina,* or *Cirsium palustre* to *Cirsium creticum* subsp. *triumfetti*). Both the original data and their corrections are stored and visible in VegItaly (www.anarchive.it). Syntaxonomy and nomenclature largely match with the recent revision undertaken within the project *Vegetation of the Czech Republic* (Šumberová et al. 2011); syntaxon names follow the International Code of Phytosociological Nomenclature (Weber et al. 2000).

Results

Species groups and formal definitions

Ten sociological species groups were combined to create formal definitions of associations (Table 1). A total of 43 associations belonging to seven alliances of the class Phragmito-Magno-Caricetea were distinguished and defined using the Cocktail method: 12 of these were assigned to Phragmition australis, eight to Eleocharito palustris-Sagittarion sagittifoliae, one to Phalaridion arundinaceae, eight to Glycerio-Sparganion, one to Carici-Rumicion hydrolapathi, three to Magno-Caricion elatae and 10 to Magno-Caricion gracilis. By applying the expert system to the complete data set of 6,543 relevés, a total of 1,538 relevés were classified. Of these, 1,399 were assigned to the associations using the Cocktail formulas, and the unclassified relevés were subsequently assigned using the Frequency-Positive Fidelity Index (FPFI). Most of the other relevés belonged to other classes than Phragmito-Magno-Caricetea.

The formal definitions are presented in Table 2 along with the numbers of relevés that met the definition criteria. In most cases these numbers are roughly proportional to the occurrence frequency of individual associations in the study area.

Ordination and ecological preferences

Similarity patterns of the Phragmito-Magno-Caricetea communities are summarized in five ordination diagrams of detrended correspondence analysis (DCA) (Figs. 2 and 3). A spider plot of all relevés included in the class Phragmito-Magno-Caricetea (Fig. 2) shows the relationships between the four orders, Phragmitetalia australis, Oenanthetalia aquaticae, Nasturtio-Glycerietalia and Magno-Caricetalia, and environmental variables. The other four diagrams (Fig. 3) represent in detail the associations included in each order and their relationship with the environmental variables.

Two main gradients in species composition, reflecting differences in altitude (axis 1) and nutrient requirements (axis 2), are obvious, but a certain differences of orders with respect to these environmental variables is also visible. Environmental variables become more important when considering the association level within the four orders (Fig. 3). Altitude, moisture and nutrients status mainly affect the diversification of associations within the orders Phragmitetalia australis and Magno-Caricetalia (Figs. 3A and 3D). Altitude appears as a very important environmental variable in all DCA diagrams. Moisture, nutrients requirements and soil reaction are among the most relevant indicator values. It is important to emphasize that altitude is a measured variable, while indicator values for relevés are calculated from species composition. For this reason the length of the altitude arrow should not be considered comparable with the length of arrows for indicator values (Zelený & Schaffers 2012). Relationships of individual associations to the environmental variables are shown in box-and-whisker plots (Figs. 4 and 5).

Syntaxonomical synopsis

Phragmito-Magno-Caricetea Klika in Klika et Novák 1941
Phragmitetalia australis Koch 1926
Phragmition australis Koch 1926
1. Schoenoplectetum lacustris Chouard 1924
2. Typhetum angustifoliae Pignatti 1953
3. Typhetum latifoliae Nowiński 1930

4. Typhetum laxmannii Nedelcu 1968
5. Typhetum domingensis Brullo, Minissale et Spampinato 1994
6. Phragmitetum australis Savič 1926
7. Phragmito-Typhetum minimae Trinajstić 1964
8. Mentho aquaticae-Typhetum minimae Venanzoni et Gigante 2000
9. Glycerietum maximae Nowiński 1930 corr. Šumberová, Chytrý et Danihelka in Chytrý 2011
10. Iridetum pseudacori Eggler ex Brzeg et Wojterska 2001
11. *Bolboschoenus maritimus* agg.-community
12. Schoenoplectetum tabernaemontani Soó 1947

Oenanthetalia aquaticae Hejný ex Balátová-Tuláčková, Mucina, Ellmauer et Wallnöfer in Grabherr et Mucina 1993

Eleocharito palustris-Sagittarion sagittifoliae Passarge 1964

13. Eleocharitetum palustris Savič 1926
14. Butometum umbellati Philippi 1973
15. Oenanthetum aquaticae Soó ex Nedelcu 1973
16. Alopecuro-Alismatetum plantaginis-aquaticae Bolbrinker 1984
17. Eleocharito-Alismatetum lanceolati Minissale et Spampinato 1985
18. *Bolboschoenus glaucus*-community
19. *Persicaria amphibia*-community
20. *Schoenoplectus pungens*-community

Nasturtio-Glycerietalia Pignatti 1953

Phalaridion arundinaceae Kopecký 1961

21. Rorippo-Phalaridetum arundinaceae Kopecký 1961

Glycerio-Sparganion Braun-Blanquet et Sissingh in Boer 1942

22. Glycerio-Sparganietum neglecti Koch 1926
23. Glycerietum fluitantis Nowiński 1930
24. Glycerietum notatae Kulczyński 1928
25. Nasturtietum officinalis Gilli 1971
26. Beruletum erectae Roll 1938
27. Helosciadietum nodiflori Maire 1924
28. Oenantho aquaticae-Rorippetum amphibiae Lohmeyer 1950
29. Leersietum oryzoidis Eggler 1933

Magno-Caricetalia Pignatti 1954

Carici-Rumicion hydrolapathi Passarge 1964

30. Mentho aquaticae-Caricetum pseudocyperi Orsomando et Pedrotti 1986

Magno-Caricion elatae Koch 1926

31. Caricetum elatae Koch 1926
32. Cladietum marisci Allorge 1921
33. Caricetum acutiformis Eggler 1933

Magno-Caricion gracilis Géhu 1961

34. Caricetum ripariae Máthé et Kovács 1959
35. *Mentha aquatica*-community
36. Cyperetum longi Micevski 1957
37. Phalaridetum arundinaceae Libbert 1931
38. Galio palustris-Juncetum inflexi Venanzoni et Gigante 2000
39. Leersio oryzoidis-Juncetum effusi Lastrucci, Paci et Raffaelli 2010
40. Caricetum gracilis Savič 1926
41. Caricetum vesicariae Chouard 1924
42. Caricetum acutiformi-paniculatae Vlieger et van Zinderen Bakker in Boer 1942
43. Caricetum vulpinae Nowiński 1927

Table 2. Formal definitions of associations/communities. For each association/community the formal definition and the number of relevés included in the definition are reported. Definitions were created using the resampled data set of 6,083 relevés, including different vegetation types from central Italy. Percentages indicate species cover.

Association/Community	Formal definition	No. relevés
1. Schoenoplectetum lacustris	*Schoenoplectus lacustris* > 25% NOT *Typha angustifolia* > 50%	55
2. Typhaetum angustifoliae	*Typha angustifolia* > 50% OR *(Typha angustifolia* > 25% NOT *Persicaria lapathifolia* Group)	38
3. Typhetum latifoliae	*Typha latifolia* > 25%	51
4. Typhetum laxmannii	*Typha laxmannii* > 25%	4
5. Typhetum domingensis	*Typha domingensis* > 25%	7
6. Phragmitetum australis	*Phragmites australis* > 50%	185
7. Phragmito-Typhetum minimae	*Typha minima* > 25% NOT *Tetragonolobus maritimus* Group	16
8. Mentho aquaticae-Typhetum minimae	*Typha minima* > 25% AND *Tetragonolobus maritimus* Group	9
9. Glycerietum maximae	*Glyceria maxima* > 50%	6
10. Iridetum pseudacori	*Iris pseudacorus* > 25% NOT *Glyceria maxima* > 50%	46
11. *Bolboschoenus maritimus* s.l.-community	*Bolboschoenus maritimus* s.l. > 25% NOT *Phragmites australis* > 50% NOT *Schoenoplectus tabernaemontani* > 50% NOT *Schoenoplectus lacustris* > 50% NOT *Agrostis stolonifera* > 50%	41
12. Schoenoplectetum tabernaemontani	*Schoenoplectus tabernaemontani* > 25%	21
13. Eleocharitetum palustris	*Eleocharis palustris* > 25% NOT *Alopecurus rendlei* Group NOT *Ranunculus ophioglossifolius* > 25% NOT *Schoenoplectus mucronatus* > 50% NOT *Schoenoplectus tabernaemontani* > 25% NOT *Carex hirta* > 25% NOT *Potamogeton natans* > 50%	51
14. Butometum umbellati	*Butomus umbellatus* > 25%	9
15. Oenanthetum aquaticae	*Oenanthe aquatica* > 25% NOT *Schoenoplectus lacustris* > 50%	2
16. Alopecuro-Alismatetum plantaginis-aquaticae	*Alisma plantago-aquatica* > 25% NOT *Eleocharis palustris* > 50% NOT *Glyceria notata* > 25%	8
17. Eleocharito-Alismatetum lanceolati	*Alisma lanceolatum* > 25%	2
18. *Bolboschoenus glaucus*-community	*Bolboschoenus glaucus* > 25%	2
19. *Persicaria amphibia*-community	*Persicaria amphibia* f. *terrestris* > 50% OR (*Persicaria amphibia* f. *terrestris* > 25% AND *Eleocharis palustris* Group) NOT *Carex distans* > 50%	18
20. *Schoenoplectus pungens*-community	*Schoenoplectus pungens* > 25%	3
21. Rorippo-Phalaridetum arundinaceae	*Phalaroides arundinacea* > 25% AND *(Urtica dioica* Group OR *Persicaria lapathifolia* Group*)* NOT *Salix alba* > 25%	11
22. Glycerio-Sparganietum neglecti	*Sparganium erectum* s.l. > 25% NOT *Carex elata* > 25% NOT *Carex pseudocyperus* > 25% NOT *Schoenoplectus lacustris* > 50% NOT *Salix alba* > 25% NOT *Typha latifolia* > 25% NOT *Carex cuprina* > 50%	109
23. Glycerietum fluitantis	(*Glyceria fluitans* f. *fluitans* 25% OR *Glyceria fluitans* f. *terrestris* > 25%) NOT *Eleocharis palustris* > 50%	15
24. Glycerietum notatae	*(Glyceria notata* f. *fluitans* > 25% OR *Glyceria notata* f. *terrestris* > 25%) NOT *Helosciadium nodiflorum* > 25% NOT *Sparganium erectum* s.l. > 25%	62
25. Nasturtietum officinalis	*Nasturtium officinale* > 50% OR [(*Nasturtium officinale* > 25% AND *Helosciadium nodiflorum* Group) NOT *Salix cinerea* > 25%]	62
26. Beruletum erectae	[*Berula erecta* > 25% OR (*Berula erecta* > 10% AND *Helosciadium nodiflorum* Group)] NOT *Iris pseudacorus* > 25% NOT *Petasites hybridus* > 50%	18
27. Helosciadietum nodiflori	(*Helosciadium nodiflorum* > 50% NOT *Urtica dioica* Group) OR (*Helosciadium nodiflorum* > 25% AND *Helosciadium nodiflorum* Group NOT *Typha latifolia* > 50% NOT *Nasturtium officinale* > 50%)	86
28. Oenantho aquaticae-Rorippetum amphibiae	*Rorippa amphibia* > 25%	9
29. Leersietum oryzoidis	*Leersia oryzoides* > 25%	3
30. Mentho aquaticae-Caricetum pseudocyperi	[*Carex pseudocyperus* > 50% OR (*Carex pseudocyperus* > 25% AND *Mentha aquatica* Group)] NOT *Phragmites australis* > 50%	44

Table 2. cont.

Association/Community	Formal definition	No. relevés
31. Caricetum elatae	*Carex elata* > 25% NOT *Phragmites australis* > 50%	41
32. Cladietum marisci	*Cladium mariscus* > 25% NOT *Molinia caerulea* subsp. *arundinacea 50%*	22
33. Caricetum acutiformis	[*Carex acutiformis* > 50% OR (*Carex acutiformis* > 25% NOT *Carex riparia* > 25% NOT *Salix cinerea* > 50%)] NOT *Cynosurus cristatus* Group	48
34. Caricetum ripariae	*Carex riparia* > 25% NOT *Phragmites australis* 50% NOT *Alnus glutinosa* 50% NOT *Galega officinalis* > 50% NOT *Salix alba* 50% NOT *Salix cinerea* > 50% NOT *Populus × canescens* > 50% NOT *Mentha aquatica* > 50% NOT *Iris pseudacorus* > 50%	69
35. *Mentha aquatica*-community	*Mentha aquatica* > 50% NOT *Carex pseudocyperus* > 25% NOT *Sparganium erectum* s.l. > 25%	13
36. Cyperetum longi	*Cyperus longus* > 50%	36
37. Phalaridetum arundinaceae	*Phalaroides arundinacea* > 25% NOT *Phragmites australis* > 50% NOT *Salix alba* > 50% NOT *Urtica dioica* Group NOT *Persicaria lapathifolia* Group	26
38. Leersio oryzoidis-Juncetum effusi	*Juncus effusus* > 25% NOT *Ranunculus repens* > 50% NOT *Juncus inflexus* > 25% NOT *Scirpus sylvaticus* > 25%	26
39. Galio palustris-Juncetum inflexi	*Juncus inflexus* > 25% NOT *Scirpoides holoschoenus* s.l. > 25% NOT *Mentha longifolia* > 5%	17
40. Caricetum gracilis	*Carex acuta* > 50% OR (*Carex acuta* > 25% AND *Ranunculus flammula Group* NOT *Carex vesicaria* > 25%)	52
41. Caricetum vesicariae	*Carex vesicaria* > 50% OR (*Carex vesicaria* > 25% NOT *Carex acuta* > 25%)	35
42. Caricetum acutiformi-paniculatae	*Carex paniculata* > 25%	13
43. Caricetum vulpinae	*Carex vulpina* > 25%	8

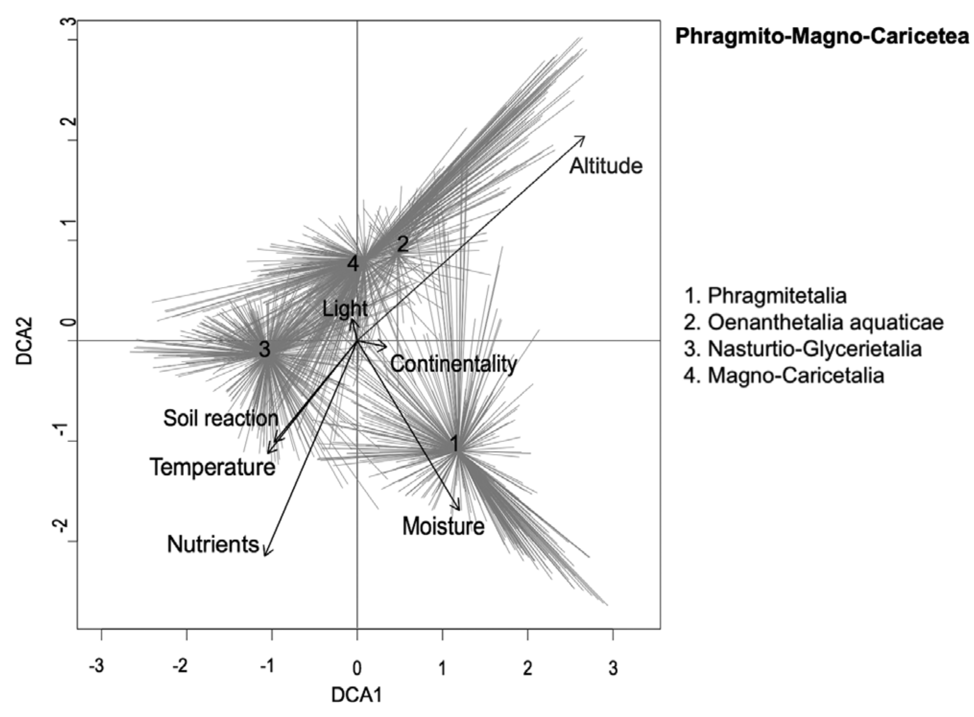

Fig. 2. DCA ordination diagram (axes 1 and 2) with passively plotted indicator values (averages for relevés) and altitude for the class Phragmito-Magno-Caricetea.

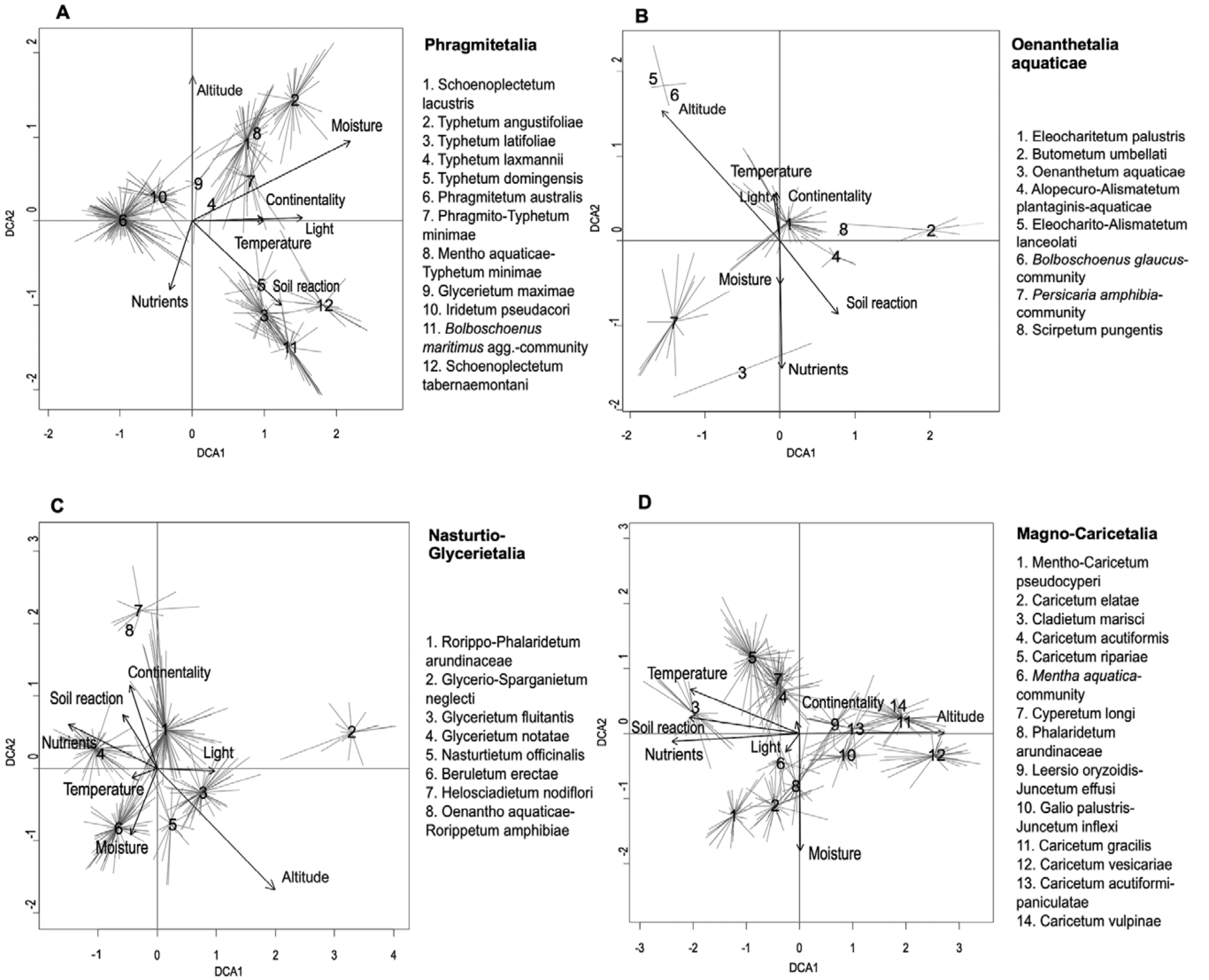

Fig. 3. DCA ordination diagrams (axes 1 and 2) for (A) Phragmitetalia, (B) Oenanthetalia aquaticae, (C) Nasturtio-Glycerietalia, and (D) Magno-Caricetalia with passively plotted indicator values (averages for relevés) and altitude.

A list of 20 associations belonging to Phragmito-Magno-Caricetea but not included in the analysed data set, mostly from northern and southern Italy, is reported in Table 3. Their names and syntaxonomic reference (as recorded by the respective authors), geographical distribution in Italy and main bibliographic sources are indicated. Three of these (Thelypterido palustris-Phragmitetum australis, Sparganietum erecti and Scirpetum compacto-litoralis) are partially or entirely included in other definitions (see below). The association Cypero-Caricetum otrubae, frequently also occurring in central Italy, was not included in the present revision because, based on its species composition and in accordance with other authors (Díaz González & Fernández-Prieto 1994; Rivas-Martínez et al. 2001), we assigned it to the class Molinio-Arrhenatheretea. Among the remaining 16 associations, some are not recorded from central Italy and probably do not occur there; others are mentioned in the literature for central Italy but relevés were not available for our analysis.

Descriptions of associations

The class Phragmito-Magno-Caricetea includes wetland vegetation dominated by emergent plants. In the present paper we distinguished 43 associations of this class and assigned them to seven alliances included in four orders (Table 4, 5). The orders are distinct both ecologically and structurally. The order Phragmitetalia australis includes associations dominated by tall perennial grasses, occurring partially submerged to emergent in marshes. The order Oenanthetalia aquaticae comprises communities of short emergent plants in still water. Nasturtio-Glycerietalia includes associations of short emergent plants, which grow in running water. The

Table 3. List of the associations of the class Phragmito-Magno-Caricetea, recorded from Italy but not included in the revision. *Associations partially or completely included in other vegetation units described in the text. **Associations not considered in the present study because belonging to another class.

Association	Order	Alliance	Distribution	References
*Scirpetum compacto-litoralis (Braun-Blanquet in Braun-Blanquet, Roussine et Nègre 1952) O. Bolòs 1962 corr. Rivas-Martínez, Costa, Castroviejo et E. Valdés 1980	Phragmitetalia Koch 1926 / Bolboschoenetalia compacti Dall et Hadač 1941 corr. Rivas-Martínez, Costa, Castroviejo et E. Valdés 1980	Scirpion compacto-littoralis Rivas-Martínez 1980	Southern and central Italy	Géhu et al. (1984); Biondi et al. (2004)
*Sparganietum erecti (Roll 1938) Philippi 1973	Nasturtio-Glycerietalia Pignatti 1953	Glycerio-Sparganion Br.-Bl. et Sissingh in Boer 1942	Northern, central and southern Italy	Marchiori & Sburlino (1986); Corbetta & Pirone (1990); Baldoni & Biondi (1993); Prosser & Sarzo (2003)
*Thelypterido palustris-Phragmitetum australis Kuiper ex van Donselaar et al. 1961	Phragmitetalia Koch 1926	Magno-Caricion elatae Koch 1926	Northern and central Italy	Arrigoni (1982); Pedrotti (1990, 1991)
**Cypero-Caricetum otrubae R. Tx. in R. Tx. et Oberd. 1958	Magno-Caricetalia Pignatti 1953	Magno-Caricion elatae Koch 1926	Southern and central Italy	Minissale & Spampinato (1995); Brullo et al. (2002); Venanzoni & Gigante (2000)
Bolboschoeno compacti-Cyperetum alopecuroidis Brullo et Sciandrello 2006	Scirpetalia compacti Hejný in Holub, Hejný, Moravec et Neuhäusl 1967 corr. Rivas-Martínez, Costa, Castroviejo et E. Valdés 1980	Scirpion compacto-littoralis Rivas-Martínez 1980	Southern Italy	Brullo & Sciandrello (2006)
Caricetum appropinquatae Aszód 1935	Magno-Caricetalia Pignatti 1953	Magno-Caricion elatae Koch 1926	Northern Italy	Venanzoni (1991)
Caricetum diandrae Jonas 1933	Phragmitetalia Koch 1926	Phragmition Koch 1926	Northern Italy	Pedrotti (1991)
Caricetum distichae Nowiński 1927	Magno-Caricetalia Pignatti 1953		Central Italy	Pedrotti (2001)
Caricetum hispidae Brullo et Ronsisvalle 1975	Magno-Caricetalia Pignatti 1953	Magno-Caricion elatae Koch 1926	Southern Italy	Brullo & Furnari (1976); Géhu & Biondi (1988); Brullo et al. (2002)
Caricetum rostratae Rübel 1912 / Caricetum rostratae (Dagys 1932) Balátová-Tuláčková 1963 / Caricetum rostratae Osvald 1923 [Probably synonyms of Equiseto fluviatilis-Caricetum rostratae Zumpfe 1929]	Magno-Caricetalia Pignatti 1953	Magno-Caricion elatae Koch 1926 / Caricion rostratae Balátová-Tuláčková 1963	Northern Italy	Sburlino (1986); Gentile et al. (1988); Ferrari & Manzi (1987); Caniglia et al. (1992); Aita et al. (1979); Prosser & Sarzo (2003); Pedrotti (1991); Venanzoni (1988); Balátová-Tuláčková & Venanzoni (1990)
Carici distantis-Schoenetum nigrescentis Brullo, Minissale, Scelsi et Spampinato 1993	Magno-Caricetalia Pignatti 1953	Magno-Caricion elatae Koch 1926	Southern Italy	Tomaselli (2004); Brullo et al. (1998); Brullo et al. (2002)
Cicuto virosae-Caricetum pseudocyperi Boer et Sissingh in Boer 1942	Phragmitetalia Koch 1926	Phragmition Koch 1926	Northern Italy	Anoé & Caniglia (1987)
Junco maritimi-Cladietum marisci Géhu et Biondi 1988	Scirpetalia compacti Hejný in Holub, Hejný, Moravec et Neuhäusl 1967 corr. Rivas-Martínez, Costa, Castroviejo et E. Valdés 1980	Scirpion compacto-littoralis Rivas-Martínez 1980	Southern Italy	Géhu & Biondi (1988); Corbetta & Pirone (1999); Géhu & Biondi (1996)
Peucedano-Calamagrostietum canescentis Weber 1978 [Probably synonym of Carici elatae-Calamagrostietum canescentis Jílek 1958]	Phragmitetalia Koch 1926	Magno-Caricion elatae Koch 1926	Northern Italy	Sartori & Bracco (1997); Gerdol (1987)
Polygono salicifolii-Phragmitetum Barbagallo, Brullo & Furnari 1979	Phragmitetalia Koch 1926	Phragmition Koch 1926	Southern Italy	Minissale & Spampinato (1990); Minissale & Spampinato (1995); Brullo et al. (1998); Tomaselli (2004)
Sagittario sagittifoliae-Sparganietum emersi Tüxen 1953	Phragmitetalia Koch 1926	Phragmition Koch 1926	Northern Italy	Marchiori et al. (1993); Marchiori & Sburlino (1997); Sartori & Bracco (1997); Tomaselli et al. (1994)
Schoenoplecto litorali-Cyperetum distachyi (Barbagallo, Brullo & Furnari 1990) Brullo et Sciandrello 2006	Scirpetalia compacti Hejný in Holub, Hejný, Moravec et Neuhäusl 1967 corr. Rivas-Martínez, Costa, Castroviejo et E. Valdés 1980	Scirpion compacto-littoralis Rivas-Martínez 1980	Southern Italy	Brullo & Sciandrello (2006)
Soncho maritimi-Cladietum marisci (Braun-Blanquet et O. Bolòs 1958) Cirujano 1980	Phragmitetalia Koch 1926	Phragmition Koch 1926	Central Italy	Vagge & Biondi (1999)
Scirpo-Juncetum subulati Géhu et al. 1992	Scirpetalia compacti Hejný in Holub, Hejný, Moravec et Neuhäusl 1967 corr. Rivas-Martínez, Costa, Castroviejo et E. Valdés 1980	Scirpion compacto-littoralis Rivas-Martínez 1980	Sardinia	Filigheddu et al. (2000)
Astero tripolii-Bolboschoenetum maritimi Filigheddu et al. 2000	Scirpetalia compacti Hejný in Holub, Hejný, Moravec et Neuhäusl 1967 corr. Rivas-Martínez, Costa, Castroviejo et E. Valdés 1980	Scirpion compacto-littoralis Rivas-Martínez 1980	Sardinia	Filigheddu et al. (2000)
Festuco-Elytrigietum athericae Brullo in Brullo et al. 1988	Phragmitetalia Koch 1926	Agrostio-Elytrigion athericae Brullo et Siracusa 1996	Sicily	Brullo & Siracusa (1996); Brullo et al. (1988)

Table 4. Synoptic table of the associations of the alliances Phragmition australis and Eleocharito palustris-Sagittarion sagittifoliae. In all synoptic tables, number represents constancy (percentage occurrence frequency). Diagnostic species of associations (with the phi value > 0.30) are indicated by shading. Dark shading indicates highly diagnostic species (with phi > 0.50). Values with frame but without shading indicate additional diagnostic species with phi < 0.30 (only in Phragmitetum australis). Fidelity was calculated using the data set of 6,083 relevés including both wetland and other vegetation types of central Italy. Species with a frequency lower than 10% in all columns of the table are not displayed.

Community number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
No. of relevés	55	38	51	4	7	185	16	9	6	46	41	21	51	9	2	8	2	2	18	3
Diagnostic species of Schoenoplectetum lacustris																				
Schoenoplectus lacustris	100	29	8	.	14	7	6	33	33	.	20	10	6	11	50	38	.	.	6	.
Diagnostic species of Typhetum angustifoliae																				
Typha angustifolia	16	100	4	.	.	5	13	22	.	.	10	.	2	.	.	25	.	.	11	.
Diagnostic species of Typhetum latifoliae																				
Typha latifolia	9	5	100	25	.	5	25	.	.	2	.	19	8	.	.	13	.	.	11	.
Diagnostic species of Typhetum laxmannii																				
Typha laxmannii	.	.	.	100	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Juncus subnodulosus	.	.	.	50	.	.	.	22	.	.	.	.	.	.	.	.	.	.	.	.
Diagnostic species of Typhetum domingensis																				
Typha domingensis	.	.	8	.	100	.	13	.	.	.	.	14	2	.	.	.	.	.	.	.
Diagnostic species of Phragmitetum australis																				
Phragmites australis	42	39	20	75	43	100	25	11	17	20	27	10	14	33	.	38	.	.	11	.
Diagnostic species of Phragmito-Typhetum minimae																				
Equisetum ramosissimum	.	3	6	.	.	1	56	44	.	.	2	14	.	.	.	.	.	.	.	.
Diagnostic species of Mentho aquaticae-Typhetum minimae																				
Tetragonolobus maritimus	.	.	.	.	.	.	.	89	.	.	.	.	.	.	.	.	.	.	.	.
Phleum nodosum	.	.	.	.	.	.	6	67	.	.	.	.	.	.	.	.	.	.	.	.
Lotus herbaceus	.	.	.	.	.	.	6	44	.	.	.	.	.	.	.	.	.	.	.	.
Genista tinctoria	.	.	.	.	.	.	6	56	.	.	.	.	.	.	.	.	.	.	.	.
Scirpoides holoschoenus s.l.	2	16	4	25	14	1	19	67	.	4	2	.	2	.	.	.	.	.	.	.
Diagnostic species of Glycerietum maximae																				
Glyceria maxima	7	.	2	.	.	.	.	.	100	4	.	.	.	.	.	.	.	.	.	.
Rorippa amphibia	7	.	4	.	.	1	.	.	50	2	.	.	.	.	50	.	.	.	17	.
Diagnostic species of Iridetum pseudacori																				
Iris pseudacorus	13	8	6	25	.	16	.	11	33	100	5	.	4	.	.	13	.	.	11	.
Diagnostic species of Bolboschoenus maritimus agg.- community																				
Bolboschoenus maritimus agg.	16	13	14	25	29	8	.	11	.	4	100	24	6	33	.	38	.	.	6	.
Diagnostic species of Eleocharitetum palustris																				
Eleocharis palustris	7	11	2	.	.	3	.	.	.	17	7	10	100	33	.	50	.	50	39	.
Diagnostic species of Butometum umbellati																				
Butomus umbellatus	9	.	.	.	.	2	.	.	.	.	5	.	2	100	.	.	.	.	.	.
Diagnostic species of Oenanthetum aquaticae																				
Oenanthe aquatica	5	.	.	.	.	2	.	.	17	.	.	.	.	11	100	.	.	.	17	.
Diagnostic species of Alopecuro-Alismatetum plantaginis-aquaticae																				
Alisma plantago-aquatica	18	18	35	.	29	5	19	11	17	26	12	19	33	11	50	100	.	.	28	.
Diagnostic species of Eleocharito-Alismatetum lanceolati																				
Lythrum hyssopifolia	.	.	.	.	.	.	.	11	.	.	.	.	.	.	.	.	100	50	.	.
Diagnostic species of Persicaria amphibia-community																				
Persicaria amphibia terrestrial ecophene	15	3	2	.	.	5	.	.	50	39	10	5	22	11	50	13	50	50	100	.
Diagnostic species of Scirpetum pungentis																				
Schoenoplectus pungens	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	100

Table 4. Continued

Community number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
No. of relevés	55	38	51	4	7	185	16	9	6	46	41	21	51	9	2	8	2	2	18	3
Other diagnostic species																				
Schoenoplectus tabernaemontani	.	11	22	25	86	2	13	11	.	.	12	100	2	11	.	.	.	.	6	.
Juncus articulatus	4	18	8	75	29	3	19	100	.	2	12	19	29	.	.	63	.	.	17	100
Bolboschoenus glaucus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100	100	.	.
Alisma lanceolatum	7	.	6	.	29	1	.	.	.	2	.	5	14	.	.	.	100	100	22	.
Epipactis palustris	2	3	.	50	.	.	.	78	.	.	.	.	4	.	.	.	.	.	.	.
Typha minima	.	3	2	50	.	1	100	100	.	.	.	.	.	.	.	13	.	.	.	.
Ranunculus trichophyllus	5	5	2	.	.	1	.	.	.	13	.	.	16	11	.	13	100	50	33	.
Potamogeton schweinfurthii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67
Other species																				
Sparganium erectum s.l.	31	3	10	.	.	7	.	.	33	22	.	14	8	22	50	13	.	.	6	.
Glyceria fluitans terrestrial ecophene	5	3	.	.	.	1	.	.	.	.	.	.	2	.	50	13	.	.	17	.
Callitriche palustris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	.	.	.	.
Glyceria notata terrestrial ecophene	4	3	2	.	.	.	.	.	.	33	.	.	22	.	.	.	.	.	6	.
Helosciadium nodiflorum	9	8	16	.	.	6	.	.	.	7	.	.	2	.	.	13	.	.	.	.
Leersia oryzoides	2	.	4	.	.	1	.	.	.	2	7	.	4	11	.	.	.	.	.	.
Bidens frondosus	7	.	8	.	.	11	.	11	17	9	17	10	6	22	.	.	.	.	.	.
Carex pseudocyperus	5	.	2	.	.	15	.	.	.	4	.	.	.	22	.	.	.	.	.	.
Lysimachia vulgaris	7	3	.	.	.	4	.	.	17	20	.	.	.	11	.	.	.	.	.	.
Carex acutiformis	.	.	4	.	.	5	6	.	.	4	.	.	.	.	.	.	.	.	.	.
Carex riparia	4	.	2	.	.	11	.	.	17	11	.	.	2	.	.	.	.	.	6	.
Juncus effusus	2	3	12	.	.	3	25	.	.	9	.	.	4	.	.	13	.	.	.	.
Carex vesicaria	2	.	.	.	.	.	.	.	.	20	.	5	4	.	50	.	.	.	.	.
Tussilago farfara	.	.	.	.	.	1	6	33	.	.	.	.	.	.	.	.	.	.	.	.
Pulicaria dysenterica	5	.	2	25	.	6	6	44	.	.	.	.	4	.	.	.	.	.	.	.
Daucus carota s.l.	.	.	.	.	.	1	13	11	.	.	2	.	.	.	.	.	.	.	.	.
Thalictrum flavum	.	.	.	25	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leucanthemum vulgare	.	.	.	.	.	.	.	56	.	.	.	.	.	.	.	.	.	.	.	.
Epilobium hirsutum	5	13	14	25	14	8	19	.	.	7	5	.	.	.	.	13	.	.	.	.
Ranunculus sardous	.	.	.	.	.	.	.	.	.	24	.	.	4	.	.	.	50	50	6	.
Solanum nigrum	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	13	.	.	.	.
Sonchus asper	.	.	2	.	.	2	.	.	.	.	2	.	.	.	.	13	.	.	.	.
Oenanthe fistulosa	.	.	.	.	.	2	.	.	.	13	.	.	.	.	.	.	.	.	.	.
Galega officinalis	.	3	2	25	.	4	.	.	.	2	.	.	2	.	.	.	.	.	.	.
Cirsium arvense	.	.	.	.	.	10	.	.	.	2	2	.	.	.	.	.	.	.	.	.
Rumex crispus	2	.	.	.	.	2	.	.	.	20	2	.	8	.	.	.	.	.	.	.
Carex cuprina	2	.	.	.	.	3	.	.	.	11	.	.	6	.	.	.	.	.	.	.
Potentilla reptans	.	.	2	.	.	2	.	33	33	7	.	.	4	.	.	.	.	50	17	.
Paspalum distichum	5	3	4	.	.	3	.	.	.	4	20	10	10	22	.	.	.	.	6	.
Lemna gibba	4	.	2	.	.	.	.	.	.	.	.	.	.	11	.	.	.	.	.	.
Nymphaea alba	4	5	.	.	.	1	.	.	17	2	.	.	.	.	.	.	.	.	.	.
Phalaroides arundinacea	9	.	4	.	.	8	.	.	33	9	7	.	.	11	.	.	.	.	22	.
Juncus inflexus	.	8	.	.	.	3	6	.	.	4	2	.	6	11	.	.	.	.	.	.
Leontodon hispidus	.	.	.	.	.	.	.	22	.	.	.	.	.	.	.	.	.	.	.	.
Schedonorus arundinaceus	.	.	.	25	.	1	6	22	.	2	.	.	.	.	.	.	.	.	.	.
Carex distans	.	3	.	.	.	.	13	22	.	2	.	.	2	.	.	.	.	.	.	.
Cirsium creticum s.l.	2	5	.	.	.	12	.	.	.	2	.	.	.	.	.	.	.	.	.	.
Molinia caerulea s.l.	.	.	.	.	.	1	.	33	.	.	.	.	.	.	.	.	.	.	.	.
Lemna minor	5	11	4	.	.	1	.	.	.	2	.	5	2	.	.	.	.	.	.	.
Najas marina	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.	.	.	.	.	.
Trifolium fragiferum	.	.	.	.	.	.	.	.	.	13	.	.	.	.	.	.	.	.	.	.
Carex hirta	.	.	.	.	.	2	.	.	.	15	.	.	12	.	.	.	.	.	6	.
Azolla filiculoides	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.	.	.	.	.	.
Ranunculus neapolitanus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	6	.
Trifolium repens	.	.	.	.	.	.	.	.	.	17	.	.	.	.	.	.	.	.	.	.
Persicaria lapathifolia	11	5	10	.	14	6	6	11	.	7	17	10	2	.	.	.	.	50	.	.
Persicaria hydropiper	2	3	.	.	.	4	.	.	.	.	.	5	.	.	.	25	.	.	.	.
Bidens tripartitus	13	3	10	25	14	12	13	.	.	.	15	10	4	.	.	13	.	.	.	.
Symphyotrichum squamatum	7	.	.	25	.	2	.	.	.	.	7	.	.	.	.	.	.	.	.	.
Echinochloa crus-galli	5	5	6	.	.	2	.	11	.	2	5	14	2	.	.	13	.	.	.	.
Persicaria dubia	.	3	.	.	.	4	.	.	.	2	2	10	.	11	.	.	.	.	.	.
Rorippa sylvestris	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	13	.	.	6	.
Lotus tenuis	.	.	.	.	.	1	6	33	.	.	12	.	2	.	.	.	.	.	.	.
Plantago major	4	.	.	.	.	1	.	11	.	9	2	.	.	.	.	13	.	.	.	.
Xanthium orientale subsp. *italicum*	15	11	8	.	14	8	31	.	17	2	12	14	6	11	.	.	50	100	11	.
Agrostis stolonifera	9	8	8	75	.	8	25	11	.	37	10	10	25	.	.	13	.	.	.	.

Table 4. Continued

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. of relevés	55	38	51	4	7	185	16	9	6	46	41	21	51	9	2	8	2	2	18	3
Galium palustre s.l.	7	3	2	.	.	16	.	.	17	50	5	.	8	22	.	.	.	.	11	.
Samolus valerandi	2	.	.	.	.	4	13	.	.	.	.	.	.	.	.	13	.	.	.	.
Ranunculus repens	2	3	6	50	.	3	6	11	17	46	5	.	24	11	.	.	50	.	6	.
Scutellaria galericulata	4	.	.	.	.	7	.	.	.	.	.	.	.	22	.	.	.	.	.	.
Cyperus fuscus	7	5	2	25	.	4	.	11	.	.	10	5	2	22	.	25	.	.	.	.
Solanum dulcamara	.	5	10	.	.	22	.	.	33	7	.	5	.	11	50	.	.	.	.	.
Alopecurus geniculatus	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	6	.
Alnus glutinosa	.	.	.	25	.	.	.	11	.	.	.	.	.	.	.	.	.	.	.	.
Salix alba	5	3	10	25	29	4	6	.	.	.	7	5	.	.	.	.	.	.	.	33
Helianthus tuberosus	.	.	.	.	.	1	13	.	.	.	.	.	.	.	.	.	.	.	.	.
Salix triandra s.l.	.	.	6	.	.	1	6	.	.	.	.	14	.	.	.	.	.	.	.	.
Juncus bufonius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	50	50	.	.
Cyperus strigosus	.	.	4	.	.	1	.	.	.	.	.	.	.	.	.	13	.	.	.	.
Veronica anagallis-aquatica	11	11	14	.	14	6	.	.	17	15	7	.	6	.	.	13	.	.	.	.
Persicaria maculosa	.	.	.	.	.	1	.	.	17	.	.	.	4	.	.	.	.	.	.	.
Salix purpurea	2	.	4	.	.	2	31	33	.	.	.	5	.	.	.	13	.	.	.	.
Equisetum arvense	.	5	2	.	.	1	6	56	.	.	7	.	.	.	.	.	.	.	.	.
Althaea officinalis	.	.	.	.	.	2	.	.	17	4	.	.	.	.	.	.	.	.	.	.
Urtica dioica	.	3	6	.	.	23	.	.	.	7	.	.	.	.	.	.	.	.	.	.
Carex flacca s.l.	.	5	.	.	.	.	6	11	.	.	.	.	.	.	.	.	.	.	.	.
Holcus lanatus	.	.	.	25	.	6	.	11	.	2	.	.	.	.	.	13	.	.	.	.
Equisetum palustre	4	.	6	25	.	3	13	11	.	13	2	.	6	11	.	25	.	.	.	.
Eupatorium cannabinum	5	11	6	.	.	23	13	56	.	7	5	.	2	.	.	.	.	.	.	.
Tommasinia verticillaris	.	.	.	.	.	.	.	33	.	.	.	.	.	.	.	.	.	.	.	.
Prunella vulgaris	.	.	.	25	.	.	13	11	.	.	.	.	.	.	.	.	.	.	.	.
Equisetum telmateia	.	5	2	.	.	3	.	.	.	4	.	.	.	.	.	13	.	.	.	.
Poa trivialis s.l.	2	.	.	.	.	7	.	.	.	28	2	.	2	.	.	.	.	.	.	.
Calystegia sepium	16	5	25	.	29	49	13	.	33	26	10	14	6	33	.	.	.	.	.	.
Mentha pulegium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	6	.
Carex pendula	.	.	2	.	.	1	19	.	.	9	.	.	.	.	.	.	.	.	.	.
Mentha aquatica	25	13	20	25	29	22	63	78	17	61	10	19	24	11	.	25	.	.	.	67
Lythrum salicaria	20	8	43	75	43	22	31	11	33	35	24	33	12	44	50	38	.	.	11	.
Elytrigia repens	.	.	4	.	.	1	.	.	.	.	10	.	.	.	.	.	.	.	11	.
Lycopus europaeus	18	11	22	75	43	39	13	11	17	46	12	14	6	22	.	25	.	.	.	.
Hypericum tetrapterum	2	3	.	.	.	.	.	11	.	4	.	.	.	.	.	.	.	.	.	.
Stachys palustris	4	3	2	.	.	4	.	.	.	30	.	.	.	11	.	13	.	.	6	.
Isolepis setacea	.	.	.	25	.	.	13	.	.	.	.	.	.	.	.	13	.	.	.	.
Pycreus flavescens	.	.	2	.	.	.	6	.	.	.	.	.	.	.	.	13	.	.	.	.
Schoenoplectus mucronatus	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	13	.	.	.	.
Ludwigia palustris	.	3	4	.	.	.	.	.	.	2	2	.	.	.	50	13	.	.	.	.
Rorippa palustris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	.	.	.	.
Potamogeton natans	2	5	4	.	.	2	.	.	.	.	10	10	4	33	.	.	.	.	.	.
Potamogeton lucens	2	.	2	.	.	1	.	.	17	.	.	.	.	.	.	.	.	.	.	.
Potamogeton pusillus	.	3	.	.	.	.	.	.	.	.	.	.	.	11	.	.	.	.	.	.
Callitriche obtusangula	.	.	.	.	.	1	.	.	.	2	.	.	4	.	.	13	.	.	.	.
Veronica scutellata	.	.	.	.	.	.	.	.	.	.	.	.	8	11	.	.	.	.	.	.
Callitriche brutia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	.	.	.	.

order Magno-Caricetalia includes vegetation dominated by tall sedges, which occur in marshes that are flooded for most of the year.

The 43 associations recognized in central Italy are described hereafter. Diagnostic, constant and dominant species are indicated; in brackets the corresponding *phi* value and percentage constancy (occurrence frequency) are reported. The main national references are recorded in the last part of each description.

1. Schoenoplectetum lacustris Chouard 1924

Syn.: Scirpo-Phragmitetum Koch 1926, Schoenoplectetum lacustris Eggler 1933, Scirpetum lacustris Schmale 1939

Diagnostic species: *Schoenoplectus lacustris* (*phi* value 0.47)

Constant species: *Schoenoplectus lacustris* (constancy 100%), *Phragmites australis* (42%), *Sparganium erectum* s.l. (31%)

Dominant species: *Schoenoplectus lacustris*

Monospecific or species-poor stands of *Schoenoplectus lacustris* occur along shores of mesotrophic to eutrophic lakes, ponds and within channels, usually in deeper water than other types of reed vegetation, in some cases forming a wide zone between reeds and open water. This vegetation type grows on muddy or sandy bottoms, generally without much organic sediment. It is a pioneer asso-

Table 5. Synoptic table of the associations of the alliances Phalaridion arundinaceae, Glycerio-Sparganion, Carici-Rumicion hydrolapathi, Magno-Caricion elatae and Magno-Caricion gracilis. For details see caption of Table 4.

Community number	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**
No. of relevés	11	109	15	62	62	18	86	9	3	44	41	22	48	69	13	36	26	17	26	52	35	13	8
Diagnostic species of Glycerio-Sparganietum neglecti																							
Sparganium erectum s.l.	.	100	.	13	6	17	26	.	.	27	29	.	15	10	15	11	.	12	4	2	6	15	.
Diagnostic species of Glycerietum fluitantis																							
Glyceria fluitans terrestrial ecophene	.	4	100	.	.	.	.	.	.	.	.	.	.	.	8	.	.	6	4	.	6	.	.
Eleocharis palustris	.	9	47	18	.	6	.	.	.	.	7	9	4	3	.	3	.	6	23	29	23	8	13
Ranunculus ophioglossifolius	.	.	40	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	.	.	.	.
Callitriche palustris	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Diagnostic species of Glycerietum notatae																							
Glyceria notata terrestrial ecophene	.	17	.	100	32	39	34	.	.	7	2	.	.	1	.	.	4	6	15	19	26	23	13
Diagnostic species of Nasturtietum officinalis																							
Nasturtium officinale	18	8	.	8	100	17	17	.	.	7	.	.	2	.	.	.	.	.	.	.	.	.	.
Diagnostic species of Beruletum erectae																							
Berula erecta	.	11	.	15	11	100	8	.	.	32	.	.	.	.	8	.	15	6	.	.	.	.	.
Diagnostic species of Helosciadetum nodiflori																							
Helosciadium nodiflorum	9	26	.	32	39	22	100	44	.	.	.	.	2	4	.	.	4	6	.	.	.	8	.
Rorippa amphibia	18	4	.	.	6	6	.	100	.	.	5	5	.	3	.	.	4	.	.	.	.	.	.
Diagnostic species of Leersietum oryzoidis																							
Leersia oryzoides	9	.	.	.	.	.	.	.	100	.	.	.	.	.	.	.	.	.	23	.	.	.	.
Bidens frondosus	36	6	.	.	3	6	.	11	100	18	15	.	2	.	23	3	15	18	12	.	.	.	.
Diagnostic species of Mentho aquaticae-Caricetum pseudocyperi																							
Carex pseudocyperus	.	6	.	.	.	6	.	.	.	100	.	9	.	4	.	3	8	.	.	.	.	8	.
Diagnostic species of Caricetum elatae																							
Carex elata	.	3	.	.	.	.	.	.	33	.	100	32	10	6	.	3	.	.	.	2	3	.	.
Lysimachia vulgaris	18	4	.	.	.	.	.	.	.	20	63	23	29	7	.	25	8	.	.	.	6	8	.
Diagnostic species of Cladietum marisci																							
Cladium mariscus	.	.	.	.	.	.	.	.	.	2	.	100	.	1	8	.	.	.	.	.	.	.	.
Diagnostic species of Caricetum acutiformis																							
Carex acutiformis	.	2	.	2	.	.	3	.	.	5	15	.	100	7	.	14	.	.	.	.	.	31	.
Diagnostic species of Caricetum ripariae																							
Carex riparia	9	9	.	2	.	.	5	.	.	7	20	9	8	100	8	8	4	.	.	.	3	.	.
Diagnostic species of *Mentha aquatica*- community																							
Mentha aquatica	27	31	.	29	21	56	14	.	33	89	29	32	19	16	100	11	31	6	35	17	17	15	.
Diagnostic species of Cyperetum longi																							
Cyperus longus	18	1	.	2	.	.	2	.	33	.	7	.	13	6	15	100	4	.	.	.	.	8	.
Diagnostic species of Galio palustris-Juncetum inflexi																							
Juncus inflexus	.	3	.	3	8	6	1	.	.	.	5	.	2	3	8	8	.	100	35	10	9	8	25
Diagnostic species of Leersio oryzoidis-Juncetum effusi																							
Juncus effusus	.	6	20	.	3	.	.	.	.	.	.	.	4	6	15	.	.	12	100	2	3	8	.
Diagnostic species of Caricetum gracilis																							
Carex acuta	.	3	.	5	.	.	2	.	.	.	10	.	2	3	.	6	8	.	.	100	49	8	50
Diagnostic species of Caricetum vesicariae																							
Carex vesicaria	.	1	.	2	.	.	.	.	.	5	.	.	4	1	.	.	.	.	.	21	100	.	.
Diagnostic species of Caricetum acutiformi-paniculatae																							
Carex paniculata	.	2	.	.	.	.	1	.	.	.	2	.	4	.	.	.	4	.	.	.	3	100	.
Diagnostic species of Caricetum vulpinae																							
Carex vulpina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	3	.	100
Alopecurus pratensis	.	1	.	3	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	8	.	.	38
Deschampsia cespitosa	.	.	7	2	.	.	.	.	.	.	5	.	.	1	.	.	8	12	.	40	17	.	63
Carex leporina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	.	.	.	12	4	3	.	38

Table 5. Continued

Community number	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**
No. of relevés	11	109	15	62	62	18	86	9	3	44	41	22	48	69	13	36	26	17	26	52	35	13	8
Other diagnostic species																							
Phalaroides arundinacea	100	8	.	2	2	11	3	.	.	.	10	.	6	6	.	.	100	24	4	2	11	.	.
Other species																							
Typha angustifolia	.	9	.	5	5	.	8	.	.	32	12	27	2	3	.	.	.	.	.	2	.	15	.
Typha latifolia	.	12	.	.	5	.	.	.	.	9	5	.	6	9	.	3	4	6	8	.	.	15	.
Iris pseudacorus	9	11	.	3	3	6	3	.	33	25	37	5	25	33	31	31	42	.	23	4	17	38	.
Bolboschoenus maritimus agg.	.	5	.	.	2	.	.	22	.	2	2	14	.	3	8	6	.	.	.	.	.	.	.
Oenanthe aquatica	.	.	7	.	.	.	.	22	.	9	.	.	.	4	.	.	4	.	.	.	.	.	.
Alisma plantago-aquatica	.	21	20	18	5	17	5	.	.	11	10	.	2	3	.	3	.	6	12	2	9	15	.
Persicaria amphibia terrestrial ecophene	27	8	13	5	.	.	2	.	33	5	15	5	10	7	.	8	31	.	8	8	11	.	.
Vicia sativa s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.	.	.	.	.	.	.
Pulicaria dysenterica	.	.	.	.	.	.	.	.	.	.	2	.	13	10	15	11	.	24	.	2	.	.	.
Cruciata laevipes	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	6	.	.	.	.	25
Cerastium holosteoides s.l.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	12	.	2	.	.	25
Valeriana officinalis	.	.	.	.	.	.	.	.	.	.	17	.	8	.	.	6	.	.	.	4	.	.	.
Lathyrus pratensis	.	.	.	.	.	.	.	.	.	.	2	.	4	.	.	.	8	.	.	12	.	.	13
Epilobium hirsutum	18	33	.	24	18	6	28	.	.	.	5	18	29	10	15	17	15	12	8	13	3	54	.
Ranunculus sardous	.	.	13	2	.	.	.	.	.	.	2	.	.	4	.	6	4	.	4	2	.	.	.
Galega officinalis	.	.	.	.	2	.	.	.	.	2	.	.	2	14	8	11	8	18	.	.	.	.	.
Cirsium arvense	9	.	.	.	2	11	.	.	.	.	.	5	8	22	15	8	15	6	.	.	.	.	.
Verbena officinalis	9	.	.	.	.	.	.	.	.	.	.	.	.	1	15	.	.	.	.	.	.	.	.
Rumex crispus	9	.	.	.	.	.	.	11	.	2	.	.	.	3	.	3	4	12	.	.	.	.	13
Carex cuprina	.	3	7	3	.	.	.	.	.	.	10	.	17	6	.	6	.	.	12	12	6	.	.
Dactylorhiza incarnata	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	2	.	15	.
Potentilla reptans	9	1	.	.	.	.	.	22	.	2	10	.	17	20	.	17	4	18	.	17	.	.	13
Paspalum distichum	18	6	.	.	3	.	1	.	67	16	.	.	.	3	15	8	.	.	4	.	.	.	.
Ranunculus peltatus subsp. *baudotii*	.	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Persicaria amphibia aquatic ecophene	.	1	.	.	.	.	.	11	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
Schoenoplectus lacustris	9	6	.	.	.	.	.	.	.	11	10	14	.	3	.	.	12	.	.	.	3	.	.
Ranunculus trichophyllus	.	9	20	19	8	6	16	22	.	.	2	.	.	1	.	.	.	.	.	2	9	.	.
Schoenoplectus tabernaemontani	.	3	.	.	.	.	1	.	33	7	.	9	.	.	8	.	.	6	4	.	.	.	.
Juncus articulatus	18	2	27	10	3	.	2	.	.	7	2	.	4	4	.	6	4	12	27	4	9	.	.
Poa pratensis	18	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	13
Mentha longifolia	.	13	.	15	6	17	12	.	.	.	.	.	13	6	.	14	.	.	.	8	.	8	.
Schedonorus arundinaceus	.	.	.	.	.	.	.	.	.	.	2	.	8	1	.	25	.	.	.	2	.	.	13
Carex distans	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	6	.	6	8	4	11	.	.
Cirsium creticum s.l.	.	1	.	.	2	.	.	.	.	14	.	.	15	12	23	17	4	.	.	.	3	23	.
Ranunculus peltatus subsp. *peltatus*	.	.	.	.	.	.	.	22	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.
Festuca rubra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25
Rumex acetosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	13
Carex hirta	.	3	.	3	2	6	2	.	.	.	2	.	23	3	.	19	15	47	15	17	3	31	50
Trifolium repens	.	1	7	.	.	.	.	.	.	.	.	.	6	1	.	8	.	6	.	2	.	.	25
Scorzoneroides autumnalis	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	10	6	.	13
Scirpoides holoschoenus s.l.	.	1	.	.	3	.	.	.	.	.	.	.	.	1	15	8	.	12	.	.	.	.	.
Cynosurus cristatus	.	.	.	.	.	.	.	.	.	.	2	.	2	.	.	.	.	.	.	2	.	.	25
Persicaria lapathifolia	18	6	.	5	10	11	.	.	67	7	.	.	2	.	.	3	.	6	.	.	.	.	.
Persicaria hydropiper	9	3	.	2	3	.	5	.	.	2	.	.	2	.	8	.	4	.	.	.	.	.	.
Bidens tripartitus	9	4	.	3	2	.	6	.	.	36	.	.	.	1	.	6	4	.	.	.	.	.	.
Symphyotrichum squamatum	.	.	.	.	.	.	.	.	.	11	.	.	.	.	15	.	.	.	.	.	.	.	.
Echinochloa crus-galli	9	7	.	2	.	.	.	11	33	7	.	.	.	.	8	.	15	.	8	.	.	.	.
Persicaria dubia	9	2	.	2	2	.	.	11	.	.	.	.	.	.	8	.	.	6	4	.	.	.	.
Rorippa sylvestris	18	.	.	2	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
Lotus tenuis	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	3	.	18	.	.	.	.	.
Plantago major	9	1	7	2	.	.	.	11	.	2	.	.	.	1	.	3	.	12	4	.	3	.	.
Xanthium orientale subsp. *italicum*	36	1	.	.	3	.	.	.	.	.	5	.	.	1	.	6	.	.	8	.	.	.	.
Dactylis glomerata s.l.	.	.	.	.	.	.	.	.	.	.	.	.	4	3	.	14	.	.	.	.	.	.	.
Agrostis stolonifera	9	6	7	10	10	6	7	11	.	20	17	.	6	13	38	25	19	18	19	12	11	.	13
Symphyotrichum lanceolatum	18	1	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	.	4	.	.	.	.
Veronica serpyllifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25
Galium palustre s.l.	.	11	7	8	2	.	2	.	.	34	56	27	29	32	31	44	19	65	73	52	43	92	38
Juncus conglomeratus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	12	2	.	.	.
Ranunculus repens	27	25	20	53	27	39	22	11	.	9	29	.	29	23	46	36	19	53	27	52	20	46	38
Scutellaria galericulata	.	.	.	.	.	6	.	.	.	32	29	.	2	4	8	6	12	24	12	.	.	8	.
Ophioglossum vulgatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13
Galium mollugo s.l.	18	2	.	2	.	.	.	.	.	.	5	.	13	9	.	14	19	12	.	12	.	15	.
Sambucus ebulus	9	.	.	.	.	.	.	.	.	.	.	.	.	1	8	.	15	.	.	.	.	.	.
Geum urbanum	.	.	.	.	.	.	.	.	.	.	.	5	.	1	.	.	.	.	.	.	.	.	25
Ranunculus flammula	.	.	.	5	.	.	.	.	.	.	.	.	.	.	8	.	.	.	12	38	40	8	38
Epilobium parviflorum	.	3	7	.	.	11	3	.	.	18	.	.	4	1	8	.	.	12	4	4	.	8	13
Amaranthus retroflexus	.	4	.	.	.	.	.	.	.	14	.	.	.	1	8	.	.	.	.	.	.	.	.
Cyperus fuscus	9	9	.	.	2	6	.	.	.	34	2	.	.	.	.	.	.	.	.	.	.	.	.
Glyceria notata terrestrial ecophene	.	.	.	13	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia palustris	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.

Table 5. Continued

Community number	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**
No. of relevés	11	109	15	62	62	18	86	9	3	44	41	22	48	69	13	36	26	17	26	52	35	13	8
Thalictrum lucidum	.	1	.	.	.	.	.	.	.	.	5	.	4	.	.	3	12	.	.	.	.	.	.
Solanum dulcamara	9	12	.	8	13	11	3	.	.	16	7	18	6	13	8	3	.	.	.	.	3	15	.
Salix caprea	.	.	.	.	.	.	.	.	.	11	.	.	.	.	.	.	.	.	.	.	.	.	.
Atriplex patula	.	.	.	.	.	.	.	11	.	5	.	.	.	1	.	3	.	.	.	.	.	.	.
Alopecurus geniculatus	.	3	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	3	.	13
Salix alba	27	3	.	.	2	.	2	.	.	9	2	.	2	3	.	.	.	6	19	.	.	.	.
Veronica beccabunga	9	4	7	24	23	22	8	.	.	.	.	.	.	3	.	.	15	12	12	4	.	15	13
Agrostis canina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	.	.	.	8	13	6	.	38
Rubus ulmifolius	.	.	.	.	.	.	.	.	.	.	.	9	10	9	23	3	.	.	8	.	.	.	.
Veronica chamaedrys	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13
Thelypteris palustris	.	.	.	.	.	.	.	.	.	2	.	5	.	.	8	.	.	.	.	.	.	.	.
Linum catharticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13
Fraxinus angustifolia subsp. *oxycarpa*	.	.	.	.	.	.	.	.	.	.	2	5	.	.	.	.	.	.	12	.	.	.	.
Lactuca saligna	.	.	.	.	.	.	.	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Juncus sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	.	.	.	13
Salix cinerea	.	1	.	2	.	.	.	.	.	2	10	23	2	1	.	6	.	.	4	.	3	.	.
Gratiola officinalis	.	.	20	.	.	.	.	.	.	.	.	.	.	1	.	3	.	.	8	4	.	.	.
Anisantha sterilis	18	.	.	.	.	.	.	.	.	.	.	.	.	1	.	6	.	.	.	.	.	.	.
Epilobium palustre	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	15	.
Veronica anagallis-aquatica	27	20	.	35	61	56	40	11	.	9	.	.	2	3	.	.	8	.	12	10	.	15	.
Persicaria maculosa	.	1	.	.	5	6	.	11	.	.	.	.	.	.	.	.	8	.	15	.	.	.	.
Catabrosa aquatica	.	.	.	11	8	11	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myosotis laxa subsp. *cespitosa*	.	.	7	.	.	.	1	.	.	.	.	.	4	1	.	.	.	.	8	.	.	23	.
Petasites hybridus	.	5	.	6	13	6	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex hydrolapathum	.	5	.	2	2	.	.	.	.	7	29	5	6	6	.	14	.	.	.	.	.	.	.
Scrophularia umbrosa	.	14	.	11	5	17	17	.	.	9	.	5	2	4	.	6	.	6	.	6	.	23	.
Drepanocladus aduncus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	6	.	13
Myosotis scorpioides	.	6	.	15	10	11	8	.	.	2	5	.	10	.	.	.	4	.	12	8	3	.	.
Equisetum arvense	9	3	.	.	.	.	.	.	33	.	5	5	6	1	.	19	.	.	.	.	.	.	.
Galium aparine	18	.	.	.	.	.	.	11	.	.	.	.	6	9	.	8	.	6	.	2	.	.	.
Urtica dioica	64	11	.	3	3	6	.	.	.	2	7	.	10	14	31	8	19	18	4	4	.	.	.
Phragmites australis	18	12	.	5	6	6	6	.	.	68	22	82	29	51	38	28	42	35	23	.	3	.	.
Holcus lanatus	.	2	7	2	2	.	1	.	.	2	.	.	15	4	.	28	8	12	4	4	.	.	.
Equisetum palustre	18	6	.	10	.	11	3	.	.	.	17	.	25	3	8	14	15	35	12	19	3	31	.
Eupatorium cannabinum	18	5	.	.	2	6	.	.	33	32	24	14	29	17	38	25	8	12	4	6	.	31	.
Equisetum telmateia	.	6	.	.	3	.	1	.	.	.	5	.	17	3	8	14	.	.	.	2	3	.	.
Poa trivialis s.l.	18	8	20	19	8	28	10	11	.	.	7	.	23	19	8	22	8	24	19	15	3	15	13
Lysimachia nummularia	.	1	.	.	.	.	.	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Calystegia sepium	82	9	.	3	.	.	.	56	33	41	44	14	35	43	46	47	27	6	.	8	11	23	.
Mentha pulegium	.	.	40	2	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.
Veronica teucrium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13
Lythrum salicaria	64	28	.	13	11	22	13	.	100	43	59	36	42	32	54	42	42	12	15	2	11	15	.
Galium debile	.	.	27	11	.	17	.	.	.	.	2	.	19	3	.	3	.	.	.	15	3	.	13
Rumex conglomeratus	.	6	27	19	10	33	7	.	.	2	.	.	8	.	8	3	.	12	8	2	.	.	.
Elytrigia repens	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	31	12	12	.	2	3	.	.
Lycopus europaeus	27	17	.	13	11	22	12	11	.	84	15	41	25	22	77	36	15	24	27	.	.	15	.
Hypericum tetrapterum	.	2	.	.	2	22	1	.	.	2	2	.	10	1	.	19	.	12	.	6	.	15	13
Stachys palustris	.	3	.	2	2	.	3	11	.	14	22	5	.	14	15	3	4	.	8	.	.	.	.
Angelica sylvestris	.	.	.	.	.	6	.	.	.	2	.	.	6	1	15	3	8	.	.	.	.	8	.
Juncus acutiflorus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12	6	.	.
Carex panicea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17	9	.	.
Stellaria graminea s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	.	.	.	13
Viola palustris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13
Cirsium eriophorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13
Veronica scutellata	.	.	.	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	33	23	.	38
Callitriche brutia	.	.	27	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

ciation, which represents the first stage of the natural terrestrialization process. When organic sediment accumulates, it is substituted by Phragmitetum australis. It often grows in contact with aquatic vegetation of the classes Potametea and Lemnetea in deeper water and with other communities of the class Phragmito-Magno-Caricetea at the shores, e.g. Phragmitetum australis, Glycerio-Sparganietum neglecti, Typhetum latifoliae or Typhetum angustifoliae. This type of wetland vegetation is rather frequent across Italy (Poldini 1989; Brullo et al. 1994; Iberite et al. 1995; Venanzoni & Gigante 2000; Merloni & Piccoli 2001; Landi et al. 2002; Venanzoni et al. 2003; Lastrucci et al. 2007; Ceschin & Salerno 2008).

2. Typhetum angustifoliae Pignatti 1953

Syn.: Typhetum angustifolio-latifoliae Schmale 1939 (nomen ambiguum), Scirpo-Phragmitetum Koch 1926 (nomen ambiguum)

Diagnostic species: ***Typha angustifolia*** **(0.53)**

Constant species: ***Typha angustifolia*** **(100%)**, *Phragmites australis* (39%)

Dominant species: ***Typha angustifolia***

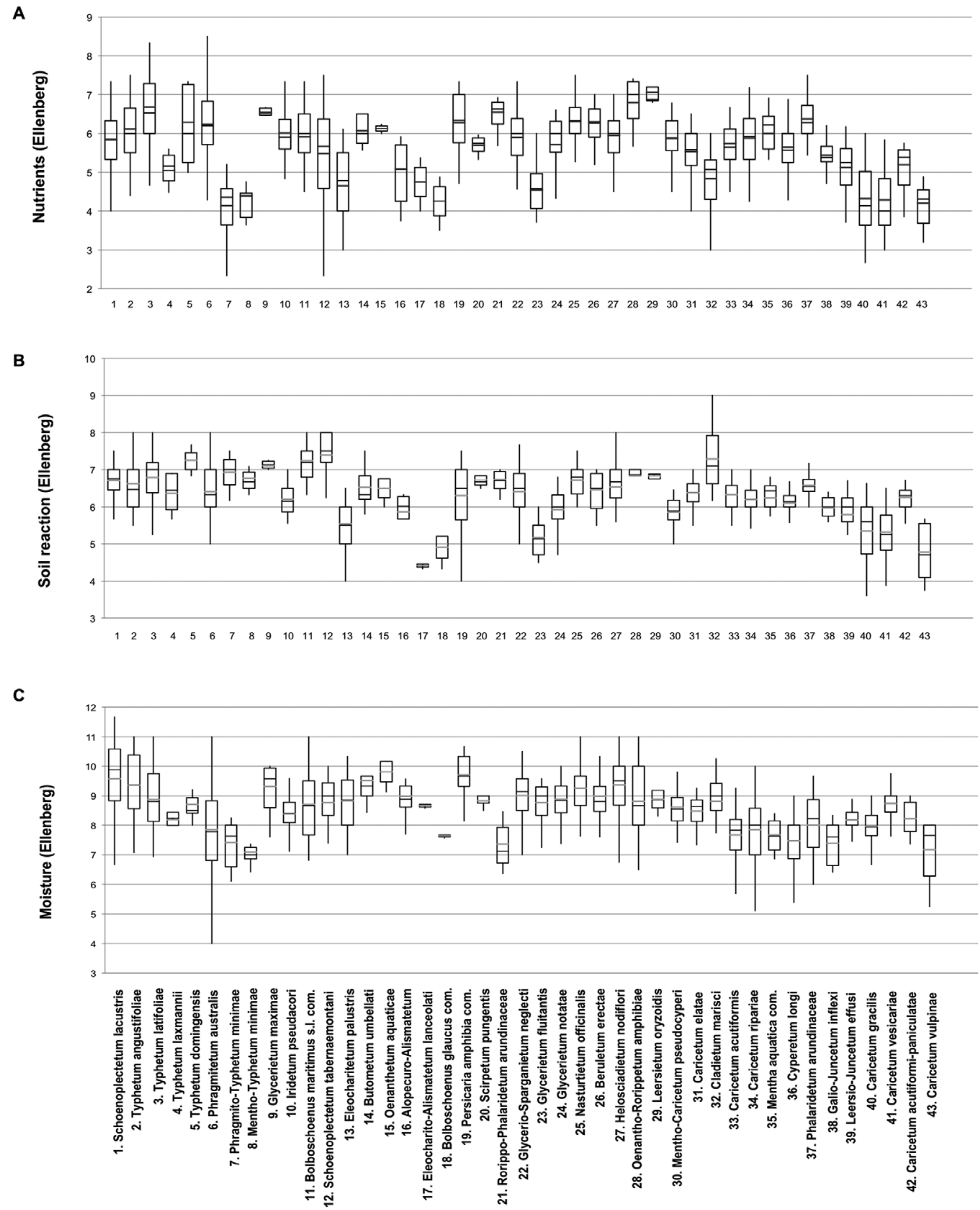

Fig. 4. Mean indicator values for (A) nutrients, (B) soil reaction and (C) moisture. Boxes indicate lower (25%) and upper (75%) quartiles, black horizontal lines indicate the median, grey horizontal lines the mean, and whiskers indicate minimum and maximum.

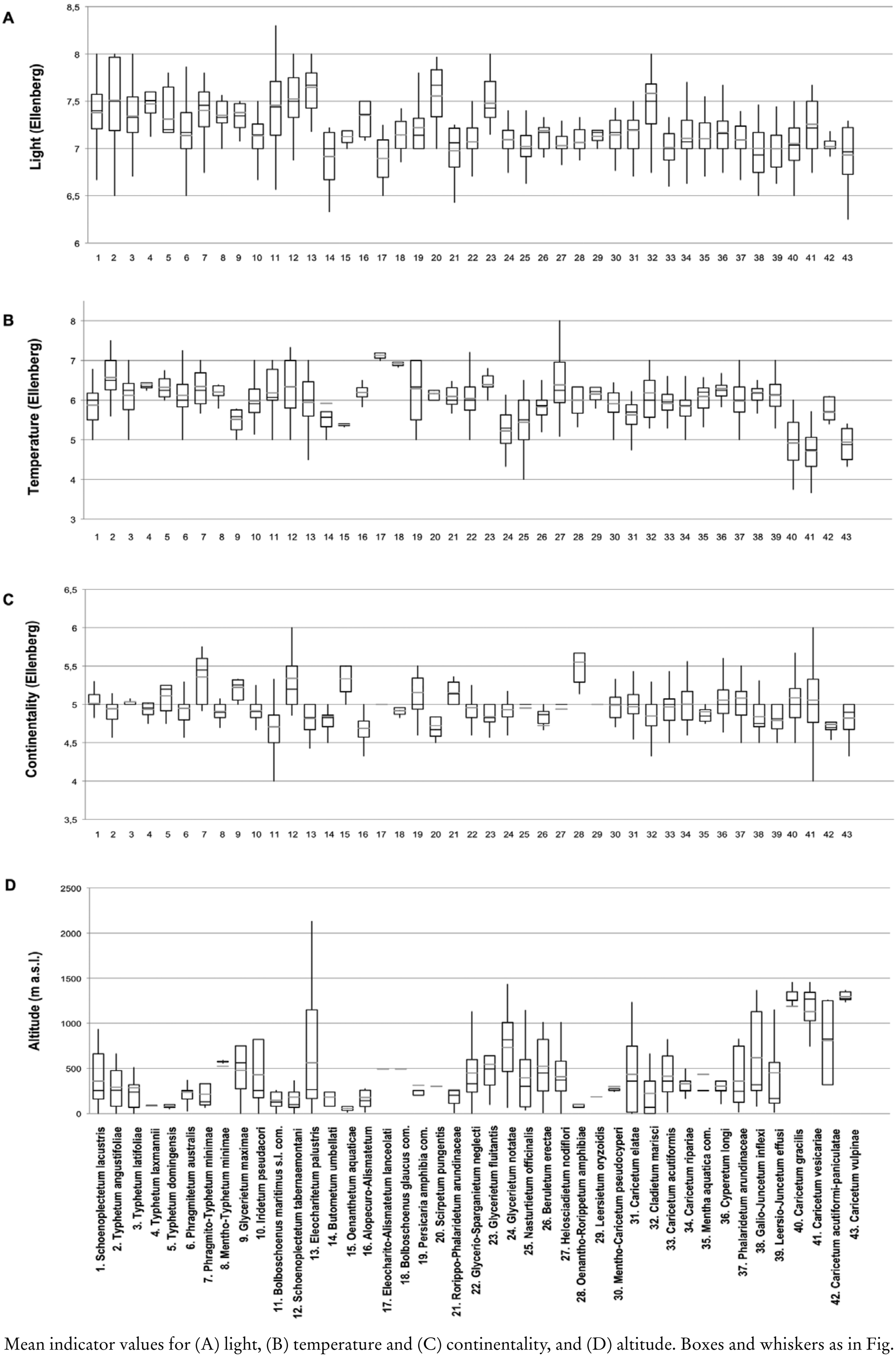

Fig. 5. Mean indicator values for (A) light, (B) temperature and (C) continentality, and (D) altitude. Boxes and whiskers as in Fig. 4.

This vegetation type, formed by monospecific or species-poor stands of *Typha angustifolia,* occurs in mesotrophic to eutrophic water bodies such as channels, artificial or natural ponds and lakes, swamps and lentic sections of streams. It is more tolerant to eutrophication than Schoenoplectetum lacustris and it can grow on clayey and sandy bottoms, often with organic sediments, and at a water depth of less than 1 m. It usually grows in contact with aquatic vegetation of the classes Charetea, Lemnetea and Potametea, and also with other communities of the class Phragmito-Magno-Caricetea. In some cases it forms isolated stands within the reeds. This association is rather frequent in Italy along streams and permanent water bodies (Granetti 1965; Gerdol & Piccoli 1984; Avena & Scoppola 1987; Corbetta & Pirone 1989; Pedrotti 1990; Biondi & Baldoni 1994; Baldoni & Biondi 1993; Venanzoni & Gigante 2000; Merloni & Piccoli 2001; Venanzoni et al. 2003b; Landi et al. 2002; Pirone et al 2003).

3. Typhetum latifoliae Nowiński 1930

Syn.: Typhetum latifoliae von Soó 1927 (nomen nudum), Typhetum angustifolio-latifoliae Schmale 1939 p.p. (nomen ambiguum), Typhetum latifoliae Lang 1973

Diagnostic species: ***Typha latifolia*** **(0.55)**

Constant species: ***Typha latifolia*** **(100%)**, *Lythrum salicaria* (43%), *Alisma plantago-aquatica* (35%)

Dominant species: ***Typha latifolia***

This association is structurally and ecologically very similar to Typhetum angustifoliae. It often grows together with other marsh associations such as Phragmitetum australis, Glycerio-Sparganietum neglecti or Iridetum pseudacori. It usually occurs in eutrophic water bodies rich in organic sediments, which can cause anoxic conditions in the soil. It is also tolerant to drying out in the summer (Hrivnák 2004; Šumberová et al. 2011). Habitats of this community are ponds, shores of lakes, banks of the lentic section of streams, deltas, swamps, natural and artificial ponds and channels. It is very common in Italy (Corbetta & Pirone 1989; Baldoni & Biondi 1993; Biondi & Baldoni 1994; Buchwald 1994; Biondi et al. 1997; Bracco et al. 2000; Venanzoni & Gigante 2000; Prosser & Sarzo 2004; Ceschin & Salerno 2008).

4. Typhetum laxmannii Nedelcu 1968

Diagnostic species: ***Typha laxmannii*** **(0.96)**, *Juncus subnodulosus* (0.47), *Epipactis palustris* (0.44), *Typha minima* (0.43)

Constant species: ***Typha laxmannii*** **(100%)**, ***Phragmites australis*** **(75%)**, ***Lythrum salicaria*** **(75%)**, ***Lycopus europaeus*** **(75%)**, ***Juncus articulatus*** **(75%)**, ***Agrostis stolonifera*** **(75%)**, *Typha minima* (50%), *Ranunculus repens* (50%), *Juncus subnodulosus* (50%), *Epipactis palustris* (50%)

Dominant species: ***Typha laxmannii***

Typha laxmannii has a Euro-Asiatic distribution and is rather rare in Italy. This association is described in the literature as typical of eutrophic habitats with sandy, muddy or marly soils and a low content of organic matter (Nobis et al. 2006). It grows on periodically flooded riverbanks. At a national scale it is recorded only from central Italy on the sites where Phragmito-Typhetum minimae is also found, but Typhetum laxmannii occurs in drier conditions, usually in contact with riparian shrubs and trees (Biondi & Baldoni 1994; Biondi et al. 1997; Pirone et al. 2003).

5. Typhetum domingensis Brullo et al. 1994

Syn.: Typho angustifoliae-Schoenoplectetum tabernaemontani Braun-Blanquet et Bolòs 1957 var. *Typha domingensis* Biondi et al. 1997

Diagnostic species: ***Typha domingensis*** **(0.82)**, ***Schoenoplectus tabernaemontani*** **(0.49)**

Constant species: ***Typha domingensis*** **(100%)**, ***Schoenoplectus tabernaemontani*** **(86%)**, *Phragmites australis* (43%), *Lythrum salicaria* (43%), *Lycopus europaeus* (43%)

Dominant species: ***Typha domingensis***

This association is dominated by *Typha domingensis*, a species with a Pantropical distribution, which is also present in the Mediterranean Basin. It occurs on muddy, often slightly saline soils that are subjected to frequent drying out. It is considered as a thermophilous vicariant of Typhetum angustifoliae. Stands dominated by *Typha domingensis* are reported from a few Italian localities, mainly from southern and central Italy (Brullo et al. 1994, 2002; Biondi et al. 1997, 2004). In the past this association was probably often overlooked due to the similarity between *Typha domingensis* and *T. angustifolia*.

6. Phragmitetum australis Savič 1926

Syn.: Scirpo-Phragmitetum Koch 1926 p. p., Phragmitetum vulgaris von Soó 1927, Phragmitetum communis (Gams 1927) Schmale 1939, Riccietum fluitantis Slavnić 1956, Calystegio-Phragmitetum Golub et Mirkin 1986

Diagnostic species: none

Constant species: ***Phragmites australis*** **(100%)**, *Calystegia sepium* (49%), *Lycopus europaeus* (39%)

Dominant species: ***Phragmites australis***

This monospecific or species-poor association is dominated by the emergent plant *Phragmites australis,* an emergent species frequently colonizing both submerged and emergent shores of lakes, swamps, pools, ponds, riverbanks and channels. This community grows in different ecological conditions, in mesotrophic and eutrophic, fresh and brackish water, and on clayey, sandy and stony bottoms, which may be covered with organic sediment. It is tolerant to biological and chemical pollution, performing an important filtering function in polluted habitats. It usually grows in contact with other vegetation types of

Phragmito-Magno-Caricetea, but also with aquatic and wetland communities of the classes Isoëto-Nano-Juncetea, Bidentetea tripartitae and Galio-Urticetea. This vegetation type is very common in all the countries of the temperate zone including Italy (e.g. GRANETTI 1965; CORBETTA & PIRONE 1989; BALDONI & BIONDI 1993; BUCHWALD 1994; IBERITE et al. 1995; PIRONE et al. 1997; VENANZONI & GIGANTE 2000; ARRIGONI & PAPINI 2002; CESCHIN & SALERNO 2008; LASTRUCCI et al. 2010b).

7. Phragmito-Typhetum minimae Trinajstić 1964
Diagnostic species: ***Typha minima*** **(0.80)**, *Equisetum ramosissimum* (0.30)
Constant species: ***Typha minima*** **(100%)**, *Mentha aquatica* (62%), *Equisetum ramosissimum* (56%), *Xanthium orientale* subsp. *italicum* (31%), *Salix purpurea* (31%), *Lythrum salicaria* (31%)
Dominant species: ***Typha minima***
This marsh vegetation occurs in areas periodically flooded by running water, such as at river bends and on islets where the muddy or clayey soil remains wet for most of the year. It is a species-poor association dominated by *Typha minima* with a few other emergent species such as *Mentha aquatica, Juncus effusus* and *Phragmites australis.* This association is not frequent in Italy, because *Typha minima* is a rare species at the national scale. Most of the records come from central Italy (PIRONE 1991; BIONDI et al. 1997; SCOPPOLA 1998; BIONDI et al. 1999).

8. Mentho aquaticae-Typhetum minimae Venanzoni et Gigante 2000
Diagnostic species: ***Tetragonolobus maritimus*** **(0.86)**, ***Typha minima*** **(0.77)**, ***Epipactis palustris*** **(0.65)**, *Lotus herbaceus* (0.36), *Juncus articulatus* (0.35), *Scirpoides holoschoenus* s.l. (0.35), *Phleum nodosum* (0.34), *Genista tinctoria* (0.34)
Constant species: ***Typha minima*** **(100%)**, ***Juncus articulatus*** **(100%)**, ***Tetragonolobus maritimus*** **(89%)**, ***Mentha aquatica*** **(78%)**, ***Epipactis palustris*** **(78%)**, *Scirpoides holoschoenus* s.l. (67%), *Phleum nodosum* (67%), *Leucanthemum vulgare* (56%), *Genista tinctoria* (56%), *Eupatorium cannabinum* (56%), *Equisetum arvense* (56%), *Pulicaria dysenterica* (44%), *Lotus herbaceus* (56%), *Equisetum ramosissimum* (44%), *Tussilago farfara* (33%), *Tommasinia verticillaris* (33%), *Schoenoplectus lacustris* (33%), *Potentilla reptans* (33%), *Molinia caerulea* (33%), *Lotus tenuis* (33%)
Dominant species: ***Typha minima***
This vegetation type is known only from a few sites in central Italy, where it was originally described (Fiumicello stream; VENANZONI & GIGANTE 2000). However, it is clearly distinct from Phragmito-Typhetum minimae because of its high number of species, which include not only typical species of the class Phragmito-Magno-Caricetea, but also those of Scheuchzerio palustris-Caricetea nigrae (such as *Tetragonolobus maritimus* and *Epipactis palustris*) and Molinio-Arrhenatheretea (such as *Scirpoides holoschoenus* s.l., *Molinia caerulea* and *Leucanthemum vulgare*). The definition of this association also perfectly matches the relevé reported by PIRONE et al. (2003) from Lake Serranella, which is therefore here assigned to Mentho aquaticae-Typhetum minimae instead of Phramito-Typhetum minimae. The occurrence of species from other classes is due to the specific water regime. This community grows along stream bends on a thick layer of organic, muddy and sandy sediments flooded only in winter.

9. Glycerietum maximae Nowinski 1930 corr. Šumberová et al. in Chytrý 2011
Syn.: Glycerietum aquaticae von Soó 1927 (nomen nudum), Glycerietum aquaticae-fluitantis Nowiński 1927 (nomen ambiguum), Glycerietum aquaticae Hueck 1931
Diagnostic species: ***Glyceria maxima*** **(0.83)**, *Rorippa amphibia* (0.38)
Constant species: ***Glyceria maxima*** **(100%)**, *Rorippa amphibia* (50%), *Persicaria amphibia* terrestrial ecophene (50%), *Sparganium erectum* s.l. (33%), *Solanum dulcamara* (33%), *Schoenoplectus lacustris* (33%), *Potentilla reptans* (33%), *Phalaroides arundinacea* (33%), *Lythrum salicaria* (33%), *Iris pseudacorus* (33%), *Calystegia sepium* (33%)
Dominant species: ***Glyceria maxima***, *Iris pseudacorus*
This vegetation type includes monospecific or species-poor stands dominated by *Glyceria maxima*. It is typical of mesotrophic to eutrophic water bodies in advanced stages of succession, such as swamps, shallow lakes and pools. It often forms a zone between Phragmitetum australis and the surrounding land, in periodically flooded habitats with a muddy and organic soil. In Italy this vegetation type is reported from lowland to submontane areas (PEDROTTI 1965; PICCOLI & GERDOL 1982; MARCHIORI & SBURLINO 1986; SARTORI & BRACCO 1997; LASTRUCCI et al. 2010a).

10. Iridetum pseudacori Eggler ex Brzeg et Wojterska 2001
Diagnostic species: *Iris pseudacorus* (0.38)
Constant species: ***Iris pseudacorus*** **(100%)**, *Mentha aquatica* (61%), *Galium palustre* s.l. (50%), *Ranunculus repens* (46%), *Lycopus europaeus* (46%), *Persicaria amphibia* terrestrial ecophene (39%), *Agrostis stolonifera* (37%), *Lythrum salicaria* (35%), *Glyceria notata* (33%)
Dominant species: ***Iris pseudacorus***
This species-poor community is dominated by the hygrophilous geophyte *Iris pseudacorus.* It usually occurs on muddy soil flooded in the winter, but subjected to drying out during the summer. Habitats of this association are riverbanks, shores of lakes and swamps, karst plains, artificial and natural ponds. The dominant species is often accompanied by other species of the class Phrag-

mito-Magno-Caricetea, such as *Mentha aquatica, Galium palustre* s.l., *Lycopus europaeus,* and also in some cases by *Stachys palustris* and *Lysimachia vulgaris.* This community is rather frequent in Italy. It can occur in contact with other associations such as Phragmitetum australis, Caricetum ripariae, Glycerio-Sparganietum neglecti and Glycerietum maximae (Brullo et al. 1994; Arrigoni & Papini 2003; Presti et al. 2005; Ceschin & Salerno 2008; Lastrucci et al. 2010b).

11. *Bolboschoenus maritimus* agg.-community
Diagnostic species: *Bolboschoenus maritimus* agg. (0.52)
Constant species: *Bolboschoenus maritimus* agg. (100%)
Dominant species: *Bolboschoenus maritimus* agg.
For many years *Bolboschoenus*-dominated vegetation in southern Europe has been assigned to various *Bolboschoenus maritimus*-dominated associations such as Scirpetum maritimi Braun-Blanquet ex Tüxen 1937 or Bolboschoenetum maritimi Eggler 1933, Scirpetum compacto-littoralis Braun-Blanquet (1931) 1952 and Astero tripolii-Bolboschoenetum maritimi Filigheddu et al. 2000. After a taxonomic revision at a European scale (Hroudová et al. 1999, 2007), five different species previously all identified as *B. maritimus* have been distinguished, and a new syntaxonomic classification of *Bolbochoenus*-dominated associations has been proposed for central Europe (Hroudová et al. 2009). In Italy the distribution and ecology of *Bolboschoenus* species are not as yet well known. For this reason and considering the impossibility of checking species identification in all relevés recorded in the literature and in the database, we decided that all relevés dominated by *Bolboschoenus* spp. (reported as *B. maritimus*) should be preliminarily assigned in a generic *Bolboschoenus maritimus* agg.-community. Nevertheless, we observed that in central Italy *B. maritimus* s. str. occurs both in fresh and brackish water along the coast, so we may suggest that more than one association dominated by this species might be distinguished in future

12. Schoenoplectetum tabernaemontani Soó 1947
Syn.: Schoenoplectetum tabernaemontani Rapaics 1927 (nomen nudum), Schoenoplectetum tabernaemontani von Soó 1927 (nomen nudum), Typho angustifoliae-Schoenoplectetum tabernaemontani Braun-Blanquet et Bolós 1957; Phragmito-Schoenoplectetum tabernaemontani Passarge 1964, Schoenoplectetum tabernaemontani-litoralis Borhidi (1969) 1996, Agrostio maritimae-Schoenoplectetum tabernaemontani (Müller-Stoll et Götz 1987) Passarge 1999, Bolboschoenetum maritimi scirpetosum tabernaemontani Biondi 1986
Diagnostic species: *Schoenoplectus tabernaemontani* (0.60)
Constant species: *Schoenoplectus tabernaemontani* (100%), *Lythrum salicaria* (33%)
Dominant species: *Schoenoplectus tabernaemontani*
This vegetation type, dominated by *Schoenoplectus tabernaemontani,* occurs both in brackish and fresh water bodies rich in calcium and nutrients (Mierwald 1988). This association is rarer at the national scale than Schoenoplectetum lacustris. Stands dominated by *S. tabernaemontani* are recorded by several authors across Italy under different names (Biondi 1986; Pedrotti 1991; Baldoni & Biondi 1993; Buchwald 1994; Biondi et al. 1997; Biondi et al. 1999; Brullo & Siracusa 2000; Lastrucci et al. 2005, 2010a).

13. Eleocharitetum palustris Savič 1926
Syn.: Eleocharitetum palustris Šennikov 1919 (nomen nudum), Eleocharitetum palustris Ubrizsy 1948
Diagnostic species: *Eleocharis palustris* (0.39)
Constant species: *Eleocharis palustris* (100%), *Alisma plantago-aquatica* (33%)
Dominant species: *Eleocharis palustris*
This pioneer association is typical of carbonate-rich, in places slightly brackish, muddy soils. Monospecific or species-poor stands of *Eleocharis palustris* usually occur in pools, ponds and on the shores of shallow lakes and swamps that dry out during the summer, but also in karst and alluvial plains flooded during the winter and spring. This vegetation type has a wide distribution in Italy, ranging from sea level to altitudes of more than 2000 m (Pedrotti et al. 1992; Buchwald 1994; Biondi et al. 1997; Venanzoni & Gigante 2000; Biondi et al. 2002; Lastrucci et al. 2007, 2010b).

14. Butometum umbellati Philippi 1973
Diagnostic species: *Butomus umbellatus* (0.80)
Constant species: *Butomus umbellatus* (100%), *Lythrum salicaria* (44%), *Potamogeton natans* (33%), *Phragmites australis* (33%), *Eleocharis palustris* (33%), *Calystegia sepium* (33%), *Bolboschoenus maritimus* agg. (33%)
Dominant species: *Butomus umbellatus*, *Potamogeton natans*
This thermophilous community dominated by *Butomus umbellatus* occurs in channels, ponds, on muddy shores of lakes and in swamps characterized by carbonate-rich water. It is tolerant of significant fluctuation in the water table. It often grows in contact with other associations of the Phragmito-Magno-Caricetea such as Phragmitetum australis or Eleocharitetum palustris or with some aquatic vegetation types capable of surviving short periods of drawdown (e.g. Potametum natantis). This vegetation type is rather rare across Italy (Marchiori et al. 1993; Buchwald 1994; Venanzoni & Gigante 2000; Prosser & Sarzo 2003; Lastrucci et al. 2010a).

15. Oenanthetum aquaticae Soó ex Nedelcu 1973

Syn.: Oenanthetum aquaticae von Soó 1927 (nomen nudum), Oenanthetum aquaticae Eggler 1933 (nomen nudum), Glycerio fluitantis-Oenanthetum aquaticae Hejný 1948 (nomen ineditum)

Diagnostic species: ***Oenanthe aquatica*** **(0.71)**

Constant species: ***Oenanthe aquatica*** **(100%)**, *Sparganium erectum* s.l. (50%), *Solanum dulcamara* (50%), *Schoenoplectus lacustris* (50%), *Rorippa amphibia* (50%), *Persicaria amphibia* terrestrial ecophene (50%), *Lythrum salicaria* (50%), *Ludwigia palustris* (50%), *Glyceria fluitans* (50%), *Carex vesicaria* (50%), *Alisma plantago-aquatica* (50%)

Dominant species: ***Oenanthe aquatica***

This vegetation type, dominated by *Oenanthe aquatica*, grows on muddy and nutrient-rich soil on sites flooded during winter and spring but which dry out in the summer. This association is not frequent at the national scale and occurs only in the lowlands. Although the dominant species occurs across Italy, it rarely forms dense stands (Lastrucci et al. 2007, 2008).

16. Alopecuro-Alismatetum plantaginis-aquaticae Bolbrinker 1984

Diagnostic species: *Alisma plantago-aquatica* (0.36)

Constant species: ***Alisma plantago-aquatica*** **(100%)**, *Juncus articulatus* (62%), *Eleocharis palustris* (50%), *Schoenoplectus lacustris* (38%), *Phragmites australis* (38%), *Lythrum salicaria* (38%), *Bolboschoenus maritimus* agg. (38%)

Dominant species: ***Alisma plantago-aquatica***, *Equisetum palustre*

This association is typical of shallow wetlands that are subject to significant fluctuations in the water level and to drying out in the summer. Several authors report stands dominated by *Alisma plantago-aquatica* from Italy, mostly assigning them to other vegetation units (Biondi & Baldoni 1994; Buchwald 1994; Venanzoni & Gigante 2000; Lastrucci et al. 2008, 2010b).

17. Eleocharito-Alismatetum lanceolati Minissale et Spampinato 1985

Syn.: Butomo-Alismatetum lanceolati Segal et Westhoff in Westhoff et den Held 1969 (nomen nudum), Alismatetum lanceolati Zahlheimer 1979 (nomen invalidum), Alismatetum lanceolati Zahlheimer ex Šumberová in Chytrý 2011

Diagnostic species: ***Bolboschoenus glaucus*** **(0.92)**, ***Lythrum hyssopifolia*** **(0.89)**, ***Alisma lanceolatum*** **(0.67)**, *Ranunculus trichophyllus* (0.45)

Constant species: ***Ranunculus trichophyllus*** **(100%)**, ***Lythrum hyssopifolia*** **(100%)**, ***Bolboschoenus glaucus*** **(100%)**, ***Alisma lanceolatum*** **(100%)**, *Xanthium orientale* subsp. *italicum* (50%), *Ranunculus sardous* (50%), *Ranunculus repens* (50%), *Persicaria amphibia* terrestrial ecophene (50%), *Juncus bufonius* (50%),

Dominant species: ***Alisma lanceolatum***

This pioneer vegetation type occurs in ponds, channels and depressions on wet arable land, where water remains for most of the year, but is subject to drying out during the summer. This association was described by Minissale & Spampinato (1985) from Lake Gurrida (Sicily) as a community dominated by *Alisma lanceolatum* and characterized by the occurrence of *Bolboschoenus maritimus* and *Eleocharis palustris.* Relevés used in the present work are from a depression in a karst plain (Grutti-Perugia, 490 m a.s.l.) in central Italy (Landucci, unpublished). In such ecological conditions *Bolboschoenus maritimus* is absent, being substituted by *B. glaucus,* a species often confused with the former.

18. ***Bolboschoenus glaucus*****-community**

Diagnostic species: ***Bolboschoenus glaucus*** **(0.92)**, ***Alisma lanceolatum*** **(0.67)**

Constant species: ***Xanthium orientale*** **subsp.** ***italicum*** **(100%)**, ***Bolboschoenus glaucus*** **(100%)**, ***Alisma lanceolatum*** **(100%)**, *Ranunculus trichophyllus* (50%), *Ranunculus sardous* (50%), *Ranunculus neapolitanus* (50%), *Potentilla reptans* (50%), *Persicaria lapathifolia* (50%), *Persicaria amphibia* terrestrial ecophene (50%), *Mentha pulegium* (50%), *Lythrum hyssopifolia* (50%), *Juncus bufonius* (50%), *Eleocharis palustris* (50%)

Dominant species: ***Bolboschoenus glaucus***

Bolboschoenus glaucus is a species recently rediscovered in Italy. It was reported for the Italian flora by Fiori (1923–1929), but had since been completely neglected and only in the recent European revision of the genus (Hroudová et al. 1999) has it been distinguished from the similar *B. maritimus*. This species is described in the literature as being more frequent in southern Europe. It occurs in river floodplains, but also in man-made habitats such as rice fields and other types of arable land. It is well-adapted to terrestrial summer-dry habitats and can form dense stands when a sufficient amount of water is available (Hroudová et al. 1999). *B. glaucus*-dominated communities have not yet been described in Europe (Hroudová et al. 2009) and the data recorded to date are still too scarce for description of a new association. More studies are necessary on the taxonomy, ecology and distribution of *Bolboschoenus* species in Italy. However the ecology of *B. glaucus* in Italy seems to be similar to the ecology of *B. planiculmis* and *B. laticarpus* in central Europe, which grow in similar habitats and form stands with similar species composition.

19. ***Persicaria amphibia*****-community**

Diagnostic species: *Persicaria amphibia* **terrestrial ecophene** (0.40)

Constant species: ***Persicaria amphibia*** **terrestrial ecophene (100%)**, *Eleocharis palustris* (39%), *Ranunculus trichophyllus* (33%)

Dominant species: ***Persicaria amphibia*** **terrestrial ecophene**

Species-poor stands dominated by the terrestrial form of *Persicaria amphibia* are sometimes reported in the national literature (Buchwald 1994; Lastrucci et al. 2007, 2010b) and have been assigned by the authors to different communities without recognizing them as an independent syntaxon. However, these stands occur in well-defined ecological conditions, forming pioneer vegetation on muddy and clayey soils that are submerged for most of the year and subjected to drying out during the summer. This community was observed in central Italy in karst and alluvial plains, ponds and swamps, in contact with other associations of the alliance Eleocharito palustris-Sagittarion sagittifoliae such as Eleocharitetum palustris.

20. *Schoenoplectus pungens*-community

Diagnostic species: *Schoenoplectus pungens* (0.95), *Potamogeton schweinfurthii* (0.70), *Juncus articulatus* (0.35)

Constant species: *Schoenoplectus pungens* (100%), *Juncus articulatus* (100%), *Potamogeton schweinfurthii* (67%), *Mentha aquatica* (67%), *Salix alba* (33%)

Dominant species: *Schoenoplectus pungens*, *Juncus articulatus*

Schoenoplectus pungens is an amphi-Atlantic species with a broad ecological range, but it is rather rare in Italy, mainly occurring in coastal salt marshes (Vanden Berghen 1967; Pignotti 2003). Rarely this species forms extensive and dense stands. It also grows in mesotrophic fresh still-water bodies characterized by a silty-clayey bottom and a high evaporation rate, such as swamps, shallow lakes or ponds. *S. pungens* can grow both as a submerged and emergent plant. For this reason its communities often contain both aquatic and emergent wetland species. In Spain, the association Scirpetum pungentis (Corillion 1950) Vanden Berghen 1967 was recorded for saline habitats and thus is included in the order Scirpetalia compacti (Molina 1996; Loidi et al. 1997; Molina & Moreno 2003), but in Italy stands dominated by *S. pungens* but not assignable to the association Scirpetum pungentis were recorded only by Lastrucci et al. (unpublished) from some fresh water bodies between the Tuscany and Umbria regions.

21. Rorippo-Phalaridetum arundinaceae Kopecký 1961

Diagnostic species: *Phalaroides arundinacea* (0.48)

Constant species: *Phalaroides arundinacea* (100%), *Calystegia sepium* (82%), *Urtica dioica* (64%), *Lythrum salicaria* (64%), *Xanthium orientale* subsp. *italicum* (36%), *Bidens frondosus* (36%)

Dominant species: *Phalaroides arundinacea*

This association, dominated by *Phalaroides arundinacea,* differs ecologically and in species composition from the association Phalaridetum arundinaceae. The association Rorippo-Phalaridetum arundinaceae, as reported in the literature, is characterized by an occurrence of nitrophilous species of the classes Galio-Urticetea and Bidentetea tripartitae. It usually occurs on occasionally flooded riverbanks, islets and terraces (Kopecký 1966, 1967; Hrivnák & Ujházy 2003; Šumberová et al. 2011). This association was recorded for the first time from Italy by Lastrucci et al. (2010b) from the River Arno. It is probably frequent across Italy, and many past records of Phalaridetum arundinaceae should be included in the present community (e.g. some relevés reported as Phalaridetum arundinaceae by Venanzoni & Gigante 2000, Arrigoni & Papini 2003 and Ceschin & Salerno 2008 were assigned to Rorippo-Phalaridetum arundinaceae by our Cocktail definition).

22. Glycerio-Sparganietum neglecti Koch 1926

Syn.: Sparganietum ramosi Roll 1938, Sparganietum erecti Zutshi 1975

Diagnostic species: *Sparganium erectum* s.l. (0.41)

Constant species: *Sparganium erectum* s.l. (100%), *Epilobium hirsutum* (33%), *Mentha aquatica* (31%)

Dominant species: *Sparganium erectum* s.l.

Stands dominated by *Sparganium erectum* s.l. grow in water bodies in an advanced stage of terrestrialization such as swamps, natural and artificial ponds, still-water channels and shallow lakes. This association occurs in mesotrophic to eutrophic water, also with organic sediments on the bottom, often in contact with other associations of Phragmito-Magno-Caricetea such as Iridetum pseudacori, Glycerietum maximae or Typhetum angustifoliae. In the literature, two associations dominated by the two subspecies *Sparganium erectum* subsp. *erectum* and *S. erectum* subsp. *neglectum* are distinguished by some authors (Buchwald 1994). However, we decided to merge these associations following Šumberová et al. (2011). In fact in many relevés subspecies were not identified in many relevés, and often both subspecies occur in the same stands or in very similar habitats. This association is frequent across the country and has been recorded by many authors (e.g. Canullo et al. 1988; Corbetta & Pirone 1989; Buchwald 1994; Venanzoni & Gigante 2000; Venanzoni et al. 2003a; Lastrucci et al. 2004, 2007; Ceschin & Salerno 2008; Pedrotti 2008).

23. Glycerietum fluitantis Nowinski 1930

Syn.: Glycerietum aquaticae-fluitantis Nowiński 1927 (nomen ambiguum), Glycerietum fluitantis Eggler 1933, Glycerietum fluitantis Wilczek 1935

Diagnostic species: *Glyceria fluitans* (0.73), *Ranunculus ophioglossifolius* (0.35), *Callitriche palustris* (0.30)

Constant species: *Glyceria fluitans* (100%), *Eleocharis palustris* (47%), *Ranunculus ophioglossifolius* (40%), *Mentha pulegium* (40%)

Dominant species: *Glyceria fluitans*, *Callitriche brutia*

The species *Glyceria fluitans* can grow in oligotrophic to eutrophic water, but it is less tolerant than *Glyceria notata* to human disturbance and strong eutrophication. This association occurs in habitats that are in an advanced stage of terrestrialization or periodically flooded, for example in ponds, banks of channels and streams or inundated depressions in karst plains. In Italy this association is less frequent than Glycerietum notatae and its occurrence is documented from only a few sites across the country (POLDINI 1989; MARIOTTI 1995; PROSSER & SARZO 2003; LASTRUCCI et al. 2007).

24. Glycerietum notatae Kulczyński 1928
Syn.: Catabroso-Glycerietum plicatae Braun-Blanquet 1949, Glycerietum plicatae Oberdorfer 1957
Diagnostic species: *Glyceria notata* (0.43)
Constant species: ***Glyceria notata* (100%)**, *Ranunculus repens* (53%), *Veronica anagallis-aquatica* (35%), *Helosciadium nodiflorum* (32%)
Dominant species: ***Glyceria notata***
This vegetation type is structurally and ecologically very similar to *Glycerietum fluitantis,* but it is dominated by *Glyceria notata*, a species more tolerant to eutrophic conditions and disturbances. This association occurs on sandy and muddy soils along riverbanks, canals in arable land, natural and artificial ponds and depressions in wet meadows. It is often found in contact with other associations of the alliance Glycerio-Sparganion such as Helosciadietum nodiflori and Nasturtietum officinalis. In Italy this vegetation type is frequent, being recorded by many authors from sea level to the mountains (e.g. CORTINI PEDROTTI et al. 1973; CANULLO et al. 1988; CORBETTA & PIRONE 1989; PEDROTTI et al. 1992; BALDONI & BIONDI 1993; BUCHWALD 1994; SCOPPOLA 1998; BIONDI et al. 1999, LASTRUCCI et al. 2004; PEDROTTI 2008).

25. Nasturtietum officinalis Gilli 1971
Syn.: Nasturtietum officinalis Seibert 1962 (phantom name), Nasturtietum officinalis Philippi 1973
Diagnostic species: ***Nasturtium officinale* (0.52)**
Constant species: ***Nasturtium officinale* (100%)**, *Veronica anagallis-aquatica* (61%), *Helosciadium nodiflorum* (39%), *Glyceria notata* (32%)
Dominant species: ***Nasturtium officinale***
This partially submerged vegetation, dominated by *Nasturtium officinale,* occurs in mesotrophic to eutrophic, still or running water. It forms monospecific or species-poor stands along small rivers, channels and also in shallow pools and ponds. In Italy this association often grows in contact with other associations of the alliance Glycerio-Sparganion, such as Helosciadietum nodiflori, Beruletum erectae and Glycerietum (e.g. CANULLO et al. 1988; CORBETTA & PIRONE 1989; BALDONI & BIONDI 1993; BIONDI et al. 1997; PIRONE et al. 1997; SCOPPOLA 1998; BRULLO et al. 2002; TOMASI & CANIGLIA 2004; CESCHIN & SALERNO 2008; PEDROTTI 2008; LASTRUCCI et al. 2010b).

26. Beruletum erectae Roll 1938
Syn.: Ranunculo trichophylli-Sietum erecti submersi Müller 1962, Apio-Beruletum erecti Philippi 1973, Veronico-Sietum erecti Passarge 1982, Cardamino-Beruletum erectae Turoňová 1985, Veronico beccabungae-Beruletum erectae Passarge 1999, Mentho aquaticae-Beruletum erectae (Nedelcu 1971) Sanda et Popescu 2001
Diagnostic species: ***Berula erecta* (0.58)**
Constant species: ***Berula erecta* (100%)**, *Veronica anagallis-aquatica* (56%), *Mentha aquatica* (56%), *Ranunculus repens* (39%), *Glyceria notata* (39%), *Rumex conglomeratus* (33%)
Dominant species: ***Berula erecta***
This association dominated by *Berula erecta* grows along streams and channels characterized by low to high current speeds, and by mesotrophic, well-oxygenated fresh water rich in calcium. It can occur as submerged, partially submerged or emergent stands. Emergent stands on riverbanks are usually rich in terrestrial species from other classes and alliances. This community is probably rather common in Italy but it has often been overlooked because of its frequent occurrence in mosaic-like stands with Helosciadietum nodiflori (PIRONE et al. 1997; LASTRUCCI et al. 2004; CESCHIN & SALERNO 2008; PEDROTTI 2008).

27. Helosciadietum nodiflori Maire 1924
Syn.: Apietum nodiflori Braun-Blanquet 1931, Helosciadietum nodiflori Braun-Blanquet et al. 1952, Veronico-Apietum submersi Buchwald 1992
Diagnostic species: *Helosciadium nodiflorum* (0.36)
Constant species: ***Helosciadium nodiflorum* (100%)**, *Veronica anagallis-aquatica* (40%), *Glyceria notata* (34%)
Dominant species: ***Helosciadium nodiflorum***
Helosciadium nodiflorum is a Mediterranean species that occurs along oligotrophic to mesotrophic streams characterized by cold water (maximum summer temperature lower than 20°) and a high concentration of carbonates and dissolved oxygen (BUCHWALD 1994). This species occurs in both submerged and emergent form and it can form stands that are completely or partially submerged, or stands on exposed riverbanks. In both types of stands, submerged and emergent, the dominant species *H. nodiflorum* is accompanied by other species which can also grow as both submerged and emergent, e.g. *Veronica anagallis-aquatica, Nasturtium officinale, Glyceria notata, Sparganium erectum* s.l. and *Berula erecta.* Aquatic stands can be enriched by species of the class Potametea such as *Potamogeton natans, Ranunculus trichophyllus* or *Callitriche obtusangula.* In contrast, stands in drained habitats can be enriched by species of the class Molinio-

Arrhenatheretea such as *Ranunculus repens*, *Agrostis stolonifera* or *Mentha longifolia.* These differences in ecology and species composition have led some authors to distinguish two associations: Helosciadietum nodiflori Braun-Blanquet et al. 1952, included in the alliance Glycerio-Sparganion, for emergent stands, and Veronico-Apietum nodiflori Buchwald 1992, included in the alliance Ranunculion fluitantis, for totally submerged or partially submerged stands (Buchwald 1992, 1994; Pirone et al. 1997; Sburlino et al. 2008; Pedrotti 2008). In the present work, it was not possible to separate these two communities due to the low number of species in the sampled stands and a frequent absence of data on environmental conditions or growth form. Moreover, in most cases these two associations were recorded as occurring in contact. For these reasons, we decided to assign both terrestrial and aquatic stands dominated by *H. nodiflorum* to a single association Helosciadietum nodiflori, considering this association as being characterized by the dominant species with a broad ecology. This association is rather frequent in Italy (e.g. Canullo et al. 1988; Pirone et al. 1997; Baldoni & Biondi 1993; Prosser & Sarzo 2003; Pedrotti 2008; Sburlino et al. 2008).

28. Oenantho aquaticae-Rorippetum amphibiae Lohmeyer 1950

Diagnostic species: ***Rorippa amphibia*** **(0.69)**, *Ranunculus peltatus* subsp. *peltatus* (0.37)

Constant species: ***Rorippa amphibia*** **(100%)**, *Calystegia sepium* (56%), *Helosciadium nodiflorum* (44%)

Dominant species: ***Rorippa amphibia***, *Ranunculus trichophyllus*, *Potentilla reptans*

Rorippa amphibia usually forms species-poor stands in shallow mesotrophic to eutrophic water bodies, in advanced stage of terrestrialization or subject to drying out in summer, such as natural and artificial ponds, swamps, lakes and oxbows. This vegetation type is rather rare in Italy probably due to the restricted distribution of the dominant and characteristic species across the Italian Peninsula (Baldoni & Biondi 1993; Biondi & Baldoni 1994; Lastrucci et al. 2007).

29. Leersietum oryzoidis Eggler 1933

Diagnostic species: ***Leersia oryzoides*** **(0.80),** ***Erigeron*** **sp. (0.55)**, *Bidens frondosus* (0.40)

Constant species: ***Lythrum salicaria*** **(100%),** ***Leersia oryzoides*** **(100%),** ***Bidens frondosus*** **(100%)**, *Persicaria lapathifolia* (67%), *Paspalum distichum* (67%), *Schoenoplectus tabernaemontani* (33%), *Persicaria amphibia* terrestrial ecophene (33%), *Mentha aquatica* (33%), *Iris pseudacorus* (33%), *Eupatorium cannabinum* (33%), *Erigeron* sp. (33%), *Equisetum arvense* (33%), *Echinochloa crus-galli* (33%), *Cyperus longus* (33%), *Carex elata* (33%), *Calystegia sepium* (33%)

Dominant species: ***Leersia oryzoides***, *Paspalum distichum*, *Lythrum salicaria*

This vegetation type dominated by the tall grass *Leersia,* occurs along rivers and on the banks of eutrophic lakes and ponds. The dominant species is often accompanied by species of the class Bidentetea tripartiti, favouring habitats characterized by nutrient-rich soil and substrata that dry out. This association has been recorded by a few authors in Italy, from the north-eastern part of the Italian Peninsula by Marchiori & Sburlino (1997), Prosser & Sarzo (2003), Tomasi et al. (2004) and from central Italy by Lastrucci et al. (unpublished).

30. Mentho aquaticae-Caricetum pseudocyperi Orsomando et Pedrotti 1986

Diagnostic species: ***Carex pseudocyperus*** **(0.62)**

Constant species: ***Carex pseudocyperus*** **(100%),** ***Mentha aquatica*** **(89%),** ***Lycopus europaeus*** **(84%)**, *Phragmites australis* (68%), *Lythrum salicaria* (43%), *Calystegia sepium* (41%), *Bidens tripartitus* (36%), *Galium palustre* s.l. (34%), *Cyperus fuscus* (34%), *Typha angustifolia* (32%), *Scutellaria galericulata* (32%), *Eupatorium cannabinum* (32%), *Berula erecta* (32%)

Dominant species: ***Carex pseudocyperus,*** *Cyperus fuscus, Mentha aquatica*

This association, dominated by *Carex pseudocyperus,* occurs in mesotrophic to eutrophic shallow water bodies in an advanced stage of terrestrialization, with muddy and organic sediments on the bottom. It was originally described from some lakes of central Italy as a submediterranean vicariant community of central and north-western European Cicuto virosae-Caricetum pseudocyperi Boer et Sissingh in Boer 1942, and it was assigned in the alliance Magno-Caricion elatae (syn. Caricion rostratae). However, considering the fact that the optimum habitat of this community is floating islands, we prefer to include it in the alliance Carici-Rumicion hydrolapathi. This vegetation type is recorded exclusively from central and southern Italy (Orsomando & Pedrotti 1986; Venanzoni & Gigante 2000; Venanzoni et al. 2003; Corbetta & Pirone 1989; Tammaro 1995), while in northern Italy it is substituted by Cicuto virosae-Caricetum pseudocyperi (Anoè & Caniglia 1987).

31. Caricetum elatae Koch 1926

Syn.: Scutellario-Caricetum elatae Passarge 1964

Diagnostic species: ***Carex elata*** **(0.69)**, *Lysimachia vulgaris* (0.33)

Constant species: ***Carex elata*** **(100%)**, *Lysimachia vulgaris* (63%), *Lythrum salicaria* (59%), *Galium palustre* s.l. (56%), *Calystegia sepium* (44%), *Iris pseudacorus* (37%)

Dominant species: ***Carex elata***

Stands dominated by *Carex elata* occur in mesotrophic to eutrophic still water rich in carbonates and nutrients.

Habitats of this association are swamps, lakeshores and floodplains such as karst plains. This association grows at sites characterized by a large seasonal fluctuation of the water table. *Carex elata* usually forms tall hummocks separated from each other by a layer of dead leaves, where also other species characteristic of this association usually grow, including *Scutellaria galericulata, Lysimachia vulgaris, Rumex hydrolapathum* and *Galium palustre* s.l. In Italy this vegetation type occurs from sea level to the mountains (Bracco 1981; Buchwald 1994; Venanzoni & Gigante 2000; Merloni & Piccoli 2001; Tomasi & Caniglia 2004; Prosser & Sarzo 2003; Lastrucci et al. 2008).

32. Cladietum marisci Allorge 1921

Syn.: Phragmito-Cladietum marisci von Soó 1930, Mariscetum serrati Zobrist 1935

Diagnostic species: ***Cladium mariscus*** **(0.85)**

Constant species: ***Cladium mariscus*** **(100%),** ***Phragmites australis*** **(82%)**, *Lycopus europaeus* (41%), *Lythrum salicaria* (36%), *Mentha aquatica* (32%), *Carex elata* (32%)

Dominant species: ***Cladium mariscus***

Cladium mariscus is typical of oligotrophic to mesotrophic (rarely eutrophic) calcareous marshes such as fens or springs, where it can form dense stands (Balátová-Tuláčková & Venanzoni 1989; Balátová-Tuláčková 1991). This vegetation is rather rare in Italy, but occurs in different ecological conditions, from sea level to the karst plains of the Apennines (Pedrotti et al. 1992; Biondi et al. 1994; Buchwald 1994; Venanzoni & Gigante 2000; Merloni & Piccoli 2001; Venanzoni et al. 2003a).

33. Caricetum acutiformis Eggler 1933

Syn.: Caricetum acutiformis Sauer 1937, Caricetum acutiformi-ripariae Soó 1938, Caricetum acutiformis Sauer ex Weber 1977, Hyperico tetrapteri-Caricetum acutiformis Corbetta et Pirone 1990.

Diagnostic species: ***Carex acutiformis*** **(0.62)**

Constant species: ***Carex acutiformis*** **(100%)**, *Lythrum salicaria* (42%), *Calystegia sepium* (35%)

Dominant species: ***Carex acutiformis***

This marsh community, dominated by *Carex acutiformis,* occurs in mesotrophic to eutrophic shallow water, such as the littoral zones of lakes, swamps, springs, depressions in wet meadows and periodically flooded riverbanks. It grows on peat and humic, usually nutrient and base-rich, but also moderately acid soil. In Italy this association occurs from the lowlands at sea level to the submontane belt, but the stands are often fragmented due to human disturbance (e.g. Corbetta & Pirone 1989; Venanzoni 1992; Tammaro 1995; Biondi et al. 1997; Biondi et al. 1999; Venanzoni & Gigante 2000; Prosser & Sarzo 2003; Lastrucci et al. 2008).

34. Caricetum ripariae Máthé et Kovács 1959

Syn.: Caricetum ripariae Soó 1928 (nomen nudum), Galio palustris-Caricetum ripariae Balátová-Tuláčková in Balátová-Tuláčková et al. 1993

Diagnostic species: ***Carex riparia*** **(0.51)**

Constant species: ***Carex riparia*** **(100%)**, *Phragmites australis* (51%), *Calystegia sepium* (43%), *Iris pseudacorus* (33%), *Lythrum salicaria* (32%), *Galium palustre* s.l. (32%)

Dominant species: ***Carex riparia***, *Phragmites australis*

This association, dominated by *Carex riparia*, is typical of mesotrophic to eutrophic wetlands, such as swamps, lakes, natural and artificial ponds and riverbanks. Stands of *Carex riparia* often grow together with other associations with similar ecological requirements such as Cyperetum longi or Phalaridetum arundinaceae, in a landward zone behind the Phragmitetum australis zone. They are usually flooded only during the winter and early spring. This association is rather frequent across the Italian Peninsula, but it is restricted to lower altitudes of below 800 m (e.g. Arrigoni & Ricceri 1982; Anoè & Caniglia 1987; Buchwald 1994; Pirone et al. 1997; Sarzo et al. 1999; Venanzoni & Gigante 2000; Venanzoni et al. 2000; Pedrotti 2008; Lastrucci et al. 2010a).

35. ***Mentha aquatica*****-community**

Diagnostic species: –

Constant species: ***Mentha aquatica*** **(100%),** ***Lycopus europaeus*** **(77%)**, *Lythrum salicaria* (54%), *Ranunculus repens* (46%), *Calystegia sepium* (46%), *Phragmites australis* (38%), *Eupatorium cannabinum* (38%), *Agrostis stolonifera* (38%), *Urtica dioica* (31%), *Iris pseudacorus* (31%), *Galium palustre* s.l. (31%)

Dominant species: ***Mentha aquatica***

Stands dominated by *Mentha aquatica* occur on disturbed riverbanks and lakeshores on a layer of plant litter or mud rich in organic matter. This vegetation type probably represents the final stage of terrestrialization occurring in the habitat of the association Mentho aquaticae-Caricetum pseudocyperi Orsomando et Pedrotti 1986, or a post-disturbance stage of marsh vegetation. This community is probably frequent across Italy in disturbed habitats, but similar vegetation was recorded only by us and Lastrucci et al. (2010a). More studies are necessary to understand the dynamics and syntaxonomical position of this community.

36. Cyperetum longi Micevski 1957

Diagnostic species: ***Cyperus longus*** **(0.52)**

Constant species: ***Cyperus longus*** **(100%)**, *Calystegia sepium* (47%), *Galium palustre* s.l. (44%), *Lythrum salicaria* (42%), *Ranunculus repens* (36%), *Lycopus europaeus* (36%), *Iris pseudacorus* (31%), *Elytrigia repens* (31%)

Dominant species: ***Cyperus longus***
Cyperus longus usually forms dense and extensive stands on the shores of mesotrophic to eutrophic lakes, swamps and in wet depressions, along rivers and natural or artificial channels on arable land, where the soil is waterlogged for most of the year. In Italy this vegetation type usually occurs in a wet zone between reeds and crops in contact with other communities of the class Phragmito-Magno-Caricetea such as Caricetum ripariae, or of the class Molinio-Arrhenatheretea such as Holoschoenetum vulgaris Braun-Blanquet ex Tchou 1948 or Junco inflexi-Menthetum longifoliae Lohmeyer ex Oberdorfer 1957 (e.g. Corbetta & Pirone 1989; Brullo et al. 1994; Tammaro 1995; Venanzoni & Gigante 2000; Pirone et al. 2003; Venanzoni et al. 2003; Pedrotti 2008; Lastrucci et al. 2010a).

37. Phalaridetum arundinaceae Libbert 1931
Diagnostic species: ***Phalaroides arundinacea*** **(0.50)**
Constant species: ***Phalaroides arundinacea*** **(100%)**, *Phragmites australis* (42%), *Lythrum salicaria* (42%), *Iris pseudacorus* (42%), *Persicaria amphibia* terrestrial ecophene (31%), *Mentha aquatica* (31%),
Dominant species: *Phalaroides arundinacea*
This marsh vegetation type, dominated by *Phalaroides arundinacea,* occurs in shallow depressions or in swamps in an advanced stage of terrestrialization, usually in contact with other associations of the alliance Magno-Caricion gracilis, such as Caricetum gracilis, C. vesicariae or C. ripariae and with those of the alliance Phragmition australis, such as Phragmitetum australis, Glycerietum maximae and Iridetum pseudacori. In contrast to the association Rorippo-Phalaridetum arundinaceae, this association is less nitrophilous and more frequently exposed to regular flooding. This community is rather frequent across the Italian Peninsula (e.g. Bracco 1981; Marchiori et al. 1993; Buchwald 1994; Venanzoni & Gigante 2000; Prosser & Sarzo 2003; Tomasi & Caniglia 2004; Lastrucci et al. 2007, 2010; Ceschin & Salerno 2008).

38. Galio palustris-Juncetum inflexi Venanzoni et Gigante 2000
Diagnostic species: ***Juncus inflexus*** **(0.46)**
Constant species: ***Juncus inflexus*** **(100%)**, *Galium palustre* s.l. (65%), *Ranunculus repens* (53%), *Carex hirta* (47%), *Phragmites australis* (35%), *Equisetum palustre* (35%)
Dominant species: ***Juncus inflexus***, *Scutellaria galericulata*
This vegetation type occurs on sandy and muddy riverbanks and lakeshores that are periodically flooded. The dominant species of this association, *Juncus inflexus*, has a broad ecological range, growing both in wetlands, accompanied by species of the class Phragmito-Magno-Caricetea, and in wet meadows, accompanied by species of the class Molinio-Arrhenatheretea. Stands dominated by *Juncus inflexus* in wetland habitats are rather frequent in Italy but are usually fragmentary, sometimes monospecific, often growing at sites that are subject to anthropogenic disturbance (Corbetta & Pirone 1989; Venanzoni & Gigante 2000; Lastrucci et al. 2005).

39. Leersio oryzoidis-Juncetum effusi Lastrucci et al. 2010
Syn.: Equiseto palustris-Juncetum effusi sensu Venanzoni et Gigante 2000 non Minissale et Spampinato 1990
Diagnostic species: ***Juncus effusus*** **(0.51)**
Constant species: ***Juncus effusus*** **(100%)**, ***Galium palustre*** **s.l. (73%)**, *Mentha aquatica* (35%), *Juncus inflexus* (35%)
Dominant species: ***Juncus effusus***
Juncus effusus is a species with a broad ecological range, tolerant to different water regimes, which can form dense or fragmentary stands both in wetlands and wet meadows. The association Leersio oryzoidis-Juncetum effusi is typically characterized by the occurrence of several species of the class Phragmito-Magno-Caricetea such as *Galium palustre* s.l., *Mentha aquatica, Lythrum salicaria* and *Iris pseudacorus.* It occurs on the shores of shallow lakes, swamps, ponds and along lentic sections of streams subject to frequent flooding. This community is different, both in its ecology and species composition, from the association Equiseto palustris-Juncetum effusi described by Minissale and Spampinato (1990) from Sicily and included in the class Molinio-Arrhenatheretea. Wetland stands dominated by *Juncus effusus* with constant species composition are reported by some authors from different localities, especially from central Italy, often without assignment to an association (Buchwald 1994; Scoppola 1998; Venanzoni & Gigante 2000; Lastrucci et al. 2010b).

40. Caricetum gracilis Savič 1926
Syn.: Caricetum acutiformi-gracilis von Soó 1927, Caricetum gracilis Graebner et Hueck 1931, Caricetum gracilis Eggler 1933, Caricetum gracilis (Almquist 1929) Tüxen 1937
Diagnostic species: ***Carex acuta*** **(0.53)**
Constant species: ***Carex acuta*** **(100%)**, *Ranunculus repens* (52%), *Galium palustre* s.l. (52%), *Deschampsia cespitosa* (40%), *Ranunculus flammula* (38%), *Veronica scutellata* (33%)
Dominant species: ***Carex acuta***
This vegetation, dominated by the rhizomatous sedge *Carex acuta*, occurs in mesotrophic to eutrophic wetlands, on wet soil rich in organic matter. The concentration of bases is usually lower than in other communities of Magno-Caricion gracilis (Balátová-Tuláčková et al. 1993; Valachovič 2001; Šumberová et al. 2011). In

central Italy, this association occurs almost exclusively at altitudes above 700 m, occupying the lowest areas of karst plains, where the water depth does not exceed 50 cm. When the water level becomes too high, this association is replaced by other communities such as Caricetum vesicariae or Phalaridetum arundinaceae (Pedrotti 1967; Cortini Pedrotti et al. 1973; Pirone 1987; Canullo et al. 1988; Buchwald 1994; Cianfaglione 2009). This community is more frequent in northern Italy but is recorded from several localities across the Italian Peninsula (e.g. Prosser & Sarzo 2003; Martini & Poldini 1980; Marchiori & Sburlino 1986; Marchiori et al. 1987, 1993; Buffa et al 1995; Marchiori & Sburlino 1997; Sartori & Bracco 1997).

41. Caricetum vesicariae Chouard 1924
Syn.: Caricetum vesicariae Braun-Blanquet et Denis 1926, Caricetum inflato-vesicariae Koch 1926, Caricetum vesicariae Rübel 1933, Caricetum vesicariae Eggler 1933, Caricetum acuto-vesicariae (Koch 1926) Westhoff 1949
Diagnostic species: ***Carex vesicaria* (0.71)**
Constant species: ***Carex vesicaria* (100%)**, *Carex acuta* (49%), *Galium palustre* s.l. (43%), *Ranunculus flammula* (40%)
Dominant species: ***Carex vesicaria***
This vegetation, dominated by *Carex vesicaria,* grows in mesotrophic to eutrophic wetlands and depressions in meadows, which are permanently flooded or saturated with water for most of the year. It grows on mineral and or partly organic soil with a high concentration of nitrogen, phosphorous and potassium and a low concentration of calcium and magnesium (Balátová-Tuláčková et al. 1993). In central Italy this association is rather rare and occurs especially in depressions of karst plains in the Apennines, where the concentration of carbonates is lower due to the accumulation of clay (Cortini Pedrotti et al. 1973; Buchwald 1994; Pirone 1987). It is also recorded from the lowlands to the mountain belt in other parts of Italy (Marchiori & Sburlino 1997; Gerdol & Tomaselli 1997; Montanari & Guido 1980; Rossi & Alessandrini 1998; Lastrucci et. al. 2008).

42. Caricetum acutiformi-paniculatae Vlieger et van Zinderen Bakker in Boer 1942
Syn.: Caricetum paniculatae Wangerin 1916 (nomen nudum), Caricetum paniculatae Wangerin ex von Rochow 1951, Eupatorio-Caricetum paniculatae Passarge 1999
Diagnostic species: ***Carex paniculata*** (0.86)
Constant species: ***Carex paniculata* (100%)**, ***Galium palustre* s.l. (92%)**, *Epilobium hirsutum* (54%), *Ranunculus repens* (46%), *Iris pseudacorus* (38%), *Eupatorium cannabinum* (31%), *Equisetum palustre* (31%), *Carex hirta* (31%), *Carex acutiformis* (31%)
Dominant species: ***Carex paniculata***
This vegetation type, dominated by *Carex paniculata,* is described in the literature as characteristic of springs or cold water, rich in carbonates and nutrients, on mineral and organic soils (Balátová-Tuláčková & Pavlíček 1980; Šumberová et al. 2011). The occurrence of this association in central and southern Italy is strictly defined by climatic factors, which influence soil formation and water regime; it therefore only occurs above 800 m in the Apennines (Pirone 1987; Venanzoni 1988; Corbetta & Pirone 1989; Buchwald 1994; Tammaro 1995; Venanzoni et al. 2003a). For this reason this community is considered as rare, although it is more frequent in northern Italy (Pedrotti 1963; Balátová-Tuláčková & Venanzoni 1990; Minghetti & Pedrotti 2000).

43. Caricetum vulpinae Nowinski 1927
Syn.: Caricetum vulpinae von Soó 1927; Caricetum otrubae Pedrotti 1982
Diagnostic species: ***Carex vulpina* (0.91)**, *Deschampsia cespitosa* (0.36), *Viola palustris* (0.35), *Carex leporina* (0.33), *Epilobium parviflorum* (0.31), *Alopecurus pratensis* (0.30)
Constant species: ***Carex vulpina* (100%)**, *Deschampsia cespitosa* (62%), *Carex hirta* (50%), *Carex acuta* (50%), *Veronica scutellata* (38%), *Ranunculus repens* (38%), *Ranunculus flammula* (38%), *Galium palustre* s.l. (38%), *Carex leporina* (38%), *Alopecurus pratensis* (38%), *Agrostis canina* (38%)
Dominant species: ***Carex vulpina***
This association, dominated by *Carex vulpina,* is described in the literature as typical of floodplain meadows and alluvial pools in an advanced stage of terrestrialization, with soil characterized by high concentration of potassium and phosphorus (Šumberová et al. 2011). It is very rare in Italy and relevés are available only from the karst plains of the Apennines at altitudes above 1000 m (Cortini Pedrotti et al. 1973; Pirone 1987), where Caricetum vulpinae is in contact with other associations of the alliance Magno-Caricion gracilis, such as Caricetum gracilis and Caricetum vesicariae. Other records are from the Venetian plain (Caniglia & Basso 1995). This community was probably overlooked in the past because of the similarity of *Carex vulpina* to *C. cuprina.*

Discussion

Application of the Cocktail method

This study is the first that applied a supervised formalized classification to Italian vegetation, using a large data set from a new national vegetation database (Venanzoni et al. 2012). The classification obtained by applying the Cocktail method to the vegetation data of the class Phragmito-Magno-Caricetea in central Italy corresponds well with previous classifications reported in both the European and Italian literature. It reproduced most of the traditional associations, but also identified some inconsistencies of the previous schemes and open questions.

In most cases, formal definitions of species-poor associations do not include any species group, but they are based on the dominance of certain species. The same approach was used in central Europe by Šumberová et al. (2011) for similar vegetation types. However, the role of sociological species groups was fundamental to the definition of some syntaxonomic units. The group *Mentha aquatica* occurs frequently in all alliances and is not diagnostic for any of them. Nevertheless, it is faithful to one association, Mentho aquaticae-Caricetum pseudocyperi, and for this reason it is an important part of its definition. In contrast, the groups *Helosciadium nodiflorum* and *Eleocharis palustris* occur almost exclusively in the alliances Glycerio-Sparganion and Eleocharito palustris-Sagittarion sagittifoliae, respectively, and may be considered as diagnostic of these alliances. Moreover, some species groups (*Urtica dioica, Persicaria lapathifolia* or *Tetragonolobus maritimus* Group) were typical of other classes but were needed to distinguish associations dominated by the same species but growing in different ecological conditions, such as Phalaridetum arundinaceae vs. Rorippo-Phalaridetum arundinaceae, or Phragmito-Typhetum minimae vs. Mentho aquaticae-Typhetum minimae. In such cases, species of these groups served as differential or transgressive differential species.

In some cases, in this work we created broad definitions of associations/communities as interim solutions for vegetation types that cannot currently be defined due to taxonomic difficulties or lack of data. This is the case for the *Bolboschoenus maritimus* agg.-community, which includes all stands dominated by different species of the *Bolboschoenus maritimus* aggregate (in Italy including *Bolboschoenus maritimus* s.str., *B. glaucus*, *B. planiculmis* and *B. laticarpus*). Another case is the definition of Glycerio-Sparganietum neglecti, which includes communities dominated by *Sparganium erectum* s.l. (including the two subspecies *S. erectum* subsp. *erectum* and *S. erectum* subsp. *neglectum*). These "multi-inclusive definitions" should be modified after sufficient data on the ecology and distribution of the dominant species become available.

The definition created for the association Phragmitetum australis also includes an unpublished relevé (by Gigante, Lastrucci and Landucci from Lake Chiusi) dominated by *Phragmites australis* with *Thelypteris palustris* occurring with a cover value of less than 5% (+). The occurrence of this stand on a floating reed island and the presence of *T. palustris* could suggest that this relevé be assigned to the association Thelypterido-Phragmitetum Kuiper ex van Donselaar et al. 1961, reported from the same locality by Arrigoni & Ricceri (1982). However, we decided not to create a definition of the association Thelypterido-Phragmitetum at this point in time because of the insufficient number of relevés and low cover value of *T. palustris*. We consider this stand to be transitional between the associations Thelypterido-Phragmitetum and Phragmitetum australis, reflecting the degradation of the floating reed island. Nevertheless, this observation opens a more general question as to whether the occurrence of a single species with a low cover value (less than 5%) should be used as a single decision criterion for assigning a relevé to an association. Overall, such solutions could lead to inflations of the associations described; there are however specific cases when the use of specialist species with particular ecological requirements, occurring in species-poor vegetation, might be justified. However, some formal criterion distinguishing such specialist species should be developed.

Syntaxonomy of tall-sedge vegetation

The order Magno-Caricetalia includes two distinct ecological groups, identified by some authors as two alliances (Magno-Caricion gracilis Géhu 1961 and Magno-Caricion elatae Koch 1926), or by others as two suballiances of the alliance Magno-Caricion elatae Koch 1926 (Caricenion gracilis (Neuhäusl 1959) Oberdorfer et al. 1967 and Caricenion rostratae (Balátová-Tuláčková 1963) Oberdorfer et al. 1967) (e.g. Rivas-Martínez et al. 2001; Valachovič 2001; Prosser & Sarzo 2003; Hrivnák 2004; Hrivnák et al. 2011). In both cases this distinction is based mainly on the mineral and organic content of the soil, vegetation physiognomy and structure, presence or absence of rhizomatous species, and tolerance to human disturbance (Balátová-Tuláčková 1994; Šumberová et al. 2011). However, in the southern European literature this distinction is often neglected (Meriaux 1981; Molina & Moreno 2003), and in the Italian literature the alliance Magno-Caricion gracilis (or suballiance Caricenion gracilis) is rarely mentioned. The authors who use this distinction include in this alliance/suballiance the associations Caricetum gracilis (Pedrotti 1981; Canullo et al. 1988; Catorci et al. 1996; Orsomando & Catorci 1999), Caricetum ripariae (Pedrotti 1980; Orsomando et al. 1993), Caricetum vulpinae (Pedrotti 1982), Caricetum vesicariae (Montanari & Guido 1980), Caricetum hispidae (Géhu & Biondi 1988) and Phalaridetum arudinaceae (Ballelli et al. 1981). Similarly the suballiance Caricenion rostratae (more often indicated in the Italian literature as the alliance Caricion rostratae Balátová-Tuláčková 1963) is mentioned only by a few authors, who include in this group the associations Caricetum paniculatae (Venanzoni 1988), Caricetum rostratae (Montanari & Guido 1980; Guido & Montanari 1983; Balátová-Tuláčková & Venanzoni 1990), Caricetum elatae (Pedrotti 1980) and Mentho-Caricetum pseudocyperi (Orsomando & Pedrotti 1986). All the other associations of the order Magno-Caricetalia, and also often the previously mentioned ones, are usually included in the single broadly conceived alliance Magno-Caricion (e.g. Marchiori & Sburlino 1986; Corbetta & Pirone 1989; Brullo et al. 1994; Sartori & Bracco 1997; Venanzoni & Gigante 2000; Lastrucci et al. 2005; Pirone et al. 2003; Prosser & Sarzo 2003; Tomasi & Caniglia 2004; Ceschin & Salerno 2008; Lastrucci et al. 2010a, 2010b). This simplified approach is probably more often adopted in Italy and southern Europe due to the objective difficulty of assigning some communities that have a broad ecological range to one of the two alliances (or suballiances). In the present paper, we decided to maintain the distinction into two groups, trying to interpret the Italian vegetation in the framework of the main classifications proposed in central Europe (Balátová-Tuláčková 1994; Valachovič 2001; Hrivnák 2004; Hrivnák et al. 2011; Šumberová et al. 2011), because the concept of a single alliance seems to be too simplistic to reflect the existing ecological differences. However, the broad ecological ranges determined for several associations are evident from the analysis of the data from central Italy (Figs. 3D, 4, 5). DCA and box-plots nonetheless reveal two main groups that represent the cores of the two alliances. The first one, identifiable as Magno-Caricion gracilis, is represented by the associations Caricetum gracilis, Caricetum vesicariae and Caricetum vulpinae. These three associations are related to nutrient-rich but usually calcium-poor soil, in accordance with the literature. In central Italy these associations are rare and occur more frequently on the karst plains of the Apennines at altitudes above 800 m, occupying the lowest zones of plains with accumulations of clay created by limestone weathering. These habitats are not very rich in calcium and their soils remain moist for most of the year. The other group, identifiable as Magno-Caricion elatae, includes the associations Caricetum elatae and Cladietum marisci. According to the European literature, these two associations are characteristic of oligotrophic to mesotrophic habitats rich in carbonates and flooded for a long time during the year. These communities are rather rare and fragmentary in central Italy because they occur mostly at altitudes below 800 m, usually in areas with a strong human impact that does not represent the optimum conditions for these communities. In addition to these, another group including all associations with intermediate requirements is visible in the DCA diagram. We decided to include all the transitional associations in the alliance Magno-Caricion gracilis based on their higher frequency in eutrophic habitats subjected to human disturbance. An exception is the association Caricetum acutiformis, assigned to Magno-Caricion elatae, because of its frequent occurrence in central Italy on calcium-rich soils and in mesotrophic conditions.

Conclusions and outlook

The present work is the first comprehensive survey of the class Phragmito-Magno-Caricetea in a large area of Italy. Although based on data from central Italy, it provides formal criteria for the extension of the proposed classification to the rest of the country. Communities formally defined in this paper represent 70% of the associations of Phragmito-Magno-Caricetea that occur in Italy (Table 3). In this study, we have attempted to give an example for possible development of a comprehensive, formalized national vegetation survey of Italy. The development of a complete national vegetation database, as assumed in the project VegItaly (Venanzoni et al. 2012), will provide sufficient data for the extension of similar studies to other vegetation types, and to the whole Italian territory and beyond.

Acknowledgements: We thank Kateřina Šumberová and Lorenzo Lastrucci for their advice on some types of wetland vegetation, Lubomír Tichý for his support with the JUICE program, Edoardo Panfili for technical support with the database "anArchive", and Alessandro Properzi and Valeria Silveri for their collaboration in the data search and database archiving.

References

Aita, L., Martini, E. & Orsino, F. (1979): Flora e vegetazione dei laghetti delle Agoraie e zone limitrofe (Appennino Ligure orientale). – Lav. Soc. Ital. Biogeogr. **6**: 163–229.

Angiolini, C., Chiarucci, A., De Dominicis, V., Gabellini, A., Morrocchi, D. & Selvi, F. (1999): Lineamenti vegetazionali dell'Area Naturale Protetta del Fiume Elsa. – Atti Accad. Fisiocritici Siena **18**: 101–122.

Angiolini, C., Landi, M., Boddi, M. & Frignani, F. (2005): La vegetazione dell'alveo fluviale del Sito di Importanza regionale Torrente Trasubbie (Grosseto, Toscana Meridionale). – Atti Soc. Tosc. Nat., Mem. Serie B **122**: 127–151.

Anoè, N. & Caniglia, G. (1987): La vegetazione acquatica e palustre di alcune cave di argilla dell'entroterra veneziano. – Lav. Soc. Ven. Sc. Nat. Venezia **12**: 159–175.

Arrigoni, P.V. & Papini, P. (2003): La vegetazione del sistema fluviale Lima – Serchio (Toscana Settentrionale). – Parlatorea **6**: 95–129.

Arrigoni, P.V. & Ricceri, C. (1982): La vegetazione dei laghi di Chiusi e di Montepulciano (Siena). – Atti Soc. Tosc. Sci. Nat. Serie B **88**: 285–299.

Avena, G.C. & Scoppola, A. (1987): Valutazione della situazione ambientale del Lago di Nemi. Caratteristiche dei complessi ad idrofite ed elofite., pp. 75–94. – Univ. "La Sapienza", Assessorato alla Sanità e all'Ambiente, Roma.

Balátová-Tuláčková, E. (1963): Zur Systematik der europäischen Phragmitetea. – Preslia **35**: 118–122.

Balátová-Tuláčková, E. (1991): Das Cladietum marisci. – Veröff. Geobot. Inst. ETH **106**: 7–34.
Balátová-Tuláčková, E. (1994): Magnocaricion elatae-Gesellschaften – Eine Ergänzung zum Werk "Die Pflanzengesellschaften Österreichs". – Verh. Zool.-Bot. Ges. Österreich **131**: 27–36.
Balátová-Tuláčková, E., Mucina, L., Ellmauer, T. & Wallnöfer, S. (1993): Phragmiti-Magnocaricetea. – In: Grabherr G. & Mucina L., Die Pflanzengesellschaften Österreichs, Teil 2, Natürliche waldfreie Vegetation, pp. 79–130. – Gustav Fischer Verlag, Jena/Stuttgart/New York.
Balátová-Tuláčková, E. & Pavlíček, V. (1980): Beitrag zur Kenntnis der chemischen Zusammensetzung der Phragmiti-Magnocaricetea und der Agropyro-Rumicion-Arten. – Folia Geobot. Phytotax. **15**: 225–244.
Balátová-Tuláčková, E. & Venanzoni, R. (1989): Sumpf- und Feuchtrasengesellschaften in der Verlandungszone des Kalterer Sees (Lago di Caldaro), der Montiggler (Monticolo) Seen und in der Etsch (Adige) Aue, Oberitalien. – Folia Geobot. Phytotax. **24**: 253–295.
Balátová-Tuláčková, E. & Venanzoni, R. (1990): Beitrag zur Kenntniss der Nass- und Feuchtwiesen in der montanen Stufe der Provinz Bozen (Bolzano), Italien. – Tuexenia **10**: 153–171.
Baldoni, M. & Biondi, E. (1993): La vegetazione del medio e basso corso del Fiume Esino (Marche – Italia centrale). – Studia Bot. **11**: 209–257.
Ballelli, S., Biondi, E., Cortini Pedrotti, C., Francalancia, C., Orsomando, E. & Pedrotti, F. (1981): Il patrimonio vegetale delle Marche. pp 182–189 – Regione Marche, Assessorato Urbanistica Ambiente, Ancona.
Biondi, E. & Baldoni, M. (1994): La vegetazione del Fiume Marecchia (Italia centrale). – Biogeographia **17**: 51–87.
Biondi, E., Bracco, F. & Nola, P. (eds.) (1996): Bibliografia fitosociologica italiana (1909–1993). – Fitosociologia **31**: 5–10.
Biondi, E., Bracco, F. & Nola, P. (eds.) (1997): Lista delle unità sintassonomiche della vegetazione italiana. – Fitosociologia **33**: 5–11.
Biondi, E., Casavecchia, S. & Radetic, Z. (2002): La vegetazione dei guazzi e il paesaggio vegetale della pianura alluvionale del tratto terminale del Fiume Musone (Italia centrale). – Fitosociologia **39**: 45–70.
Biondi, E., Giustini, A. & Taffetani, F. (1994): La vegetazione di Portonovo (Ancona): analisi, rilevamento cartografico e proposte di recupero. pp. 197–208. – Verde, Città e Territorio, Ancona.
Biondi, E., Vagge, I., Baldoni, M. & Taffetani, F. (1997): La vegetazione del Parco Fluviale Regionale del Taro (Emilia Romagna). – Fitosociologia **34**: 69–110.
Biondi, E., Vagge, I., Baldoni, M. & Taffetani, F. (1999): La vegetazione del Parco Fluviale Regionale dello Stirone (Emilia Romagna). – Fitosociologia **36**: 67–93.
Biondi, E., Vagge, I., Baldoni, M. & Taffetani, F. (2004): Biodiversità fitocenotica e paesaggistica dei fiumi dell'Italia centro-settentrionale: aspetti fitosociologici e sinfitosociologici. – Studi Trent. Sci. Nat., Acta Biol. **80**: 13–21.
Blasi, C. & Frondoni, R. (2011): Modern perspectives for plant sociology: The case of ecological land classification and the ecoregions of Italy. – Plant Biosyst. **145**: 30–37.
Bolbrinker, P. (1984): Zum Vorkommen des Elatino alsinastri-Juncetum tenageiae Libbert 1933 in Mittelmecklenburg. – Gleditschia **11**: 161–177.
Bracco, F. (1981): Note sulla vegetazione acquatica e palustre della bassa valle del Ticino. – Not. Fitosoc. **17**: 55–68.
Bracco, F. (2001): Il primo aggiornamento della Lista sintassonomica italiana. – Fitosociologia, Suppl. 1, **38**(2): 5–11.
Bracco, F., Buffa, G., Ghirelli, L., Sburlino, G. & Zuccarello, V. (2000): The phytosociological information and the management of the upspring vegetation of the River Sile regional Park (Venetian plain – Northern Italy). – Arch. Geobot. **4**: 51–57.
Bracco, F., Panfili, E., Sburlino, G. & Venanzoni, R. (2007): Il secondo aggiornamento della Lista sintassonomica italiana (2000–2004). – Fitosociologia, Suppl. 1, **44**(1): 5–12.
Braun-Blanquet J. (1964): Pflanzensoziologie – Grundzüge der Vegetationskunde, 3rd ed. Springer, Wien.
Brinson, M.M. & Malvárez, I. (2002): Temperate freshwater wetlands: types, status and threats. – Environ. Conserv. **29**: 115–133.
Bruelheide, H. (1995): Die Grünlandgesellschaften des Harzes und ihre Standortsbedingungen. Mit einem Beitrag zum Gliederungsprinzip auf der Basis von statistisch ermittelten Artengruppen. – Diss. Bot. **244**: 1–338.
Bruelheide, H. (1997): Using formal logic to classify vegetation. – Folia Geobot. Phytotax. **32**: 41–46.
Bruelheide, H. (2000): A new measure of fidelity and its application to defining species groups. – J. Veg. Sci. **11**: 167–178.
Bruelheide, H. & Chytrý, M. (2000): Towards unification of national vegetation classifications: A comparison of two methods for analysis of large data sets. – J. Veg. Sci. **11**: 295–306.
Brullo, S., De Santis, C., Furnari, F., Longhitano, N. & Ronsisvalle, G.A. (1988): La vegetazione dell'oasi della foce del Simeto (Sicilia orientale). – Braun-Blanquetia **2**: 165–188.
Brullo, S., Giusso del Galdo, G., Minissale, P. & Spampinato, G. (2002): Considerazioni sintassonomiche e fitogeografiche sulla vegetazione della Sicilia. – Boll. Acc. Gioenia Sci. Nat. **35**(361): 325–359.
Brullo, S. & Furnari, F. (1976): Le associazioni vegetali degli ambienti palustri costieri della Sicilia. – Not. Fitosoc. **11**: 1–43.
Brullo, S., Minissale, P. & Siracusa, G. (1998): Quadro sintassonomico della vegetazione iblea. – Boll. Acc. Gioenia Sci. Nat. **29**(352): 113–150.
Brullo, S., Minissale, P. & Spampinato, G. (1994): Studio fitosociologico della vegetazione lacustre dei Monti Nebrodi (Sicilia settentrionale). – Fitosociologia **27**: 5–50.
Brullo, S. & Siracusa, G. (2000): Indagine fitosociologica su di un'area umida del versante sud-occidentale dell'Etna di notevole interesse naturalistico. – Arch. Geobot. **4**(1): 71–90.
Brullo, S. & Siracusa, G. (1996): Studio fitosociologico dell'isola di Linosa. – Doc. Phytosoc. **16**: 123–164.
Brullo, S. & Sciandrello, S. (2006): La vegetazione del bacino lacustre "Biviere di Gela" (Sicilia meridionale). – Fitosociologia **43**(2): 21–40.
Buchwald, R. (1992): Il Veronico-Apietum submersi, una nuova associazione dell'Italia centrale. – Doc. Phytosoc. **14**: 513–529.
Buchwald, R. (1994): Vegetazione e odontofauna negli ambienti acquatici dell'Italia centrale. – Braun-Blanquetia **11**: 1–77.
Buffa, G., Ghirelli, L. & Sburlino, G. (1995): La vegetazione delle sorgenti del fiume Sile (Veneto – Italia nord-orientale). – Giorn. Bot. Ital. **129**: 265.
Caniglia, G. & Basso, F. (1995): Descrizione del paesaggio vegetale del corso del fiume Marzenego (Pianura Veneta) mediante un approccio sinfitosociologico. – Quaderni Staz. Ecol. Civ. Mus. St. Nat. Ferrara **9**: 137–153.
Caniglia, G., Mondin, F. & Carpenè, B. (1992): Aspetti floristico-vegetazionali di un lobo di meandro del Parco del Sile

(S. Michele Vecchio – Venezia). – Lav. Soc. Ven. Sc. Nat. **17**: 151–173.
Canullo, R., Pedrotti, F. & Venanzoni, R. (1988): I prati umidi ed inondati dell'alto Trigno (Molise, Italia). – Doc. Phytosoc. **11**: 583–606.
Catorci, A., Orsomando, E. & Silvi, B. (1996): Il paesaggio vegetale del Foglio Nocera Umbra. N. 312 della Carta d'Italia I.G.M., in Scala 1: 50.000. – Coll. Phytosoc. **24**: 665–673.
Ceschin, S. & Salerno, G. (2008): La vegetazione del basso corso del Fiume Tevere e dei suoi affluenti (Lazio, Italia). – Fitosociologia **45**: 39–74.
Chytrý, M., Tichý, L., Holt, J. & Botta-Dukát, Z. (2002): Determination of diagnostic species with statistical fidelity measures. – J. Veg. Sci. **13**: 79–90.
Chytrý, M. (ed.) (2007): Vegetace České republiky 1. Travinná a keříčková vegetace. Vegetation of the Czech Republic 1. Grassland and heathland vegetation – Academia, Praha.
Chytrý, M. (ed.) (2009): Vegetace České republiky 2. Ruderální, plevelová, skalní a sut'ová vegetace. Vegetation of the Czech Republic 2. Ruderal, weed, rock and scree vegetation. – Academia, Praha.
Chytrý, M. (ed.) (2011): Vegetace České republiky 3. Vodní a mokřadní vegetace. Vegetation of the Czech Republic 3. Aquatic and wetland vegetation. – Academia, Praha.
Cianfaglione, K. (2009): The hygrophilous vegetation of the Sulmona basin (Abruzzo, Italy). – Contrib. Bot. **44**: 49–56.
Conti, F., Abbate, G., Alessandrini, A. & Blasi, C. (ed.) (2005): An annotated check-list of the Italian vascular flora. – Palombi ed., Roma.
Corbetta, F. & Pirone, G. (1989): La vegetazione del fiume Tirino (Abruzzo). – Arch. Bot. Ital. **65**: 121–153.
Corbetta, F. & Pirone, G. (1999): Analisi comparativa della vegetazione delle lagune della costa adriatica e dell'arco jonico pugliese-lucano. Attuale situazione conservazionistica. – Boll. Mus. Civ. St. Nat. Venezia, Suppl. **49**: 135–146.
Cortini Pedrotti, C., Orsomando, E., Pedrotti, F. & Sanesi, G. (1973): La vegetazione e i suoli del Pian Grande di Castelluccio di Norcia (Appennino centrale). – Atti Ist. Bot. Lab. Critt. Univ. Pavia **6**: 155–249.
De Cáceres, M., Font, X., Vicente, P. & Oliva, F. (2009): Numerical reproduction of traditional classifications and automatic vegetation identification. – J. Veg. Sci. **20**: 620–628.
Dengler, J., Chytrý, M. & Ewald, J. (2008): Phytosociology. – In: Jørgensen, S.E., Fath, B.D. (eds.). General Ecology. Vol. 4 of Encyclopedia of Ecology, pp. 2767–2779. – Elsevier, Oxford.
Díaz González, T.E. & Fernández-Prieto, J.A. (1994): La vegetación de Asturias. – Itinera Geobot. **8**: 243–520.
Ellenberg, H., Weber, H.E., Düll, R., Wirth, W., Werner, W. & Paulißen, D. (1992): Zeigerwerte von Pflanzen in Mitteleuropa edn. 2. – Scr. Geobot. **18**: 1–258.
Ferrari, C. & Manzi, M.L. (1987): Osservazioni sulla vegetazione macrofitica del Lago Calamone (Appennino settentrionale). – Inform. Bot. Ital. **19**: 82–87.
Filigheddu, R., Farris, E. & Biondi, E. (2000): The vegetation of S'Ena Arrubia lagoon (central-west Sardinia). – Fitosociologia **37**: 39–59.
Fiori, A. (1929): Nuova Flora Analitica d'Italia, 2. – Tip. Ricci, Firenze.
Géhu, J.M. & Biondi, E. (1988): Données sur la végétation des ceintures d'atterissement des lacs Alimini (Salento Italie). – Doc. Phytosoc. **11**: 353–380.
Géhu, J.M. & Biondi, E. (1996): Synoptique des associations végétales du littoral adriatique italien. – Giorn. Bot. Ital. **130**(1): 257–270.
Géhu, J.M., Costa, M., Scoppola, A., Biondi, E., Marchiori, S., Peris, J.B., Franck, J., Caniglia, G. & Veri, L. (1984): Essai synsystématique et synchorologique sur les végétations littorales italiennes dans un but conservatoire. I - Dunes et vases salees. – Doc. Phytosoc. **8**: 393–474.
Gentile, S., Guido, M.A., Montanari, C., Paola, G., Morucchio, G.B. & Petrillo, M. (1988): Ricerche geobotaniche e saggi di cartografia della vegetazione del piccolo bacino di Lago Riane (Liguria). – Braun-Blanquetia **2**: 77–104.
Gerdol, R. (1987): Geobotanical investigations in the small lakes of Lombardy. – Atti Ist. Bot. Lab. Critt. Univ. Pavia **7**(6): 5–49.
Gerdol, R. & Piccoli, F. (1984): La vegetazione del Delta Padano: stato attuale delle conoscenze. – Atti Soc. Ital. Sc. Nat. Milano **125**: 233–244.
Gerdol, R. & Tomaselli, M. (1997): Vegetation of wetlands in the Dolomites. – Diss. Bot. **281**: 1–195.
Granetti, B. (1965): La flora e la vegetazione del Lago trasimeno. Parte I: La vegetazione litoranea. – Rivista di Idrobiol. **4**(3): 115–153.
Guielmetto Mugion, L., Montacchini, F. (1993–1994): La vegetazione del lago di Viverone. – Allionia **32**: 7–25.
Guido M. & Montanari C. (1983): Studio e cartografia della vegetazione cacuminale del Monte Aiona (Appennino ligure). – Arch. Bot. Biogeogr. Ital. **59**(3–4): 105–131.
Hill, M.O. & Gauch, H.G. Jr. (1980): Detrended Correspondence Analysis: an improved ordination technique. – Vegetatio **42**: 47–58.
Hrivnák, R. (2004): The plant communities of Phragmitetalia in the catchment area of the Ipel' River (Slovakia and Hungary) 2. Tall-sedge dominated wetlands (Magnocaricion elatae). – Biologia **59**: 457–476.
Hrivnák, R., Kochjarová, J. & Ot'ahel'ová, H. (2011): Vegetation of aquatic and marshland habitats in the Orava region, including the first records of Potametum alpini, Potametum zizii and Ranunculo-Juncetum bulbosi in the territory of Slovakia. – Biologia **66**: 626–637.
Hrivnák, R. & Ujházy, K. (2003): The stands with the Phalaroides arundinacea dominance in the Ipel' River catchment area (Slovakia and Hungary). – Acta Bot. Hung. **45**: 297–314.
Hroudová, Z., Zákravský, P. & Frantík, T. (1999): Ecological differentiation of Central European Bolboschoenus taxa and their relationship to plant communities. – Folia Geobot. **34**: 77–96.
Hroudová, Z., Zákravský, P., Ducháček M. & Marhold K. (2007): Taxonomy, distribution and ecology of Bolboschoenus in Europe. – Ann. Bot. Fenn. **44**: 81–102.
Hroudová, Z., Hrivnák, R. & Chytrý, M. (2009): Classification of inland Bolboschoenus-dominated vegetation in Central Europe. – Phytocoenologia **39**: 205–215.
Iberite, M., Paolozzi, A.M. & Resini, A.M. (1995): La vegetazione del lago di Bolsena (Viterbo, Italia centrale). – Fitosociologia **29**: 151–164.
Keddy, P. (2000): Wetland ecology: Principles and conservation. – Cambridge Univ. Press, Cambridge.
Kočí, M., Chytrý, M. & Tichý, L. (2003): Formalized reproduction of an expert-based phytosociological classification: A case study of subalpine tall-forb vegetation. – J. Veg. Sci. **14**: 601–610.
Kopecký, K. (1966): Ökologische Hauptunterschiede zwischen Röhrichtgesellschaften fliessender und stehender Binnengewässer Mitteleuropas. – Folia Geobot. Phytotax. **1**: 193–242.

Kopecký, K. (1967): Mitteleuropäische Flussröhrichtgesellschaften des Phalaridion arundinaceae-Verbandes. – Limnologica **5**: 39–79.

Landi, M., Angiolini, C. & De Dominicis, V. (2002): Analisi fitosociologica dei fiumi della Toscana meridionale: il tratto medio-basso del Merse (Italia centrale). – Stud. Bot. **21**: 37–88.

Lastrucci, L. & Becattini, R. (2008): La vegetazione delle aree umide presso Bosco ai Frati (Firenze, Toscana). – Atti Soc. Tosc. Nat., Mem., Serie B **115**: 57–67.

Lastrucci, L., Foggi, B., Gonnelli, V. & Gusmeroli, E. (2005): La vegetazione delle aree umide dei substrati ultramafici dell'Alta Valtiberina (Arezzo, Italia centrale). – Stud. Bot. **24**: 9–44.

Lastrucci, L., Foggi, B., Selvi, F. & Becattini, R. (2007): Contributo alla conoscenza della vegetazione e della flora delle aree umide nel comprensorio di Capalbio (Provincia di Grosseto, Italia centrale). – Arch. Geobot. **10**: 1–30.

Lastucci, L., Gonnelli, V. & Foggi, B. (2004): Flora e vegetazione di alcune aree umide dell'altopiano della "Pianca" nell'alta Val Marecchia (Provincia di Arezzo, Toscana). – Inform. Bot. Ital. **36**: 429–442.

Lastucci, L., Landi, M. & Angiolini, C. (2010a): Vegetation analysis on wetlands in Tuscan agricultural landscape (Central Italy). – Biologia **65**: 54–68.

Lastucci, L., Paci, F. & Raffaelli, M. (2010b): The wetland vegetation of the Natural Reserves and neighbouring stretches of the Arno river in the Arezzo province (Tuscany, Central Italy). – Fitosociologia **47**: 29–59.

Lastrucci, L., Viciani, D., Nuccio, C. & Melillo, C. (2008): Indagine vegetazionale su alcuni laghi di origine artificiale limitrofi al Padule di Fucecchio (Toscana, Italia centrale). – Ann. Mus. Civ. Rovereto **23**: 169–203.

Lengyel, A., Chytrý, M. & Tichý, L. (2011): Heterogeneity-constrained random resampling of phytosociological databases. – J. Veg. Sci. **22**: 175–183.

Loidi, J., Biurrun, I. & Herrera, M. (1997): La vegetación del centro-septentrional de España. – Itinera Geobot. **9**: 161–618.

Lososová, Z. (2004): Weed vegetation in Southern Moravia (Czech Republic): a formalized phytosociological classification. – Preslia **76**: 65–85.

Marchiori, S. & Sburlino, G. (1986): La vegetazione della Palude Brusà (Cerea - Verona). – Boll. Mus. Civ. St. Nat. Verona **13**: 265–272.

Marchiori, S. & Sburlino, G. (1997): Present vegetation of the Venetian Plain. – Allionia **34** (1996): 165–180.

Marchiori, S., Sburlino, G. & Tornadore, N. (1993): Check-list of the hydro-hygrophious vegetation of the Venetian plain. – Giorn. Bot. Ital. **127**: 720.

Marchiori, S., Sburlino, G. & Tisi, F. (1997): La vegetazione dei laghetti di Marco (Rovereto). – Ann. Mus. Civ. Rovereto **3**: 197–206.

Mariotti, M.G. (1995): Osservazioni sulla vegetazione della Liguria. – Atti Conv. Lin. **115**: 189–227.

Martini, F. & Poldini, L. (1980): Il paesaggio vegetale del fiume Noncello nell'area urbana di Pordenone. – Gortania **2**: 123–156.

Meriaux, J.L. (1981): La classe des Phragmitetea dans le Nord-Ouest de la France. – Colloq. Phytosoc. **10**: 139–147.

Merloni, N. & Piccoli, F. (2001): La vegetazione del complesso Punte alberate e Valle Mandriole (Parco Regionale del Delta del Po – Italia). – Braun-Blanquetia **29**: 1–17.

Mierwald, U. (1988): Die Vegetation der Kleingewässer landwirtschaftlich genutzter Flächen. Eine pflanzensoziologische Studie aus Schleswig-Holstein. – Arbeitsgemeinschaft Geobotanik in Schleswig-Holstein und Hamburg, Kiel.

Minghetti, P. & Pedrotti, F. (2000): La vegetazione del Laghetto delle Regole di Castelfondo (Trento). – St. Trent. Sci. Nat., Acta Biol. **74**: 175–189.

Minissale, P. & Spampinato, G. (1990): Osservazioni fitosociologiche sul "Pantano Gurna" presso Mascali (Sicilia orientale). – Boll. Acc. Gioenia Sci. Nat. **23**: 317–336.

Minissale, P. & Spampinato, G. (1995): L'impatto antropico sulla vegetazione della Riserva naturale orientata Fiume Fiumefreddo (Sicilia orientale). – Coll. Phytosoc. **21**: 343–356.

Molina, J. A. (1996): Sobre la vegetación de los humedales de la Península Ibérica (1. Phragmiti-Magnocaricetea). – Lazaroa **16**: 27–88.

Molina, J.A. & Moreno, P.S. (2003): Diversity of the helophytic vegetation in Spain. – Acta Bot. Gall. **150**: 167–193.

Montanari, C. & Guido, M.A. (1980): La vegetazione idro-igrofila di alcune conche lacustri del versante nord di Monte Ragola (alta Val Nure – Appennino ligure-piacentino). – Arch. Bot. Biogeogr. Ital. **56**: 13–42.

Nobis, M., Nobis, A. & Nowak, A. (2006): Typhetum laxmannii (Ubrizsy 1961) Nedelcu 1968 – The new plant association in Poland. – Acta Soc. Bot. Polon. **75**: 325–332.

Oberdorfer, E. (ed.) (1998): Süddeutsche Pflanzengesellschaften. Teil 1. Fels- und Mauergesellschaften, alpine Fluren, Wasser-, Verlandungs- und Moorgesellschaften. edn. 4. – Gustav Fischer Verlag, Jena/Stuttgart/Lübeck/Ulm. 314 pp.

Orsomando, E. & Pedrotti, F. (1986): Le "praterie galleggianti" a Carex pseudocyperus di alcuni laghi dell'Italia centrale. – Rivista di Idrobiol. **25**: 87–103.

Orsomando, E. & Catorci, A. (1999): Carta della vegetazione naturale potenziale dell'Umbria (scala 1: 200.000). Note Esplicative. – Reg. Umbria. Direzione Regionale Politiche Territoriali. – Ambiente ed Infrastrutture. Dip. di Botanica ed Ecologia, Univ. Camerino S.EL.CA., Firenze.

Panfili, E., Pesciaioli, P. & Venanzoni, R. (2004): AnArchive: un software per la gestione di dati d'erbario, floristici e vegetazionali da internet. – Inform. Bot. Ital. **36**: 110–112.

Pedrotti, F. (1963): Nota sulla vegetazione steppica (Stipeto-Poion xerophilae e Diplachnion) nei dintorni di Trento. – St. Trent. Sci. Nat., Acta Biol. **40**: 288–301.

Pedrotti, F. (1965): Censimento di ambienti umidi meritevoli di protezione: i piani carsici dell'Appennino umbro-marchigiano. – Atti Ist. Bot. Lab. Critt. Univ. Pavia **6**: 142–158.

Pedrotti, F. (1967) Carta fitosociologica (1:3.000) della vegetazione dei Piani di Montelago (Camerino). – Not. Fitosoc. **4**: 1–8.

Pedrotti, F. (1976): Les prairies permanentes humides de l'Apennin Central: Phytosociologie et eartographie. – Coll. Phytosoc. **5**: 181–187.

Pedrotti F. (1980): Guida all'escursione della Società Botanica Italiana in Val d'Adige e nel Parco Nazionale dello Stelvio (27–30 Giugno 1980). pp. 1–63. – Univ. Camerino, Camerino.

Pedrotti, F. (1981): Carte de la végétation de la région des Marches (Italie centrale) a l'échelle du 1/300.000. – Doc. Cart. Ecol. Grenoble **24**: 15–16.

Pedrotti, F. (1982): La végétation du Pian Grande. Guide-Itinéraire, Excursion Internationale de Phytosociologie en Italie centrale (2–11 juillet 1982). pp. 347–360. – Univ. Camerino, Camerino.

Pedrotti, F. (1990): Stato dell'ambiente dei Laghi di Caldonazzo e Levico (Trentino) attraverso l'analisi della flora e vegetazione. – Giorn. Bot. Ital. **124**: 155.

Pedrotti, F. (1991): Nota sulla flora e vegetazione del Lago di Madrano (Trentino). – Inform. Bot. Ital. **22**: 182–193.

Pedrotti, F. (2001): Environmental systems, vegetation belts and potential vegetation of the Monti Sibillini (Central Italy). – Oecol. Mont. **10**: 13–18.

Pedrotti, F. (2008). La vegetazione delle marcite di Norcia (Italia centrale). – Braun-Blanquetia **44**: 1–31.

Pedrotti, F., Gafta, D., Manzi, A. & Canullo, R. (1992): Le associazioni vegetali della piana di Pescasseroli (Parco Nazionale d'Abruzzo). – Doc. Phytos. **14**: 123–147.

Pedrotti, F. & Cortini Pedrotti, C. (1982): Les "cariceta de Pian Perduto di Gualdo". Guide-Itinéraire, Excursion Internationale de Phytosociologie en Italie centrale: (2–11 juillet 1982). pp. 337–340. – Univ. Camerino, Camerino.

Pedrotti, F. & Taffetani, F. (1982): La végétation des sources de Pontile et Fiuminata. Guide-Itineraire, Excursion Internationale de Phytosociologie en Italie centrale: (2–11 juillet 1982). pp. 237-242. – Univ. Camerino, Camerino.

Piccoli, F. & Gerdol, R. (1982): Rice-field weed communities in Ferrara Province (Northern Italy). – Aquat. Bot. **10**: 317–328.

Pignatti, S. (1953): Introduzione allo studio fitosociologico della pianura veneta orientale. – Atti Ist. Bot. Univ. Lab. Critt. Pavia **11**: 92–258.

Pignatti, S. (2005): Valori di bioindicazione delle piante vascolari della Flora Italiana. – Braun-Blanquetia **39**: 1–97.

Pignotti, L. (2003): Scirpus L. and related genera (Cyperaceae) in Italy. – Webbia **58**: 281–400.

Pirone, G. (1987): I magnocariceti degli Altipiani Maggiori d'Abruzzo. – Inform. Bot. Ital. **19**: 131–135.

Pirone, G., Ciaschetti, G., Frattaroli, A.R. & Corbetta, F. (2003): La vegetazione della Riserva Naturale Regionale Lago di Serranella (Abruzzo-Italia). – Fitosociologia **40**: 55–71.

Pirone, G., Frattaroli, A.R. & Corbetta, F. (1997): Vegetazione, cartografia vegetazionale e lineamenti floristici della riserva naturale "Sorgenti della Pescara" (Abruzzo – Italia). – Univ. degli St. dell'Aquila, Dip. di Scienze Ambientali, Popoli.

Poldini, L. (1989): La vegetazione del Carso isontino e triestino. – Lint, Trieste.

Presti, G., Di Filippo, C. & Blasi, C. (2005): La vegetazione igrofila del Monumento Naturale Pantane e Lagusiello (Lazio centrale). – Inform. Bot. Ital. **36**: 401–408.

Prosser, F. & Sarzo, A. (2003): Flora e vegetazione dei fossi nel settore trentino del fondovalle dell'Adige (Trentino-Italia settentrionale). – Ann. Mus. Civ. Rovereto. Sez: Arch., St., Sci. Nat. **18**: 89–144.

Prosser, F. & Sarzo, A. (2004): L'area umida relitta di Roncafort: un biotopo di eccezionale interesse botanico (Trentino, Italia settentrionale). – Ann. Mus. Civ. Rovereto Sez. Arch. St. Sc. Nat. **19**: 233–280.

Rivas-Martínez, S. (2004): Global bioclimatics (version 22-04-04). – Phytosociological Research Center. 15 September 2004, www.globalbioclimatics.org.

Rivas-Martínez, S., Fernández-González, F., Loidi, J., Lousã, M. & Penas, A. (2001): Syntaxonomical checklist of vascular plant communities of Spain and Portugal to association level. – Itinera Geobot. **14**: 5–341.

Rodwell, J.S. (ed.) (1998): British plant communities. Vol. 4. Aquatic communities, swamps and tall-herb fens. – Cambridge Univ. Press, Cambridge.

Roleček, J. (2007): Formalized classification of thermophilous oak forests in the Czech Republic: what brings the Coctail method? – Preslia **79**: 1–21.

Rossi, G. & Alessandrini, A. (1998): Una banca dati sulla vegetazione delle aree protette in Emilia-Romagna. – Arch. Geobot. **4**: 149–155.

Sartori, F. & Bracco, F. (1997): Present vegetation of the Po plain in Lombardy. – Allionia **34**: 113–135.

Sarzo, A., Prosser, F. & Frisinghelli, M. (1999): Flora e vegetazione della zona umida di Bolzonella (Provincia di Padova – Italia settentrionale). – Arch. Geobot. **3**: 179–200.

Sburlino, G. (1986): La vegetazione del Laghetto di Borgo Valsugana (TN). – St. Trent. Sci. Nat., Acta Biol. **62**: 113–123.

Sburlino, G., Tommaselli, M., Oriolo, G., Poldini, L. & Bracco, F. (2008): La vegetazione acquatica e palustre dell'Italia nord-orientale 2 – La classe Potametea Klika in Klika et V. Novák 1941. – Fitosociologia **45**(2): 3–40.

Schmidtlein, S., Tichý, L., Feilhauer, H. & Faude, U. (2010): A brute-force approach to vegetation classification. – J. Veg. Sci. **21**: 1162–1171.

Scoppola, A. (1998): La vegetazione della Riserva Naturale Monte Rufeno (VT.). – Reg. Lazio, Ass. U.T.V. delle risorse ambientali. Riserva Naturale Monte Rufeno, Comune di Acquapendente, Acquapendente. 69 pp.

Scoppola, A., Blasi, C., Abbate, G., Michetti, L., Scagliusi, E., Kuzminsky, E. & Antinori, F. (1990): La vegetazione della caldera del Lago di Vico. – Regione Lazio, Univ. "La Sapienza", Roma.

Sokal, R.R. & Rohlf, F.J. (1995): Biometry. edn. 3. – W.H. Freeman and Company, New York. 887 pp.

Šumberová, K., Hájková, P., Chytrý, M., Hroudová, Z., Sádlo, J., Hájek, M., Hrivnák, R., Navrátilová, J., Hanáková, P., Ekrt, L. & Ekrtová, E. (2011): Vegetace rákosin a vysokých ostřic (Phragmito-Magno-Caricetea). – In Chytrý, M. (ed.), 2011. Vegetace České republiky 3. Vodní a mokřadní vegetace. Vegetation of the Czech Republic 3. Aquatic and wetland vegetation, pp. 385–579. Academia, Praha.

Tammaro, F. (1995): Lineamenti floristici e vegetazionali del Gran Sasso meridionale. – Boll. Mus. Civ. St. Nat. Verona **19**: 1–256.

Tichý, L. (2002): JUICE, software for vegetation classification. – J. Veg. Sci. **13**: 451–453.

Tichý, L. (2005): New similarity indices for the assignment of relevés to the vegetation units of an existing phytosociological classification. – Plant Ecol. **179**: 67–72.

Tichý, L. & Chytrý, M. (2006): Statistical determination of diagnostic species for site groups of unequal size. – J. Veg. Sci. **17**: 809–818.

Tomaselli, M., Manzini, L. & Del Prete, C. (1994): Carta della vegetazione con itinerari naturalistici 1:25.000 del Parco Regionale dell'Alto Appennino Modenese. Foglio Est. – Servizio Cartografico–Provincia di Modena, Settore Difesa del Suolo, Arti Grafiche Salomone, Roma.

Tomaselli, V. (2004): Contributo alla conoscenza della vegetazione ripariale della Sicilia sud-orientale. – Arch. Geobot. **7**(2): 11–24.

Tomasi, D., Dal Lago, A. & Caniglia, G. (2004): "Le Poscole": importante fonte di biodiversità in provincia di Vicenza (Italia nordorientale). – St. Trent. Sci. Nat., Acta Biol. **80**: 245–246.

Tomasi, D. & Caniglia, G. (2004). La vegetazione de le Poscole: importante sito di biodiversità in Provincia di Vicenza (N-E Italia). – Lav. Soc. Ven. Sc. Nat. **29**: 71–78.

Valachovič M. (ed.) (2001): Rastlinné spoločenstvá Slovenska 3. Vegetácia mokradí. Plant communities of Slovakia 3. Wetland vegetation. – Veda, Bratislava.

Vanden Berghen, C. (1967): Notes sur la vegetation du sud-ouest de la France V. – Les peuplements de Scirpus ameri-

canus Pers. dans le Departement des Landes. – Bull. Jard. Bot. Nat. Belg. **54**: 393– 464.
Vagge, I. & Biondi, E. (1999): La vegetazione delle coste sabbiose del Tirreno settentrionale italiano. – Fitosociologia **36**(2): 61–95.
Venanzoni, R. (1991): La vegetazione di alcune radure formatesi in seguito a schianti provocati dal vento in Valsugana (Trentino). – Inform. Bot. Ital. **22**: 194–196.
Venanzoni, R. (1992): I prati umidi e inondati dell'Alta Valle del Velino (Rieti-Italia Centrale). – Doc. Phytosoc. **14**: 149–164.
Venanzoni, R. (1988): Contributo alla conoscenza dei prati umidi della Sila (Calabria - Italia). – Doc. Phytosoc. **11**: 613–633.
Venanzoni, R., Apruzzese, A., Gigante, D., Suanno, G. & Vale, F. (2003): Contributo alla conoscenza della vegetazione acquatica e igrofitica dei Laghi di Monticchio. – Inform. Bot. Ital. **35**: 69–80.
Venanzoni, R. & Gigante, D. (2000): Contributo alla conoscenza della vegetazione degli ambienti umidi dell'Umbria (Italia). – Fitosociologia **37**(2): 13–63.
Venanzoni, R., Landucci F., Panfili, E. & Gigante, D. (2012): Toward the Italian national vegetation database: VegItaly – Biodivers. Ecol. **4**: 185–190.
Weber, H. E., Moravec, J. & Theurillat, J.P. (2000): International Code of Phytosociological Nomenclature. 3rd edition. – J. Veg. Sci. **11**: 739–768.
Zelený, D. & Schaffers, A. (2012): Too good to be true: pitfalls of using mean Ellenberg indicator values in vegetation analyses. – J. Veg. Sci. **23**: 419–431.

Addresses of the authors
Flavia Landucci, Department of Applied Biology, Section of Plant Biology and Geobotany, University of Perugia, Borgo XX Giugno 74, 06121 Perugia, Italy and Department of Botany and Zoology, Masaryk University, Kotlářská 2, 61137 Brno, Czech Republic
Daniela Gigante, Roberto Venanzoni, Department of Applied Biology, Section of Plant Biology and Geobotany, University of Perugia, Borgo XX Giugno 74, 06121 Perugia, Italy
Milan Chytrý, Department of Botany and Zoology, Masaryk University, Kotlářska 2, 61137 Brno, Czech Republic
Corresponding author: flavia.landucci@gmail.com

Electronic appendix

App. 1. List of publications containing the relevés used and their project identification numbers in VegItaly.

App. 2. List of the main localities included in the study.

Appendix data associated with this article can be found in the online version at
www.schweizerbart.de/journals/phyto.

App. 1. List of publications containing the relevés used and their project identification numbers in VegItaly.

Publication	VegItaly - WETAQVEG project relevés
1. Angiolini et al. 1999	5467-5500
2. Angiolini et al. 2005	3584-3688
3. Arrigoni & Papini 2003	6039-6046; 6092; 6094; 6096; 6098; 6101-6106; 6109; 6115; 6120; 6126; 6135-6136; 6139; 6147-6148; 6218-6273
4. Avena & Scoppola 1987	3948-3951; 3953-3966; 3970; 3972-3974; 3976-3978; 3980-398; 4066-4069; 4205; 4212-4214; 4216-4220; 4230; 4232; 4234; 4236; 4238-4242; 4244-4245; 4308-4314; 4318; 4320-4327
5. Baldoni & Biondi 1993	3938; 3940-3941; 3943-3944; 3946-3947; 3979; 3984-3988; 3990-3991; 3993-3994; 3996-3998; 4000-4003; 4005-4065; 4070-4136
6. Biondi & Baldoni 1994	3783-3815; 3836-3858; 3875; 3885; 3887;3889-3899; 3909-3918; 3924-3930; 3932; 3934
7. Biondi et al. 1997	6214-6217; 6274-6507; 6509-6510; 6581-6582; 6584-6610; 6625; 6627; 6629-6630; 6632; 6634-6637
8. Biondi et al. 1999	5781-5782; 5785; 5790-5819; 5823-5824; 5826; 5829; 5851; 5854; 5858-5859; 5862; 5872; 5880; 5882-5884; 5916-5923; 5964; 5966; 5968-5969; 5971; 5973; 5975
9. Biondi et al. 2002	4138-4141; 4143-4153; 4155-4160; 4163; 4168-4193; 4197-4198; 4200-4204; 4206-4209
10. Buchwald 1992	5549; 5551-5553; 5555-5556; 5558-5561; 5563-5566; 5568; 5621-5636; 5638-5640; 5771-5780
11. Buchwald 1994	2068-2079; 4370; 4410; 4420; 4432; 4438; 4491-4515; 4517-4518; 4521; 4525; 4587-4604; 4616-4623; 4664-4675; 4677-4678; 4680-4681; 4683; 4685; 4687; 4706-4709; 4856; 4889-4895; 4897-4922; 4932-4933; 4935; 4938-4947; 4950; 4952; 4954; 4956; 4963-4967; 4980-4982; 4985; 4987-4988; 5069-5071; 5076-5200; 5203-5209; 5224-5237; 5240; 5243; 5248-5251; 5291; 5298; 5300; 5004; 5006; 5310-5317; 5319-5321; 5323; 5325; 5327-5328; 5432-5456
12. Canullo et al. 1988	4676; 4679; 4682; 4684; 4686; 4688-4705; 4710-4761
13. Ceschin & Salerno 2008	2935-3114
14. Cianfaglione 2009	3285-3305
15. Corbetta & Pirone 1990	5269-5290; 5292-5297; 5299; 5301-5303; 5305; 5307-5308; 5318; 5322; 5324; 5326; 5329-5359; 5361-5363
16. Cortini Pedrotti et al. 1973	4843-4855; 4857-4888; 4992-4994; 5017-5034
17. Iberite et al. 1995	4223; 4225-4229; 4231; 4233; 4235; 4250-4307
18. Landi et al. 2002	3689-3747; 3779-3782
19. Lastucci et al. 2004	2260-2261; 2263-2264; 2266-2269; 2274-2284
20. Lastrucci et al. 2005	2901-2934
21. Lastrucci et al. 2007	5045-5054; 5110-5128; 5130-5153
22. Lastrucci & Becattini 2008	3499-3532
23. Lastrucci et al. 2008	3533-3583
24. Lastucci et al. 2010a	3401-3498
25. Lastucci et al. 2010b	3748-3778; 3816-3835; 3859-3874; 3876-3884; 3886; 3888; 3900-3808; 3919-3923; 3931; 3933; 3935-3937; 3939; 3942; 3945; 3967-3969; 3971; 3775;3982-3983; 3989; 3992; 3995; 3999; 4004; 4137; 4142; 4154; 4161-4162; 4164-4167; 4194-4196; 4199; 4211; 4215; 4221-4222; 4224; 4237; 4243; 4246-4249
26. Lastrucci et al. (submitted)	7889-7893; 7895-7897; 7899-7926; 7928-7935; 7937-8004; 8006-8015
27. Merloni & Piccoli 2001	6746; 6778; 6783; 6789-6790; 6792-6840
28. Orsomando & Pedrotti 1986	3209-3222
29. Pedrotti & Cortini Pedrotti 1982	5263-5268
30. Pedrotti & Taffetani 1982	4808-4819
31. Pedrotti et al. 1992	5746; 5750; 5783; 5789; 5820; 5879;5943; 5948; 5950; 5955-5956; 5958; 5962; 5967; 5985-5986; 5967; 5985-5986; 5990; 6054; 6058; 6063; 6072-6075; 6078; 6080; 6084-6087; 6093; 6095; 6097; 6099-6100; 6111; 6117;6132-6133; 6138;6146; 6154-6155; 6211-6213; 6580, 6583; 6626; 6628; 6639; 6737; 6742-6744
32. Pedrotti 2008	2163-2255
33. Pirone 1987	5210-5223
34. Pirone et al. 1997	4364-4369; 4371-4409; 4411-4419; 4421-4431; 4433-4437; 4439-4490
35. Scoppola 1998	5578-5608; 5618-5619; 5662-5686; 5691-5692; 5694; 5696
36. Venanzoni 1992	4762-4768; 4771-4807
37. Venanzoni & Gigante 2000	866-877; 1358-1367;1369-1381; 1393; 1395-1397; 1399-1401; 1403; 1405-1518; 1523-1530; 1556-1589; 1636-1640; 1645-1660
38. Venanzoni et al. 2003b	4315-4317; 4319; 4328-4354
39. Pirone et al. 2003	8102-8179

App. 2. List of the main localities included in the study. Provinces are indicated in the brackets. The geographic coordinates are expressed in WGS84.

Locality	Administrative region	Latitude	Longitude	Locality	Administrative region	Latitude	Longitude
Abbadia di S. Ruffino (Fermo)	Marche	42° 58' N	13° 21' E	Punte Alberete - Valle Mandriole, Natural Reserve (Ravenna)	Emilia Romagna	44° 29' N	12° 14' E
Alfadena (L'Aquila)	Abruzzo	41° 43' N	14° 01' E	River Cesano (Ancona)	Marche	43° 44' N	13° 09' E
Ansa Baldella (Arezzo)	Toscana	43° 30' N	11° 38' E	River Chiascio (Perugia)	Umbria	43° 08' N	12° 34' E
Bisegna (L'Aquila)	Abruzzo	41° 55' N	13° 45' E	River Chienti mouth (Macerata)	Marche	43° 16' N	13° 28' E
Bosco ai Frati (Firenze)	Toscana	43° 59' N	11° 17' E	River Clitunno springs (Perugia)	Umbria	42° 49' N	12° 46' E
Caldarola (Macerata)	Marche	43° 08' N	13° 12' E	River Corno (Perugia)	Umbria	42° 47' N	12° 59' E
Campo Imperatore (L'Aquila)	Abruzzo	42° 25' N	13° 37' E	River Elsa (Siena)	Toscana	43° 30' N	10° 58' E
Cannara (Perugia)	Umbria	42° 59' N	12° 34' E	River Esino (middle course - Macerata)	Marche	43° 26' N	13° 01' E
Capo d'Acqua (L'Aquila)	Abruzzo	42° 16' N	13° 47' E	River Esino mouth (Macerata)	Marche	43° 35' N	13° 20' E
Castel S. Vincenzo (Isernia)	Molise	41° 39' N	14° 03' E	River Fiastra (Macerata)	Marche	43° 13' N	13° 24' E
Colfiorito (Perugia)	Umbria-Marche	43° 01' N	12° 52' E	River Marecchia (lower course - Rimini)	Emilia Romagna	44° 04' N	12° 30' E
Fiume Nera (Perugia)	Umbria	42° 42' N	12° 49' E	River Marecchia (middle course - Rimini)	Emilia Romagna	43° 55' N	12° 19' E
Fiuminata plain (Macerata)	Marche	43° 11' N	12° 56' E	River Marecchia (upper course - Rimini)	Emilia Romagna	43° 45' N	12° 11' E
Fresagradinaria (Chieti)	Abruzzo	41° 58' N	14° 39' E	River Merse (lower course - Siena)	Toscana	42° 57' N	11° 20' E
Gavelli (Perugia)	Umbria	42° 41' N	12° 54' E	River Merse (middle course - Grosseto)	Toscana	42° 49' N	11° 14' E
Grutti (Perugia)	Umbria	42° 50' N	12° 29' E	River Merse (upper course - Grosseto)	Toscana	42° 42' N	11° 04' E
Gualchiera (Prato)	Toscana	43° 33' N	12° 01' E	River Musone A (Ancona)	Marche	43° 28' N	13° 37' E
La Pianca plateau (Arezzo)	Toscana	43° 44' N	12° 07' E	River Musone B (Ancona)	Marche	43° 27' N	13° 27' E
Lake Alviano (Terni)	Umbria	42° 36' N	12° 14' E	River Pescara, Villareia (Pescara)	Abruzzo	42° 20' N	14° 07' E
Lake Bolsena (Viterbo)	Lazio	42° 38' N	11° 54' E	River Pescara springs, Popoli (Pescara)	Abruzzo	42° 09' N	13° 49' E
Lake Calamone (Reggio-Emilia)	Emilia Romagna	44° 22' N	10° 16' E	River Potenza, Pioraco (Macerata)	Marche	43° 10' N	12° 59' E
Lake Chiusi (Siena)	Toscana	43° 03' N	11° 58' E	River Potenza, Porto Recanati (Macerata)	Marche	43° 25' N	13° 40' E
Lake Marruchetone (Grosseto)	Toscana	42° 30' N	11° 26' E	River Potenza, Recanati (Macerata)	Marche	43° 22' N	13° 34' E
Lake Montepulciano (Siena)	Toscana	43° 05' N	11° 54' E	River Scarsito (Macerata)	Marche	43° 10' N	12° 57' E
Lake Montisola (Contigliano, Rieti)	Lazio	42° 28' N	12° 47' E	River Serchio (Pisa)	Toscana	43° 57' N	10° 25' E
Lake Nemi (Roma)	Lazio	41° 43' N	12° 42' E	River Taro (Regional Park - Parma)	Emilia Romagna	44° 46' N	10° 10' E
Lake Pescaie (Firenze)	Toscana	43° 34' N	11° 59' E	River Tevere (lower course A - Roma)	Lazio	41° 47' N	12° 23' E
Lake Piediluco (Terni)	Umbria	42° 32' N	12° 45' E	River Tevere (lower course B - Roma)	Lazio	42° 00' N	12° 31' E
Lake Portonovo (Ancona)	Marche	43° 33' N	13° 35' E	River Teverone, Bevagna (Perugia)	Umbria	42° 56' N	12° 38' E
Lake S. Liberato (Narni)	Umbria	42° 31' N	12° 33' E	River Tirino, Bussi (Pescara)	Abruzzo	42° 13' N	13° 49' E
Lake Scanno (L'Aquila)	Abruzzo	41° 55' N	13° 52' E	River Tirino, Capestrano (L'Aquila)	Abruzzo	42° 16' N	13° 47' E
Lake Serranella (Chieti)	Abruzzo	42° 07' N	14° 22' E	River Trigno Vastogirardi (Isernia)	Abruzzo	41° 46' N	14° 16' E
Lake Trasiemno (Perugia)	Umbria	43° 08' N	12° 06' E	Rognosi mountains (Arezzo)	Toscana	43° 31' N	11° 58' E
Lake Ventina (Terni-Rieti)	Umbria-Lazio	42° 30' N	12° 45' E	Sanbucheto, Montecassino (Macerata)	Marche	43° 21' N	13° 28' E
Lake Vetoio (L'Aquila)	Abruzzo	42° 21' N	13° 21' E	Spello (Perugia)	Umbria	42° 59' N	12° 40' E
Macerata (Macerata)	Marche	43° 18' N	13° 26' E	Spring Capo Volturno (Isernia)	Molise	41° 38' N	14° 04' E
Marcite di Norcia (Perugia)	Umbria	42° 47' N	13° 05' E	Stream Anione, Tivoli (Roma)	Lazio	41° 57' N	12° 49' E
Montelago (Sefro)	Marche	43° 07' N	12° 58' E	Stream Farfa (Rieti)	Lazio	42° 12' N	12° 41' E
Monticchio Lakes (Potenza)	Basilicata	40° 55' N	15° 36' E	Stream Fiumicello (Perugia)	Umbria	43° 20' N	12° 27' E
Mount Rufeno, Natural Reserve (Viterbo)	Lazio	42° 47' N	11° 54' E	Stream Lima (Pistoia - Lucca	Toscana	44° 01' N	10° 38' E
Nocera Scalo (Perugia)	Umbria	43° 05' N	12° 45' E	Stream Stirone (Regional Park - Parma)	Emilia Romagna	44° 51' N	10° 01' E
Nocera Umbra (Perugia)	Umbria	43° 06' N	12° 47' E	Stream Treja (Viterbo)	Lazio	42° 17' N	12° 25' E
Opi (L'Aquila)	Abruzzo	41° 46' N	13° 49' E	Stream Tresubbie (Grosseto)	Toscana	42° 47' N	11° 15' E
Pescasseroli plain (L'Aquila)	Abruzzo	41° 47' N	13° 48' E	Stream Val S. Angelo, Camerino (Macerata)	Marche	43° 08' N	13° 04' E
Pian Grande (Castelluccio di Norcia)	Umbria	42° 47' N	13° 11' E	Stream Ventia (Perugia)	Umbria	43° 12' N	12° 28' E
Pian Perduto di Gualdo (Perugia)	Umbria	42° 50' N	13° 12' E	Sulmona basin (L'Aquila)	Abruzzo	42° 02' N	13° 54' E
Pian Piccolo (Perugia)	Umbria	42° 46' N	13° 12' E	Swamp Fucecchio (Pisa)	Toscana	43° 48' N	10° 47' E
Plain of Pescocostanzo (L'Aquila)	Abruzzo	41° 53' N	14° 05' E	Upper Tiber valley (Arezzo - Perugia)	Umbria-Toscana	43° 34' N	12° 03' E
Plain of Cinquemiglia (L'Aquila)	Abruzzo	41° 52' N	14° 00' E	Upper Velino valley (Rieti)	Lazio	42° 33' N	13° 08' E
Plain of Rascino (Rieti - L'Aquila)	Lazio-Abruzzo	42° 16' N	13° 07' E	Valdichiana (Arezzo)	Toscana	43° 16' N	11° 50' E
Ponte a Buriano (Arezzo)	Toscana	43° 30' N	11° 46' E	Valley S. Angelo (Pesaro e Urbino)	Marche	43° 39' N	12° 22' E
Ponte Zittola, Castel di Sangro (L'Aquila)	Abruzzo	41° 45' N	14° 05' E				