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Biodiversity in the Sibillini Mountain range (Sibillini National Park, central Apennines): the example of Piè Vettore

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Abstract
We present here a phytosociological study performed on the vegetation of 'Piè Vettore', which includes the southern slopes of Mount Vettore and Mount Vettoretto. These are the highest peaks of the mountain group of the Sibillini Mountain range (Central Apennines), within the National Park of 'Monti Sibillini', and included in two Natura 2000 areas. The great environmental variability and complexity that characterises the territory under investigation has resulted in great phytocoenotic diversity, as seen by the nine vegetational types detected here and updated with the latest nomenclature and syntaxonomic revisions. Five of these belong to habitats of European Community interest. These new associations are here proposed: *Cerastio tomentosi-Seslerietum nitidae, Gentiano dinaricae-Globularietum meridionalis, Viburno lantanae-Ostryetum carpinifoliae, Sorbo ariae-Juniperetum nanae* as well as numerous subassociations and syntaxa variants that have already been described but have not been reported for this mountain group. The intermixing of Mediterranean and montane-Mediterranean species that are typical of the mesotemperate bioclimatic belt with species of the supratemperate and orotemperate belt serve as a common thread in the characterisation of the floristic composition of different plant communities described. This intermixing is also linked to the southern exposure of the slopes, and is perhaps amplified by the ongoing climate change, thus contributing to the differentiation of a unique and original landscape. Moreover, during the sampling of the relevé data, rare species of phytogeographical interest were also found. Among these, *Juniperus communis* subsp. *hemisphaerica* detected for the first time in the Sibillini Mountain range, and according to our present knowledge, it has here its northernmost distribution limit along the Apennines. The results of this study have allowed us to broaden the floristic-vegetational knowledge of the National Park of Monti Sibillini, and they have also contributed to further definition the vegetational and landscape framework of a representative sector of this important Apennine district. As far as reforestation is concerned, which until now has been little investigated from the phytosociological point of view, the data obtained in this study provides important ecological information, and should provide the basis for silvicultural renaturation of the area.

Key words: biodiversity; Central Apennines; Habitat Directive; phytosociology; Sibillini Mountains National Park; vegetation.

Introduction

The issues that relate to the conservation and management of biodiversity are currently of great interest for the maintenance of the multi-functional potential of the ecosystems. The European Community (EC) Habitat Directive (92/43/EEC) is a valuable tool for the management of biodiversity of the territories of the European Union, as it lists not only the individual plant species and animal species for protection, but also the ecosystems in which they live and for which the conservation is proposed. The floristic and phytocoenotic knowledge of the territories subjected to the conservation of biodiversity is therefore essential, and in particular within the Natura 2000 areas. In this context, this phytosociological study of the vegetation present was carried out in the supratemperate bioclimatic belt, in an area of the Sibillini Mountains (central Apennines) known as 'Piè Vettore', which includes the southern slopes of Mount Vettore and Mount Vettoretto, the highest peaks of this mountain group. This is an area of great interest for its biodiversity, and it is part of the National Park of the Sibillini Mountains, and within two Natura 2000 areas. However, at present, a comprehensive picture of the vegetation as a whole is still missing, apart from a few published phytosociological studies on some of the shrub vegetation communities (Pedrotti, 1994; Stanisci, 1997). This lack of knowledge applies in general to the whole district of the Sibillini Mountains; there remain few published studies of this vegetation, and as they are mostly older, they have often focused only on a few vegetational aspects of limited territories. A special note goes to the contribution by Pedrotti (2001), who provided a synthesis of the vegetation of the Sibillini Mountains with a map of the potential vegetation at a scale of 1:300,000, on the basis of the studies that had been published up to that time. Of particular interest to the knowledge of the biodiversity of this system, there have been recent phytosociological studies that have considered the grasslands of the Ambro Valley (Catorci *et al*., 2008) and the beech woods of the Sibillini Mountains (Catorci *et al*., 2010). However, in this beech wood study, the locations of the relevés were not reported, although they were carried out almost exclusively on the slopes with a predominantly northern exposure (as can be

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seen from the phytosociological tables). As well as the poor support offered by the phytosociological studies in the literature, there should be added the difficulties in the interpretation of the vegetational dynamism that has occuring in the territory under study, due to the presence of a complex mosaic of environments that have been shaped by the effects of both present and past morphogenic processes. As it can be see in Figure 1, the area under study can be ideally divided in two sectors: a Western sector that is characterised by a mosaic of environments with a predominance of grasslands, and which has been affected by vegetational dynamism caused by several morphogenic processes (e.g., erosion, landslides, surface sliding, deforestation, overgrazing, and trampling by livestock); and an Eastern sector that is largely covered by reforestation with European black pine (*Pinus nigra* subsp. *nigra*) that is sometimes mixed with the European silver fir (*Abies alba*), which dates back to the 1950's and is known as the Piè Vettore pinewoods. The forest heterogeneity that characterises this sector is linked to the presence of original autochthonous forest edges and newly formed preforestal edges, some of which have a durable nature.

The objectives of the present study are: (i) recognition and ecological description of the plant communities, or phytocoenoses, through a detailed phytosociological study in relation to the local lithological, geomorphological, bio-climatic and anthropic characteristics, identification of any syntaxonomic autonomy, updated with the recent syntaxonomic acquisitions; (ii) identification of species in the area that are rare or are of phytogeographical interest, and recognition, and conservation status of, the habitats in the area that are of European Community interest.

Study area

Geography

The territory under study is known as 'Piè Vettore' (coordinates: N, 42°48'13"; E, 13°16'25") and it covers an area of ca. 325 ha, which includes the southern slopes of the Vettore and Vettoretto Mountains, at altitudes between 1,300 m and 1,600 m a.s.l.. It is located in the extreme southern sector of the Sibillini Mountain range (Figure 2; Umbria-Marche limestone Apennines), close to the siliciclastic reliefs of the Laga Mountains (Monti della Laga), which reach their greatest altitude with the peak of Mount Vettore (2,476 m a.s.l.). These are at a distance from the sea of ca. 50 km.

From the administrative point of view, this area includes part of the Ascoli Piceno Province, within the municipality of Arquata del Tronto. The study area is fully included in the National Park of the Sibillini Mountains. Moreover, this area includes two Natura 2000 sites, the SAC (IT5340014) area of "Monte Vettore e Valle del Lago di Pilato", and the SPA (IT5330029) area of "dalla Gola del Fiastrone al Monte Vettore".

Geological and geomorphological features

From the geological point of view (Figure 3), the area under consideration extends across two distinctly different structural domains: one consists of the limestone hills of the south-eastern slopes of Mount Vettore (the extreme southern sector of the Sibillini Mountains); and the other, of the terrigenous siliciclastic, turbiditic reliefs of a western sector of the

Fig. 1 - The southern slope of Monte Vettore.

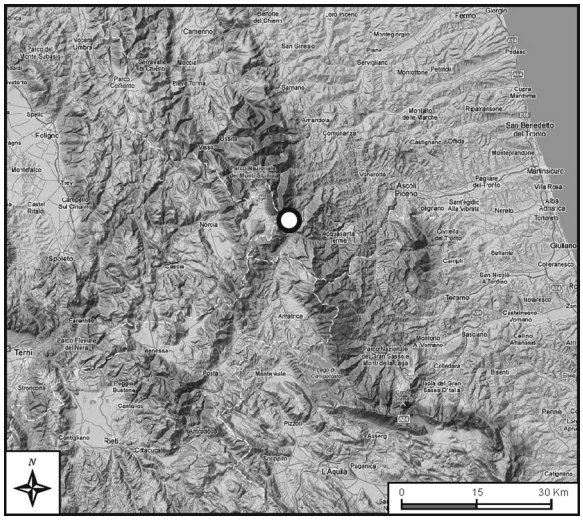

Fig. 2 - The Monte Vettore study area.

Laga Basin (Cantalamessa et al, 1983, 1986; AA.VV., 1991). The SE aspects of Mount Vettore is essentially characterised by the presence of the limestone massif formations of Corniola, which have risen to the surface extensively, along the steep walls of the relief (Marche Region, Geological Cartography [CARG] project, Sections 325160-337040, 2003). Conversely, at the lower end of these slopes (with the area of this study), covering detrital layers are widespread, and can also be of considerable thicknesses (tens of meters), so that they almost completely cover the local geological substrate (limestone and siliciclastic).

The calcareous terms come into tectonic contact, between the overthrusting layers with an approx. ENE-SSW direction, and the terrigenous layers of the Laga, with this last showing extensively outcropping in the eastern sector of the study area.

Considering the different lithological natures of the substrates, the general conditions of the considerable steepness of the slopes, the high absolute altitudes, as meters a.s.l., as well as the particular 'tectonic history' of this sector of the Apennines, the area under consideration presents multiple forms, deposits and processes that arise from the more or less concomitant actions of various morphogenic factors, including: ice, snow, surface flooding waters, gravity, karst erosion and tectonics (e.g., morphological scarps, caves and cavities, groundwater, debris cones and gullies, avalanche gullies, concentrated or widespread erosion and run-off waters, different types of landslides, water emergencies, small valleys and hills).

Climate characteristics

The bioclimatic classification of the study area was carried out using the climatic data collected at the Montemonaco (987 m a.s.l.) and Bolognola (1,445 m a.s.l.) thermo-pluvial stations. These are located to the north-east and north, respectively, of the territory under study, at distances of 11 km and 22 km, respectively.

According to the bioclimate classification of Rivas-Martinez (2008), both of these thermopluviometric stations considered are included in the temperate ma-

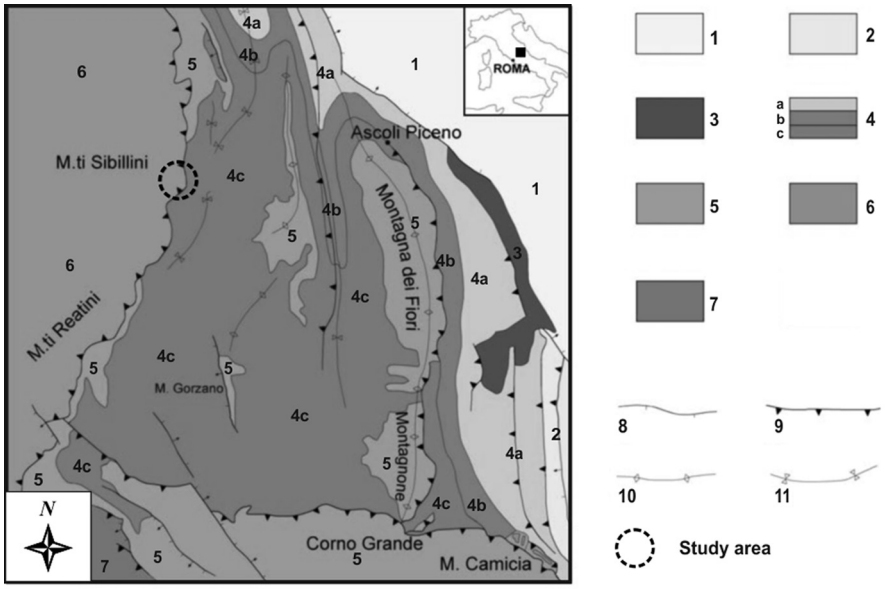

Fig. 3 - Geological sketch map of umbria-marche-abruzzi sector (from Moscatelli et al., 2004 modified). LEGEND: 1 - Pliopleistocene continental and marine deposits; 2 – Cellino Formation; 3 - Vomano Marls; 4 - Pteropodi Marls and Laga Formation (a: post-evaporitic member; b: evaporitic member ; c: pre-evaporitic member); 5 - Marche-Abruzzo basin pelagic limestones; 6 - Umbro-Marche basin pelagic limestones; 7 - Latium-Abruzzo carbonate platform; 8 - Normal fault; 9 - Thrust; 10 - Anticline axis; 11 - Syncline axis.

croclimate, oceanic bioclimate; the thermotype and ombrotype is low supratemperate and upper humid for Montemonaco and upper supratemperate upper humid for Bolognola (Figure 4).

Materials and Methods

The study of the plant communities was carried out following the phytosociological method of the Zurich-Montpelliere sigmatist school, as successively integrated (Tüxen 1978; Géhu & Rivas-Martinez, 1981; Miyawaki, 1986; Géhu, 1991; Theurillat, 1992; Biondi *et al*., 2004a; Allegrezza *et al*. 2008; Rivas-Martìnez, 2005; Géhu, 2006; Biondi, 2011; Pott, 2011).

The 75 relevés included 70 original phytosociological relevés carried out in the study area during the spring and summer of 2009 and 2012, plus five published relevés from Table 1 of Pedrotti (1994).

The phytosociological relevés concerning different physionomic typologies (wood shrubs and grasses) were submitted to multivariate analysis using Matedit program (Burba *et al*., 1992) and the VEGAN community ecology package for R (Oksanen *et al*., 2012). The numerical classification (cluster analysis) was carried out by applying the complete average link algorithm (Orloci, 1978) to the (dis)similarity ratio matrix (Westoff & Van der Maarel, 1978) computed on phytosociological relevés values converted according to the Van der Maarel (1979) scale. The ordering of the non-metric multidimensional scaling (NMDS), which is suitable for the analysis of ordinal data such as those of Van der Maarel (Podani 2007), was used to describe the main trends in the structure of the phytosociological data. For a comparison and the simultaneous display of the results of the cluster analysis and the NMDS, these clusters were superimposed on the two-dimensional plot of the NMDS.

Species nomenclature and chorological and biological characterisation follow Aeschimann *et al*. (2004); moreover, the following studies were also consulted: Tutin *et al*. (1964–80, 1993), Pignatti (1982), Conti *et al*. (2005, 2007), Jalas *et al*. (1972-1994), Castroviejo *et al*. (1986), Ballelli *et al*. (2005).

The chorological types were grouped as follows: Endemic (Endem.; Subendem.; Illir.-Apenn.; Apenn.-Alp.; E Alp.-Apenn.; W Alp.-Apenn.), Mediterranean (Medit.; Medit. mont.; C Asiat.-Medit. mont.; Medit.-SW Asiat; Medit.-W Asiat, W Europ-Medit.; NE Medit. mont.), Eurasian (Eurasiat.; Eurasiat.-Afr.); Europ. (C, S, SE, SW); Europ-Caucas.; Europ. (S, SE)-Asiat. (W, SW); Eurasiat.-N Amer.; Europ. mont. (S Europ. mont.; SE Europ. mont.; SW Europ. mont.; C Europ.

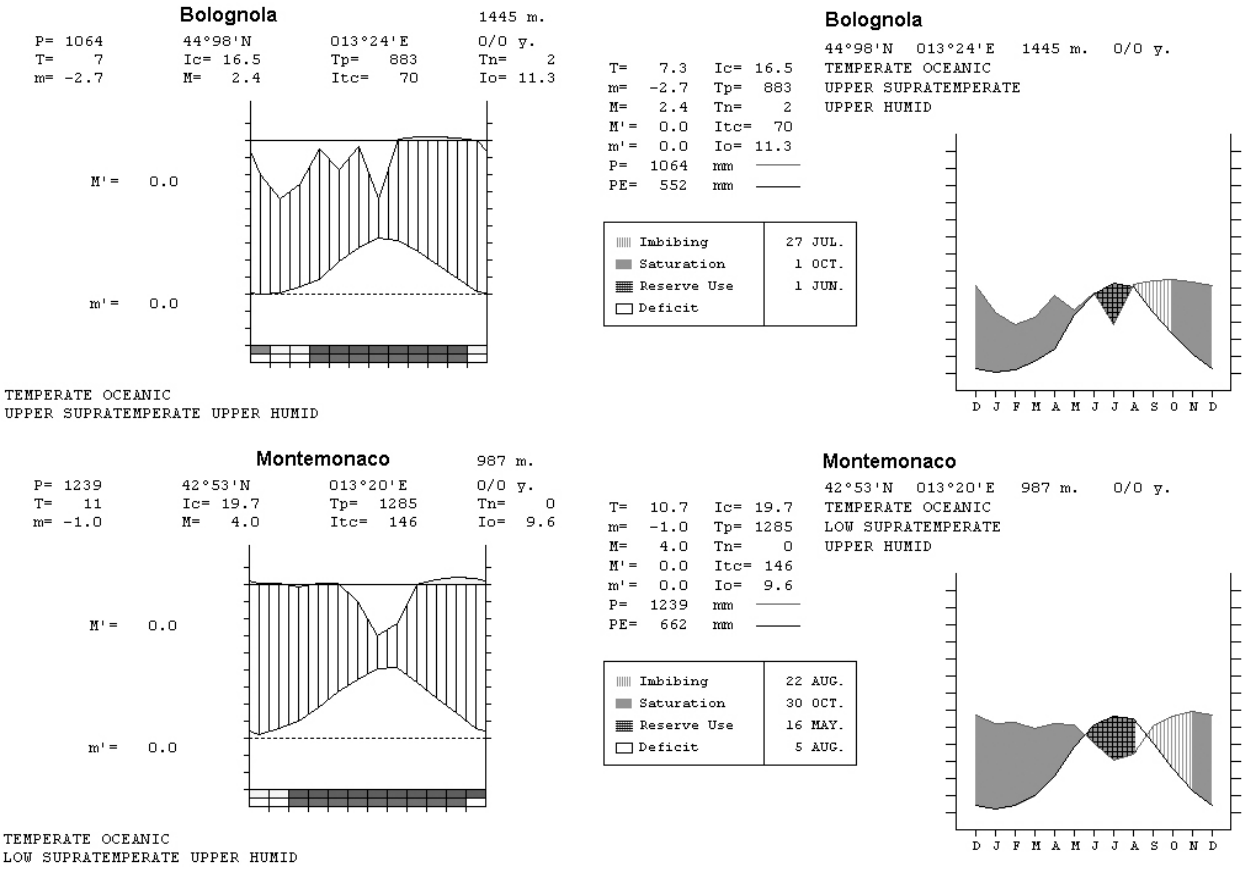

Fig. 4 – Bioclimatic and evapotraspiration diagrams from the two nearby thermo-pluvial stations.

mont.); Boreal (Eurosib.; Eurosib.-N Amer.); Cosmopolitan (Cosmop.; Subcosmop.).

For the phytosociological nomenclature of the higher syntaxonomic levels, as order and class, the following were consulted: Rodwell *et al*. (2002), Ellmauer & Mucina (1993), Oberdorfer (1994) and Rivas-Martinez *et al*. (2001). Publications regarding syntaxonomic review or local phytosociological studies were considered to define the vegetation types (Ballelli *et al*., 1982; Pedrotti, 1994, 1995; Stanisci, 1997; Cutini *et al*., 2002; Biondi *et al*., 1995, 1999, 2002, 2005, 2008; Biondi & Ballelli, 1995; Biondi & Galdenzi, 2012; Allegrezza, 2003; Allegrezza *et al*., 1997, 2010; Allegrezza & Biondi, 2011; Catorci & Gatti, 2007, Catorci *et al*., 2008, 2010; Brullo *et al*., 2001; Taffetani *et al*., 2004, Blasi *et al*., 2004; Di Pietro, 2011).

Vegetation

Forest plant communities

The phytosociological relevés of the forest vegetation took into consideration both the autochthonous vegetation and the reforestation with *Pinus nigra* subsp. *nigra* only and *P. nigra* subsp. *nigra* mixed with *Abies alba* that occupied most of the eastern sector of the study area (Figure 1). With the exception of the reforestation with *A. alba* that occupied the large siliciclastic outcrop of the Laga Flysch on the eastern edge of the study area (southern exposure of the slopes), the rest of the forest vegetation was located on the calcareous debris layer and/or on calcareous outcrops. The dendrogram that was obtained from 37 phytosociological relevés identified five major groups that are clearly separated by the non-metric multidimensional scaling (Figure 5):

Group 1 – The *Salix apennina* communities
Group 2 – The *Populus tremula* communities
Group 3 – Reforestation
Group 4 – The *Ostrya carpinifolia* communities
Group 5 - The *Fagus sylvatica* communities

LATHYRO VENETI-FAGETUM SYLVATICAE Biondi et al. ex Biondi, Casavecchia, Pinzi, Allegrezza & Baldoni 2013 (rels. 1-15)
amelanchieretosum ovalis subass. nova hoc loco (rels. 1-9, holotypus rel. 1)
fraxinetosum excelsioris subass. nova hoc loco (rels. 12-14, holotypus n. 13)
Cytisophyllum sessilifolium and *Pinus nigra* subsp. *nigra* variant (rels. 10-11) *(*Table 1, group 5*)*.

In the area under study, the beech forest (Table 1) is extremely reduced in extent compared to its previous potential, as it is under conservation only in the sectors that are the most stable from the geomorphological point of view, and which are not subject to reforestation. These woods are mainly on the layer of limestone

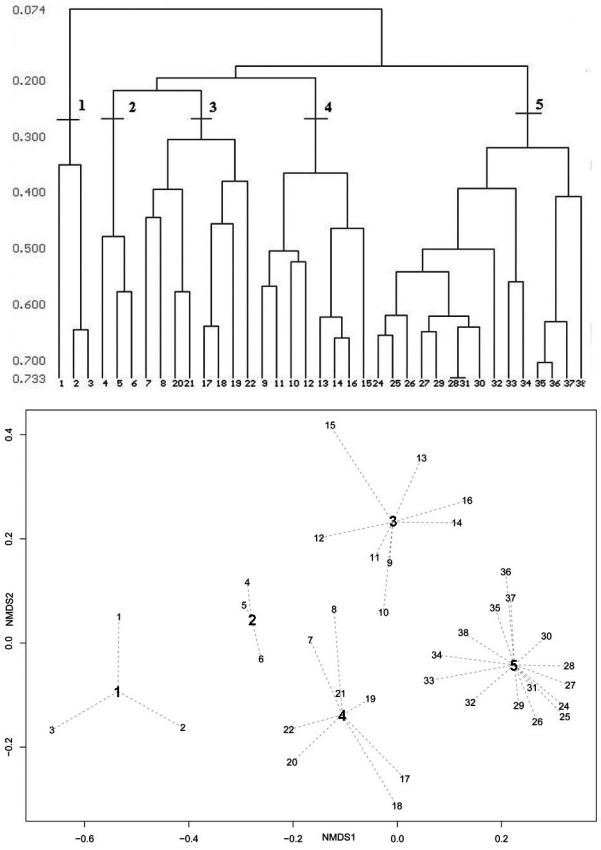

Fig. 5 – Dendrogram (A) and NMDS ordination (B) of the woods phytosociological relevés. Clusters are overimposed ("ordispider" function) to NMDS plot. (group 1 – *Salix apennina* communities, group 2 – *Populus tremula* communities, group 3 – Reforestation , group 4 – *Ostrya carpinifolia* communities, group 5 – *Fagus sylvatica* communities).

debris from 1,300 m to 1,600 m a.s.l., positioned on the slopes and the watersheds, with an average slope of 30°, as the siliciclastic outcropping of the Laga Mountains are now covered by reforestation with a prevalence of *Abies alba* and *Pinus nigra* subsp. *nigra*, except for some nuclei of beech.

Considering the floristic composition of the beech forests investigated (Table 1), which are characterized by the regular presence of submontane species such as *Hepatica nobilis, Ostrya carpinifolia, Carex digitata,* etc, and with the constant presence of *Cytisophyllum sessilifolium* at the edges of the forest coenoses up to more than 1,600 m a.s.l., and the dynamic and chain relationships, it can be hypothesised that the these beech forests can be considered as macrothermal submontane beech forests that can be referred to the alliance *Geranio versicoloris-Fagion sylvaticae*. The alliance *Aremonio agrimonioidis-Fagion sylvaticae,* suballiance *Cardamino kitaibelii-Fagenion sylvaticae,* is therefore excluded by the absence in the investigated plant communities of typical species of the microthermal beech forests.

On the basis of the relevés carried out and the com-

Tab. 1 - *Lathyro veneti-Fagetum sylvaticae* Biondi et al. ex Biondi, Casavecchia, Pinzi, Allegrezza & Baldoni 2013 (rels. 1-15), *amelanchieretosum ovalis* subass. nova hoc loco (rels. 1-9, holotypus rel. 1), *fraxinetosum excelsioris* subass. nova hoc loco (rels. 12-14, holotypus n. 13 Tab. 1), *Cytisophyllum sessilifolium* and *Pinus nigra* subsp. *nigra* variant (rels. 10-11).

	Relevé number	1°	2	3	4	5	6	7	8	9	10	11	15	12	13*	14	
	Relevé number from dendrogram Fig. 5	24	25	26	27	28	29	30	31	32	33	34	38	35	36	37	
	Cluster	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
Chorotype	Altitude (m a.s.l.) x 10	160	159	159	157	151	150	148	148	144	141	139	130	135	133	133	
	Aspect	SE	SE	SE	SE	SE	SE	SE	SE	ESE	S	SE	ESE	SSE	SE	SE	Presences
	Slope (°)	40	40	35	40	30	30	30	30	10	35	35	30	30	20	30	
	Coverage (%)	85	70	90	95	95	95	95	90	90	90	100	90	100	100	100	
	Area (m^2)	80	60	80	100	150	150	150	100	200	400	400	300	100	300	250	
	Number of species x relevé	25	20	24	15	14	15	13	16	26	20	26	31	33	32	31	
	Charact. and diff. species of the *Lathyro veneti-Fagetum sylvaticae* ass. and *Geranio versicoloris-Fagion sylvaticae* all.																
EUROP.	Fagus sylvatica L. subsp. sylvatica	4.4	3.4	4.4	5.5	4.5	4.5	5.5	4.4	4.5	3.4	4.4	4.4	4.5	4.4	4.5	15
EUROP. MONT.	Sorbus aria (L.) Crantz subsp. aria	1.2	1.2	2.2	+	+.2	+.2	+	+.2	1.2	1.2	.	+.2	1.2	+.2	.	13
EUROP.	Hepatica nobilis Schreb.	+.2	.	1.2	+	+.2	+	1.2	1.2	2.3	.	1.2	+.2	1.1	1.1	1.1	13
SE EUROP.	Ostrya carpinifolia Scop.	.	.	.	.	.	(+.2	.	.	1.2	1.2	2.2	1.2	+.2	.	.	6
MEDIT.	Viola alba Besser subsp. dehnhardtii (Ten.) W. Becker	.	.	.	.	.	.	.	.	+	.	+	1.2	+	+	.	5
S EUROP.	Cyclamen hederifolium Aiton subsp. hederifolium	.	.	.	.	.	.	.	.	.	.	.	+.2	2.2	2.3	1.1	4
SE EUROP.	Acer opalus Mill. subsp. obtusatum (Waldst. et Kit. ex Willd.) Gams	.	.	.	.	.	.	.	.	+.2	1.2	+	.	.	.	.	3
SE EUROP.	Lathyrus venetus (Mill.) Wohlf.	.	.	.	.	.	.	.	.	.	.	.	.	+	+.2	+	3
	Diff. species of the *amelanchieretosum ovalis* subass.																
EUROSIB.-N AMER.	Solidago virgaurea L. subsp. virgaurea	1.2	2.2	+	+	1.1	+.2	+	1.1	+	.	+.2	+	+	.	.	12
EUROP.-SW ASIAT.	Amelanchier ovalis Medik. subsp. ovalis	+.2	+.2	+	+	+	+	.	+	+.2	.	.	.	.	.	.	8
SE-EUROP.	Peucedanum austriacum (Jacq.) Koch	+	1.1	+.2	+	.	.	.	.	.	.	.	.	.	.	.	4
	Diff. species of the *Cytisophyllum sessilifolium* and *Pinus nigra* subsp. *nigra* variant																
MEDIT.	Cytisophyllum sessilifolium (L.) O. Lange	.	.	.	+.2	.	.	.	.	.	1.1	+.2	.	.	.	(+)	4
SE EUROP. MONT.	Pinus nigra Arnold subsp. nigra	.	.	.	.	.	.	+.2	.	.	1.2	+.2	.	.	+.2	.	4
	Diff. species of the *fraxinetosum excelsioris* subass.																
EUROP.	Fraxinus excelsior L. subsp. excelsior	.	.	.	.	.	.	.	.	.	.	.	.	+.2	1.2	1.2	3
EUROSIB.	Populus tremula L.	.	.	.	.	.	.	.	.	.	.	.	.	(1.2)	1.2	1.2	3
EUROP.-W ASIAT.	Prunus avium L. subsp. avium	.	.	.	.	.	.	.	.	.	.	.	.	1.2	+.2	.	2
EUROP.-W ASIAT.	Acer pseudoplatanus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	+	2
	Charact. species of the *Fagetalia sylvaticae* ord.																
EUROP.	Viola reichenbachiana Jord. *ex* Boreau	+.2	.	.	.	+.2	.	1.2	+.2	+.2	.	1.2	2.3	2.2	1.1	1.1	10
EUROP.	Epipactis muelleri Godfery	+	.	.	.	.	+	+	.	+	1.1	+.2	.	+	+	+.2	9
EUROP.-W ASIAT.	Sanicula europaea L.	.	.	.	.	.	.	.	.	.	.	+	+	1.1	+.2	+	5
EURASIAT.	Campanula trachelium L. subsp. trachelium	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	4
EUROP.-W ASIAT.	Euphorbia amygdaloides L. subsp. amygdaloides	.	.	.	.	.	.	.	.	.	.	.	.	+.2	1.1	+	3
EUROP.	Rosa arvensis Huds.	+	.	.	+	.	.	.	.	.	.	.	.	+	.	.	3
EUROSIB.	Neottia nidus-avis (L.) Rich.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	3
EUROP.	Melica uniflora Retz.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	1.2	+	3
S EUROP.	Aremonia agrimonoides (L.) DC. subsp. agrimonoides	.	.	.	.	.	.	.	.	.	.	.	1.2	+.2	+	.	3
EUROP.-W ASIAT.	Festuca heterophylla Lam.	+	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	2
EUROSIB.	Viola mirabilis L.	.	.	.	.	.	.	.	.	.	.	.	1.2	.	+	.	2
EUROP.	Luzula sylvatica (Huds.) Gaudin subsp. sylvatica	.	.	.	.	.	1.2	.	.	.	+.2	.	.	.	.	.	2
EUROP.	Prenanthes purpurea L.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.2	+	2
EUROP.	Anemonoides ranunculoides (L.) Holub	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1
EURASIAT.-N AMER.	Poa nemoralis L. subsp. nemoralis	.	.	.	.	.	.	.	.	.	.	+.2	.	.	.	.	1
EUROP.-CAUC.	Primula vulgaris Hudson	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1
EURASIAT.	Polygonatum multiflorum (L.) All.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1
EUROP.-W ASIAT.	Rubus caesius L.	.	.	.	.	.	.	.	.	+.2	.	.	.	.	.	.	1
EUROSIB.	Polystichum aculeatum (L.) Roth	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1
EUROSIB.	Galium odoratum (L.) Scop.	.	.	.	.	.	.	.	.	.	.	.	.	+.3	.	.	1
EUROSIB.	Lathyrus vernus (L.) Bernh.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1
	Stellaria nemorum L. (*s.l.*)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1
S EUROP. MONT.	Euonymus latifolius (L.) Mill.	.	.	.	.	.	.	.	.	.	.	.	+.2	.	.	.	1
EURASIAT.	Listera ovata (L.) R. Br.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1
EURASIAT.	Lilium martagon L.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1
EUROP.	Cephalanthera damasonium (Mill.) Druce	.	.	.	.	.	.	.	.	.	.	.	+.2	.	.	.	1
	Charact. species of the *Querco-Fagetea* class																
EUROP.-W ASIAT.	Hieracium murorum L. (*s.l.*)	1.1	+.2	+	+	+.2	1.1	.	1.1	1.1	+	+	.	.	.	.	10
EUROSIB.	Carex digitata L.	+.2	.	+	.	.	.	+.2	.	.	.	1.1	.	+.2	+.2	1.1	7

EURASIAT.	Lactuca muralis (L.) Gaertn.	+	.	.	.	.	.	.	.	+	.	+	+	+	+	.	6
EUROP.	Corylus avellana L.	.	.	.	.	.	.	.	.	.	+.2	+	.	+.2	.	(+)	4
EURASIAT.	Cephalanthera longifolia (L.) Fritsch	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	3
C EUROP.	Rubus hirtus (group)	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	3
EUROSIB.	Lonicera xylosteum L.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	3
MEDIT.	Potentilla micrantha Ramond *ex* DC.	.	.	.	.	.	.	.	.	.	.	.	+.2	.	+	+	3
SE EUROP. MONT.	Doronicum columnae Ten.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	2
EURASIAT.-N AMER.	Geranium robertianum L.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	2
S EUROP.-W ASIAT.	Fraxinus ornus L. subsp. ornus	.	.	.	.	.	.	.	.	.	.	.	1.2	.	+	.	2
EUROP.-SW ASIAT.	Hedera helix L. subsp. helix	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	2
SE EUROP.-SW ASIAT.	Quercus cerris L.	.	.	.	.	.	.	.	.	.	+.2	.	.	.	.	.	1
EUROP.-W ASIAT.	Ajuga reptans L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1
C EUROP. MONT.	Lilium bulbiferum L. subsp. croceum (Chaix) Jan	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1
S EUROP. MONT.	Laburnum anagyroides Medik. subsp. anagyroides	.	.	.	.	.	.	.	.	.	.	.	1.2	.	.	.	1
	Others species																
MEDIT.	Arabis turrita L.	.	.	+	+	+	+	+	.	+	1.1	+.2	+	.	.	+	10
ENDEM.	Campanula micrantha Bertol.	1.1	+.2	+	+	+.2	+	.	1.1	+.2	.	.	+	.	.	.	9
ENDEM.	Sesleria nitida Ten. (*s.l.*)	.	.	+.2	.	+	+	.	+	+.2	+.2	+	1.2	.	.	.	8
SUBENDEM.	Digitalis lutea L. subsp. australis (Ten.) Arcang.	.	.	.	.	.	.	+	+	+.2	1.2	+	.	+	+	+	8
EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	+	+	+.2	+	+.2	+	+.2	.	.	.	.	.	.	.	.	7
EUROSIB.-N AMER.	Juniperus communis L. subsp. nana Syme	+	+	+	.	+.2	.	+	+.2	.	.	.	.	.	.	.	6
ENDEM.	Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti et Gubellini	1.1	+	+.2	.	.	.	.	+	+	.	.	.	.	.	.	5
SUBENDEM.	Carex macrolepis DC.	+	+.2	1.2	.	.	.	.	+	.	.	.	.	.	.	.	4
C ASIAT.-MEDIT. MONT.	Daphne oleoides Schreb.	+	+	+.2	.	.	.	.	.	+.2	.	.	.	.	.	.	4
EUROP.-W ASIAT.	Viburnum lantana L.	.	.	.	.	.	.	.	+.2	+.2	.	+	.	.	.	+.2	4
EUROP.	Clematis vitalba L.	.	.	.	.	.	.	.	.	+	.	.	+.2	.	+	+	4
SE EUROP.	Lonicera caprifolium L.	.	.	.	.	.	.	.	.	.	.	.	+.2	+	+	+	4
	Accidental species	6	5	6	2	1	1	0	2	4	3	3	3	2	1	2	

parison with the data in the literature (Fig. 6), it is believed that the beech woods on the debris layer (Table 1: rels 1-14; Fig. 6: groups 1, 2, 3) can be included in the association *Lathyro veneti-Fagetum sylvaticae* Biondi *et al*. ex Biondi Casavecchia, Pinzi, Allegrezza & Baldoni 2013, of the alliance *Geranio versicoloris-Fagion sylvaticae*. The beech woods should be included in the same association that grows on the slopes corresponding to the limited outcrops of the flysh of the Laga Mountains (Table 1, rel. 15), in areas that are, however, still affected by the limestone layer, as these woods are not sufficiently differentiated at the floristic level. Among the characteristic and differential species of the association *Lathyro veneti-Fagetum sylvaticae* that are widely distributed in the lower supratemperate belt of the central Apennines and are present in the Sibillini Mountain range at 1,100-1,200 (1,400) m a.s.l. (Catorci *et al*. 2010) in the area under study, there are: *Sorbus aria* subsp. *aria*, *Viola alba* subsp. *dehnhardtii*, *Cyclamen hederifolium*, *Lathyrus venetus*. For this association here, two new subassociations and a variant are also recognized, on the basis of the topographical position and geomorphological conditions. The new sub-association *fraxinetosum excelsioris* subass. nova hoc loco (Table 1, rels. 12-14; holotypus rel. 13), for which the differential species are *Fraxinus excelsior, Acer pseudoplatanus, Populus tremula* and *Prunus avium*, is found on the steep slopes of the large watersheds on well-developed brown soil (average 1,300-1,350 m a.s.l.). This indicates the chain linkage of the beech woods with the *Tilio-Acerion pseudoplatani* coenoses is dynamic with the poplar woods of the association *Melico uniflorae-Populetum tremulae*. The new subassociation *amelanchieretosum ovalis* subass. nova hoc loco (Table 1, rels. 1-9, holotypus rel. 1), for which the differential species are: *Amelanchier ovalis* subsp. *ovalis, Solidago virgaurea, Sorbus aria* subsp. *aria*, and *Peucedanum austriacum*, refers to the beech forest at the present upper limit of the enclosed forest and representative sintaxon of the rocky floristic context in which the beech woods of the association *Lathyro veneti-Fagetum sylvaticae* have developed, in the summit portions of the slope and up to the present upper limit of the enclosed forest (above 1,500 m a.s.l., on average), where there are limestone outcrops and/or a debri layer and steep slopes (30°/40°). On the basis of the literature data, the new sub-association *amelanchieretosum ovalis* that dynamically links with the shrubbery association *Rhamno alpinae-Amelanchieretum ovalis,* subassociation *cytisetosum sessilifolii,* currently represents the rocky aspects at the highest altitudes of the association *Lathyro veneti-Fagetum sylvaticae*. Finally, the variant with *Cytisophyllum sessilifolium* and *Pinus nigra* subsp. *nigra* that is found in the steep slope positions (1,400 m a.s.l.; slope, 35°) in the parts marginally covered by the reforestation of *Pinus nigra* subsp. *nigra*, indicates the relatively open aspect of the slope beech wood of the association *Lathyro veneti-Fagetum sylvaticae* and the transition toward beech forests in the upper edge indicated by the

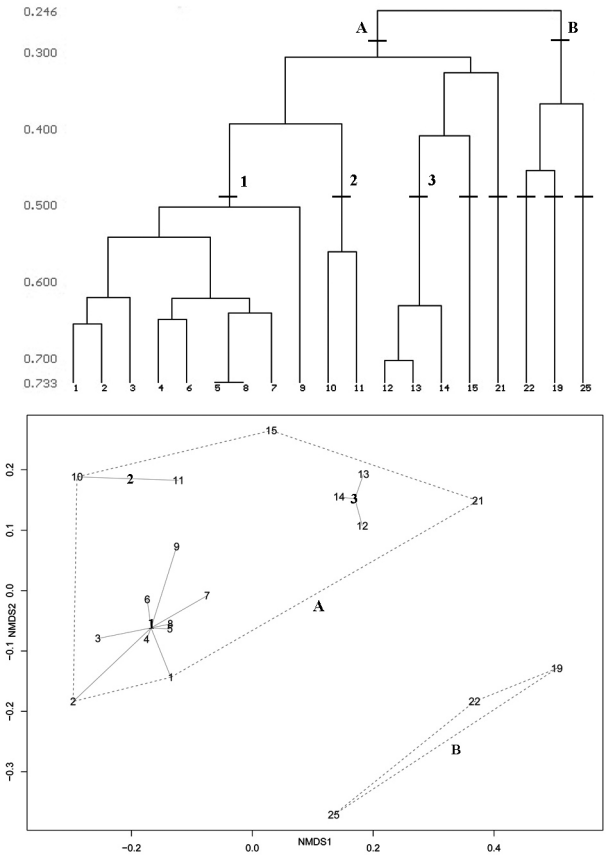

Fig. 6 - Dendrogram and NDMS ordination of the *Fagus sylvatica* communities phytosociological relevés. Cluster are overimposed ("ordispider" function) to NMDS plot. (group 1 – *Lathyro veneti-Fagetum sylvaticae* ass. *amelanchieretosum ovalis* subass.; group 2 – *Lathyro veneti-Fagetum sylvaticae* ass. *Cytisophyllum sessilifolius* and *Pinus nigra* subsp. *nigra* variant; group 3 – *Lathyro veneti-Fagetum sylvaticae* ass. *fraxinetosum excelsioris* subass.; A – Basophilous group (*Lathyro veneti-Fagetum sylvaticae* rel. 21: rel. typus in Biondi et al., 2002) and B – Acidophilous and subacidophilous group (*Solidagini-Fagetum sylvaticae* rel. 22: rel. typus in Longhitano & Ronsisvalle, 1974; *Potentillo micranthae-Fagetum sylvaticae* rel. 19: rel. typus in Biondi et al., 2008); *Hieracio racemosi-Fagetum sylvaticae* rel. 25: rel. typus in Allegrezza, 2003).

new sub-association *amelanchieretosum ovalis*.

VIBURNO LANTANAE-OSTRYETUM CARPINIFOLIAE ass. nova hoc loco (rels. 1-7, holotypus rel. n. 6)
viburnetosum lantanae subass. nova *typicum*
amelanchieretosum ovalis subass. nova hoc loco (rels. 1-3, holotypus rel. n. 3)
Salix apennina variant (rel. 4) (Tab. 2 – group 4).

Within the studied territory, the hop hornbeams are typically found between 1,350 m and 1,500 m a.s.l. on the accumulated rockfalls in the eastern part of the area and in partially stable avalanche gullies in zones of *Pinus nigra* subsp. *nigra* reforestation. In general, these are high-shrubby, dense, and pioneer preforestal coenoses, which are dominant in *Ostrya carpinifolia* (Table 2) that are sometimes considered durable in relation to natural (avalanches, landslips) and human (reforestation) perturbations. As shown in the dendrogram in Figure 5, in this cluster of relevés, there are also two carried out in the *Pinus nigra* subsp. *nigra* reforestation (Table 2, rel. 7-8), where the renaturalization process is highly advanced due to former and recent activities of silvicultural thinning. To evaluate the renaturalization progress of the reforestation and the impact of the conifer litter on the species diversity, it is appropriate to include these relevés in Table 3. This choice is also supported by the ordering diagram in Figure 5, where relevés 7-8 have an intermediate position between the *Ostrya carpinifolia* woods (group 4) and the reforestation (group 3). In phytosociological terms, the *Ostrya carpinifolia* communities studied (Table 2) have floristic and ecological similarities with the subassociation *seslerietosum nitidae* Allegrezza, Biondi, Ballelli & Formica 1997, which represents the most pioneer aspect of the association *Scutellario columnae-Ostryetum carpinifoliae* Pedrotti, Ballelli, Biondi, Cortini Pedrotti & Orsomando 1980 of the alliance *Carpinion orientalis*. Here there are found: *Sesleria nitida* (s.l.), *Sorbus aria* subsp. *aria, Fraxinus ornus* subsp. *ornus, Corylus avellana, Laburnum anagyroides*, and others. For the association *Scutellario columnae-Ostryetum carpinifoliae,* subassociation *seslerietosum nitidae*, the *Ostrya carpinifolia* communities detected can be differentiated due to the presence of species belonging to the alliance *Berberidion*, which are: *Viburnum lantana* and *Amelanchier ovalis*. Together with *Cytisophyllum sessilifolium*, these highlight the dynamic relationships and submontane character of these coenoses.

Despite the floristic diversity in rocky areas, and in particular the biogeographic aspects, the *Ostrya carpinifolia* communities studied (Table 2, rels. 1-3) show ecological and structural similarities with the *Ostrya carpinifolia* communities on rock and scree of the association *Amelanchiero ovalis-Ostryetum carpinifoliae* Poldini (1978) 1982, as described for the south-eastern area of the Alps and for the Trieste Karst (Poldini, 1978, 1982, 1989; Lausi *et al*., 1982) and positioned in the alliance *Carpinion orientalis*. The new association *Viburno lantanae-Ostryetum carpinifoliae* ass. nova hoc loco (Table 2, holotypus rel. 6) is therefore proposed, the characteristic and differential species of which are considered to be: *Ostrya carpinifolia, Cytisophyllum sessilifolius, Viburnum lantana, Sesleria nitida, Sorbus aria* subsp. *aria, Fraxinus ornus* subsp. *ornus* and *Corylus avellana*. The new association proposed is referred to the alliance *Carpinion orientalis*, suballiance *Laburno-Ostryenion carpinifoliae*, and includes the preforestal durable formations of *Ostrya carpinifolia* found for the southern aspects

Tab. 2 - *Viburno lantanae-Ostryetum carpinifoliae* ass. nova hoc loco (rels. 1-7; holotypus rel. n. 6), subass. *viburnetosum lantanae* subass. nova subass. *typicum*, subass. *amelanchieretosum ovalis* subass. nova hoc loco (rels. 1-3; holotypus rel. n. 3), *Salix apennina* variant (rel. 4).

	Relevé number	1	2	3°	4	5	6*	7	
	Relevé number from dendrogram Fig. 5	17	18	N	22	19	21	20	
	Cluster	4	4	N	4	4	4	4	
	Altitude (m a.s.l.)	1475	1460	1520	1370	1350	1360	1350	
	Aspect	ESE	ESE	ESE	SSE	SSE	SSE	SSE	Presences
Chorotype	Slope (°)	35	40	40	30	30	30	30	
	Coverage (%)	85	90	90	80	90	80	100	
	Area (m^2)	80	70	100	200	200	300	200	
	Number of species x relevé	24	22	26	21	24	24	31	
	Charact. and diff. species of the ass.								
SE EUROP.	Ostrya carpinifolia Scop.	4.4	4.4	4.4	3.4	4.4	3.4	4.4	7
MEDIT.	Cytisophyllum sessilifolium (L.) O. Lange	+.2	+	(+.2)	1.1	1.2	1.1	+.2	7
ENDEM.	Sesleria nitida Ten. (*s.l.*)	+.2	1.2	+.2	1.2	.	3.3	2.3	6
EUROP. MONT.	Sorbus aria (L.) Crantz subsp. aria	2.3	2.3	1.2	.	1.2	+.2	1.2	6
EUROP.-W ASIAT.	Viburnum lantana L.	.	+.2	+.2	.	+.2	1.1	1.2	5
EUROP.	Corylus avellana L.	.	.	+.2	+.2	+.2	+.2	1.2	5
S EUROP.-W ASIAT.	Fraxinus ornus L. subsp. ornus	.	.	+.2	.	+.2	1.2	2.3	4
	Diff. species of the *amelanchieretosum ovalis* subass.								
ENDEM.	Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti et Gubellini	1.1	+.2	+	+.2	.	.	.	4
EUROP.-SW ASIAT.	Amelanchier ovalis Medik. subsp. ovalis	1.2	+.2	+.2	.	+.2	.	.	4
SE EUROP. MONT.	Rhamnus alpina L. subsp. fallax (Boiss.) Maire *et* Petimg.	1.2	+.2	1.2	.	.	.	.	3
C ASIAT.-MEDIT. MONT.	Daphne oleoides Schreb.	+.3	+.2		.	.	.	.	2
	Species of *Salix apennina* variant								
APENN.-ALP.	Salix apennina A.K. Skvortsov	.	.	.	1.2	.	.	.	1
OROF. S-EUROP.	Salix eleagnos Scop.	.	.	.	+.2	.	.	.	1
EURASIAT.	Salix caprea L.	.	.	.	+.2	.	.	.	1
	Charact. and diff. species of the *Laburno-Ostryenion carpinifoliae* suball. and the *Carpinion orientalis* all.								
EUROP.	Hepatica nobilis Schreb.	+.2	1.2	1.2	+.2	.	+.2	.	5
SUBENDEM.	Digitalis lutea L. subsp. australis (Ten.) Arcang.	+	.	+	.	+	+	+	5
SE EUROP.	Acer opalus Mill. subsp. obtusatum (Waldst. *et* Kit. *ex* Willd.) Gams	+	.	1.2	.	.	+.2	.	3
S EUROP. MONT.	Laburnum anagyroides Medik. subsp. anagyroides	.	.	.	1.2	.	.	+.2	2
EURASIAT.	Campanula trachelium L. subsp. trachelium	.	.	.	.	.	.	+.2	1
C EUROP. MONT.	Lilium bulbiferum L. subsp. croceum (Chaix) Jan	.	.	.	+	.	.	.	1
	Charact. and diff. species of the *Quercetalia pubescentis-petraeae* ord. and *Querco-Fagetea* class								
EUROSIB.-N AMER.	Solidago virgaurea L. subsp. virgaurea	+	2.2	+.2	+	1.1	.	.	5
EUROP.-W ASIAT.	Hieracium murorum L. (*s.l.*)	+	1.1	+	.	+	.	.	4
MEDIT.	Viola alba Besser subsp. dehnhardtii (Ten.) W. Becker	.	.	.	+	+.2	1.2	.	3
EUROP.	Fagus sylvatica L. subsp. sylvatica arb.	+.2	.	1.2	.	+	.	.	3
EUROP.	Epipactis muelleri Godfery	.	+	.	.	+	.	.	2
EURASIAT.	Polygonatum multiflorum (L.) All.	.	+.3	.	.	+.2	.	.	2
EURASIAT.	Lactuca muralis (L.) Gaertn.	.	.	.	.	1.1	.	+	2
EURASIAT.	Listera ovata (L.) R. Br.	.	.	.	.	.	+	+	2
S EUROP.	Cruciata glabra (L.) Ehrend. subsp. glabra	.	.	.	.	.	1.2	1.2	2
EURASIAT.	Cephalanthera longifolia (L.) Fritsch	.	+.2	.	.	.	.	.	1
EUROSIB.	Sorbus aucuparia L. subsp. aucuparia arb.	.	+	.	.	.	.	.	1
EUROP.	Viola reichenbachiana Jord. *ex* Boreau	.	.	.	.	+	.	.	1
EUROP.-SW ASIAT.	Hedera helix L. subsp. helix	.	.	.	.	.	+	.	1
EUROP.	Cephalanthera damasonium (Mill.) Druce	.	.	.	.	.	+	.	1
EUROSIB.	Neottia nidus-avis (L.) Rich.	.	.	.	.	.	+	.	1
EUROP.-W ASIAT.	Rubus caesius L.	.	.	.	.	.	.	+.2	1
	Charact. species of the *Rhamno-Prunetea* class								
SE EUROP.	Lonicera caprifolium L.	.	.	.	+.2	1.1	1.1	1.2	4
EUROP.	Clematis vitalba L.	+.2	.	.	+	.	.	+	3
EURASIAT.-N AMER.	Juniperus communis L. subsp. communis	.	.	.	.	+	+.2	+	3
EUROP.-W ASIAT.	Crataegus monogyna Jacq.	.	.	.	.	.	+.2	+.2	2
S EUROP. MONT.	Rosa montana Chaix	.	.	.	.	.	+	+.2	2
EUROP.-W ASIAT.	Prunus spinosa L. subsp. spinosa	.	.	.	.	.	.	+	1
EUROSIB.	Cytisus hirsutus L. subsp. polytrichus (M. Bieb.) Hayek	+	.	.	.	.	.	.	1
EUROP.-SW ASIAT.	Cotoneaster integerrimus Medik.	.	+.2	.	.	.	.	.	1

	Others species								
MEDIT.	Arabis turrita L.	+	.	+	+.2	+.2	.	1.1	4
ENDEM.	Campanula micrantha Bertol.	+.2	+	+	.	.	.	+	4
SE EUROP. MONT.	Pinus nigra Arnold subsp. nigra	.	.	+.2	+.2	+.2	+.2	.	4
S EUROP.	Peucedanum oreoselinum (L.) Moench	.	+		+	+	.	.	3
SUBENDEM.	Carex macrolepis DC.	.	.	+.2	+.2		+.2		3
MEDIT.	Tanacetum corymbosum (L.) Sch. Bip. subsp. achillae (L.) Greuter	.	.	+	.	.	+	+	3
	Accidental species	6	3	5	3	2	1	11	

Rel. 3° - unpublished reléve carried after the relevés classification

of the limestone hills of the supratemperate level, in the sectors affected by periodic natural perturbations (avalanches, collapses), in dynamic connection with the *Sesleria nitida* grasslands of the association *Cerastio tomentosi-Seslerietum nitidae* and with the plant mantles of the alliance *Berberidion*.

In the new association *Viburno lantanae-Ostryetum carpinifoliae*, two new subassociations and one variant are indicated: *viburnetosum lantanae* subass. nova hoc loco (Table 2, holotypus rel. 6, subass. *typicum*), *amelanchieretosum ovalis* subass. nova hoc loco (Table 2, holotypus n. 3) and the *Salix apennina* variant (Table 2, rel. 4). The new subassociation *amelanchieretosum ovalis* is differentiated by *Amelanchier ovalis* subsp. *ovalis*, *Laserpitium siler* subsp. *siculum, Rhamnus alpina* subsp. *fallax*, and *Daphne oleoides*. This refers to the markedly rocky aspect of the *Ostrya carpinifolia* communities studied, and it indicates the link between the hop hornbeams of the *Viburno lantanae-Ostryetum carpinifoliae* and the *Amelanchier ovalis* shrubs of the association *Rhamno alpinae-Amelanchieretum ovalis* subass. *cytisophylletosum sessilifolii*. In particular, the association *Viburno lantanae-Ostryetum carpinifoliae*, subassociation *amelanchieretosum ovalis*, can be considered the biogeographic vicariant of the Central Apennines of the association *Amelanchiero ovalis-Ostryetum carpinifoliae*, with a south-eastern Alpine distribution (Poldini, 1978, 1982, 1989). Finally, the *Salix apennina* variant that is differentiated by *Salix apennina, S. eleagnos* and *S. caprea*, can be referred to the *Ostrya carpinifolia* woods of the *Viburno lantanae-Ostryetum carpinifoliae* association found where there are very deep gullies of strongly broken debris.

PINUS NIGRA subsp. *NIGRA* (rels. 1-6); *PINUS NIGRA* subsp. *NIGRA* and *ABIES ALBA* (rels. 7-10) (Table 3, group 3).

Although reforestation with conifers with a dominance of *Pinus nigra* subsp. *nigra* is very frequent in the Apennines, this has mainly been the subject of purely forestal studies, with relatively few phytosociological studies published to date (e.g., Biondi & Ballelli 1973). In the present study, the choice was to extend the phytosociological relevés to include also the widespread reforestation of Piè Vettore. This was carried out with the aim being to observe how the re-naturalization by autochthonous species has progressed in relation to the coverage of conifers, and thus to better understand the vegetation dynamics that have taken place, and consequently the vegetation potential in relation to the characteristics of the substrate. This is linked to the fact that the reforestation with *Pinus nigra* subsp. *nigra* (Table 3, rels. 1-6) is mainly on the limestone layer, while that with a prevalence of *Abies alba* (Tab. 3, rels 7-10) is on the outcrops of siliciclastic flysch of the Laga Mountains. From an examination of the phytosociological table (Table 3), we can see that the number of species per relevé ranges from 12 to 50. Of course, the relevés that are richest in terms of the number of species are those carried out under conditions of low to medium-low coverage of *Pinus nigra* subsp. *nigra*, while the poorest are those carried out in the enclosed reforestation with mixed *Abies alba* and *Pinus nigra* subsp. *nigra*. For the syntaxonomic categories identified here, Table 3 shows how the increase in the coverage of conifers corresponds to a percentage increase in the nemoral herbaceous and shrub species of the class *Querco-Fagetea* and a sharp decline in the mantle species of the vegetation edges, of the classes *Rhamno-Prunetea* and *Trifolio-Geranietea*, that are also absent when the conifer coverage exceeds 80%. As far as the class *Querco-Fagetea* is concerned, under conditions of low and medium coverage of conifers, the species of the order *Quercetalia pubescenti-petraeae* and the alliance *Carpinion orientalis* are well represented, with *Ostrya carpinifolia, Fraxinus ornus* subsp. *ornus, Acer opalus* subsp. *obtusatum, Sorbus aria* subsp. *aria*, and others. Instead, species of the order *Fagetalia sylvaticae* are more scarse, and are, on the other hand, better represented in the enclosed reforestation. On the basis of the comparison with the data for the various forest coenoses that have been identified, it can be assumed that in the reforestation with *Pinus nigra* subsp. *nigra* that is growing on the limestone layer, the present vegetation dynamics will determine the establishment of the sub-montane beech forest of the association *Lathyro-Fagetum sylvaticae*, via the preforestal vegetation of *Ostrya carpinifolia*. In the reforestation with *Abies alba*, considering the presence of acidophilic species, and also due to the presence of original tree specimens of *Fagus sylvatica* subsp. *sylvatica* and of well-developed brown soil on the outcrops of flysh of the Laga Mountains, the establishment of a subacidophilic and mesophilous beech

wood of the alliance *Aremonio-Fagion sylvaticae* can be assumed.

MELICO UNIFLORAE-POPULETUM TREMULAE Pedrotti 1995 em. Taffetani 2000 (rels. 1-3) *Salix apennina* variant (rels. 2-3) (Table 4, group 2).

The communities with *Populus tremula* are found mainly at the base of large watersheds, on slightly slo-

Tab. 3 - *Pinus nigra* subsp. *nigra* reforestation (rels. 1-6); *Pinus nigra* subsp. *nigra* and *Abies alba* reforestation (rels. 7-10).

	Relevé number		1	2	3	4	5	6	7	8	9	10	
	Relevé number from dendrogram Fig. 5		7	8	9	10	11	12	13	14	15	16	
	Cluster		4	4	3	3	3	3	3	3	3	3	
Chorotype	Altitude (m a.s.l.) x 10		132	129	130	130	128	135	131	129	131	129	Presences
	Aspect		SE	SSE	OSO	SSE	S	SSE	OSO	SO	ESE	SSO	
	Slope (°)		35	25	35	30	30	35	20	30	25	25	
	Area (m^2)		300	300	300	300	300	300	300	300	300	300	
	Number of species x relevé		50	32	28	23	18	19	17	16	16	12	
	Conifer coverage I: <40%; II: 40%-80%; III: 80%-100%		I	I	II	II	II	II	III	III	III	III	
	Introduced conifers (b-shrub; c-seedling)												
SE EUROP. MONT.	Pinus nigra Arnold subsp. nigra		1.2	2.3	3.3	4.4	3.3	3.3	3.4	3.4	4.5	3.4	10
		c	.	.	.	.	.	+	.	.	.	.	1
S EUROP. MONT.	Abies alba Mill.		.	.	+.2	.	+.2	.	4.4	1.2	4.4	1.2	6
		b	.	+	.	.	+.2	.	.	1.2	.	2	4
		c	.	.	+	.	+	.	3.3	+.2	.	+	5
	Tree species of the *Querco-Fagetea class* * Charact. species of the *Fagetalia sylvaticae* ord. (b-shrub; c-seedling)												
EUROP.	*Fagus sylvatica L. subsp. sylvatica		.	.	1.2	.	1.2	.	1.2	2.3	.	2.2	5
		b	+.2	+.2	+	2.2	.	.	.	.	.	.	4
		c	.	.	+	+	.	.	.	+	.	.	3
EUROP.	Corylus avellana L.		4.4	4.4	.	+.2	+.2	.	.	.	+	.	5
		c	.	+.2	.	.	.	+	.	.	.	.	2
S EUROP. MONT.	Laburnum anagyroides Medik. subsp. anagyroides		1.2	1.2	.	.	.	+	.	.	.	.	3
SE EUROP.	Ostrya carpinifolia Scop.		.	.	2.3	.	1.2	1.1	+.2	.	.	+	5
		b	1.2	1.2	.	1.2	2.2	.	.	.	.	.	4
		c	.	.	.	.	.	+	.	.	.	.	1
S EUROP.-W ASIAT.	Fraxinus ornus L. subsp. ornus		.	.	+.2	.	+.2	1.1	.	.	.	+	4
		b	.	2.2	1.2	.	.	.	.	.	+	.	3
		c	.	+.2	.	+.2	.	.	.	.	.	.	2
EUROP. MONT.	Sorbus aria (L.) Crantz subsp. aria		+.2	1.2	+	2.2	+.2	.	.	.	.	.	5
		c	.	1.1	.	3.3	.	.	.	.	.	.	2
SE EUROP.	Acer opalus Mill. subsp. obtusatum (Waldst. *et* Kit. *ex* Willd.) Gams		.	.	.	.	2.3	+.2	.	.	.	.	2
		b	.	1.2	.	.	+	.	.	.	.	.	2
		c	.	+	.	+	.	+	.	.	+	.	4
EUROP.	*Fraxinus excelsior L. subsp. excelsior		.	.	.	.	.	.	+.2	.	.	.	1
EUROP.-W ASIAT.	*Acer pseudoplatanus L.		.	.	.	.	+.2	.	.	.	.	.	1
		b	.	.	+.2	.	.	.	.	.	.	.	1
		c	.	.	+	.	+	.	+	+	.	1.1	5
EUROP.-SW ASIAT.	*Taxus baccata L.		.	.	+	.	.	.	.	.	.	.	1
EUROSIB.	Populus tremula L.		.	.	.	+.2	.	.	.	.	.	.	1
		c	.	.	.	+	.	.	.	.	.	.	1
													2
S EUROP.-SW ASIAT.	*Fraxinus angustifolia Vahl subsp. oxycarpa (Willd.) Franco et Rocha Afonzo	c	.	.	.	+	.	.	.	.	+	.	
S EUROP.	Quercus pubescens Willd. subsp. pubescens		.	.	.	+	.	.	.	.	.	.	1
SE EUROP.-SW ASIAT.	Quercus cerris L.		+.2	.	.	.	.	.	.	.	.	.	1
W EUROP.-MEDIT.	Daphne laureola L.		.	.	+.2	.	.	.	.	.	.	.	1
EUROP.-W ASIAT.	Prunus avium L. subsp. avium		.	.	+	.	.	.	.	.	.	.	1
EUROP.-SW ASIAT.	Hedera helix L. subsp. helix		.	+	.	.	.	.	.	.	.	.	1
	Herbaceous species of the *Querco-Fagetea* class *Charact. species of the *Fagetalia sylvaticae* ord.												
MEDIT.	Viola alba Besser subsp. dehnhardtii (Ten.) W. Becker		1.2	+.2	+.2	.	1.2	+	+.2	+	+.2	.	8
EUROP.-W ASIAT.	*Sanicula europaea L.		1.2	.	2.3	+	+	+	+.2	+	+	.	8
EUROP.-W ASIAT.	Cephalanthera rubra (L.) Rich.		+	.	+	.	+	+	+	1.1	+	+	8
EUROP.	*Viola reichenbachiana Jord. *ex* Boreau		+	+.2	1.2	.	+.2	.	+	1.2	.	+	7
EUROP.	Hepatica nobilis Schreb.		+.2	1.2	+.2	+	.	.	.	1.2	+	.	6
EURASIAT.	Lactuca muralis (L.) Gaertn.		1.1	+	+.2	.	.	+	+	.	+	.	6
EUROSIB.-N AMER.	*Orthilia secunda (L.) House		+	.	+	+.2	.	.	+	1.1	.	+	6
EUROSIB.-N AMER.	*Solidago virgaurea L. subsp. virgaurea		.	+.2	.	+.2	.	+	.	+	.	.	4
W EUROP.-MEDIT.	*Primula vulgaris Huds. subsp. vulgaris		.	.	1.2	.	.	.	+	+.2	.	+	4
S EUROP.	*Aremonia agrimonoides (L.) DC. subsp. agrimonoides		.	+	.	.	.	.	+	.	.	+	3

EUROSIB.	Neottia nidus-avis (L.) Rich.	+	.	+	.	.	.	.	.	+.2	.	3
EUROP.-W ASIAT.	Hieracium murorum L. (*s.l.*)	+	+.2	+.2	.	.	.	.	.	.	.	3
EUROP.	*Cardamine bulbifera (L.) Crantz	+	.	+.2	.	.	.	.	.	+	.	3
S EUROP.	Cyclamen hederifolium Aiton subsp. hederifolium	+.2	1.1	.	.	.	.	+.2	.	.	.	3
EUROP.	Melittis melissophyllum L. subsp. melissophyllum	.	+	.	.	.	+	.	.	.	.	2
EURASIAT.	Lilium martagon L.	.	+	.	+	.	.	.	.	.	.	2
EURASIAT.	Listera ovata (L.) R. Br.	.	.	+	.	+.2	.	.	.	.	.	2
EURASIAT.	Cephalanthera longifolia (L.) Fritsch	.	.	.	.	+	.	.	.	+	.	2
EUROSIB.-N AMER.	*Moneses uniflora (L.) A. Gray	.	.	.	.	.	.	+	+	.	.	2
EUROP.	Epipactis muelleri Godfery	+	.	.	.	.	.	.	.	.	.	1
S EUROP. MONT.	*Geranium nodosum L.	.	.	.	.	.	.	.	.	.	+.2	1
EUROP.-CAUC.	*Corydalis cava (L.) Schweigg. *et* Körte subsp. cava	+	.	.	.	.	.	.	.	.	.	1
EUROP.	Euphorbia dulcis L.	.	+	.	.	.	.	.	.	.	.	1
EURASIAT.	Viola mirabilis L.	.	.	.	.	.	.	.	.	+.2	.	1
C EUROP. MONT.	Lilium bulbiferum L. subsp. croceum (Chaix) Jan	+	.	.	.	.	.	.	.	.	.	1
EUROSIB.-N AMER.	*Goodyera repens (L.) R. Br.	.	.	.	+.2	.	.	.	.	.	.	1
EUROSIB.-N AMER.	*Corallorhiza trifida Châtel.	.	.	.	.	.	.	.	.	+	.	1
	Charact. species of the *Rhamno-Prunetea* class											
EUROP.	Clematis vitalba L.	+	1.2	+	+	.	.	.	.	.	.	4
MEDIT.	Cytisophyllum sessilifolium (L.) O. Lange	+.2	+.2	.	1.1	.	+	.	.	.	.	4
EURASIAT.-N AMER.	Juniperus communis L. subsp. communis	+.2	+.2	.	+.2	.	1.2	.	.	.	.	4
SE EUROP.	Lonicera caprifolium L.	+.2	.	+.2	.	.	.	.	+.2	.	.	3
EUROP.-W ASIAT.	Crataegus monogyna Jacq.	+.2	+.2	.	.	.	.	.	.	.	.	2
C EUROP.	Rubus hirtus (group)	+.2	.	.	.	+.2	.	.	.	.	.	2
EUROP.-W ASIAT.	Viburnum lantana L.	2.2	.	.	.	.	.	.	.	.	.	1
S EUROP. MONT.	Rosa montana Chaix	+	.	.	.	.	.	.	.	.	.	1
S EUROP.-SW ASIAT.	Prunus mahaleb L.	+.2	.	.	.	.	.	.	.	.	.	1
	Charact. and diff. species of the *Trifolio-Geranietea* class											
SUBENDEM.	Digitalis lutea L. subsp. australis (Ten.) Arcang.	1.1	1.1	.	.	.	.	.	.	.	.	2
S EUROP.	Cruciata glabra (L.) Ehrend. subsp. glabra	+	+	.	.	.	.	.	.	.	.	2
EURASIAT.	Fragaria vesca L. subsp. vesca	2.2	1.2	.	.	.	.	.	.	.	.	2
ENDEM.	Campanula micrantha Bertol.	+	.	+	.	.	.	.	.	.	.	2
MEDIT.	Arabis turrita L.	1.1	.	.	.	.	+	.	.	.	.	2
COSMOPOL.	Pteridium aquilinum (L.) Kuhn subsp. aquilinum	.	+	.	.	+	.	.	.	+	.	3
S EUROP.	Vicia villosa Roth subsp. varia (Host) Corb.	+.3	.	.	.	.	.	.	.	.	.	1
EURASIAT.	Geum urbanum L.	+	.	.	.	.	.	.	.	.	.	1
EURASIAT.-N AMER.	Clinopodium vulgare L. subsp. vulgare	+	.	.	.	.	.	.	.	.	.	1
	Others species											
ENDEM.	Sesleria nitida Ten. (*s.l.*)	3.4	1.2	2.3	3.4	2.2	3.4	.	+.2	.	.	7
EURASIAT.	Galium aparine L.	+	.	.	.	.	.	+	.	.	.	2
MEDIT.	Tanacetum corymbosum (L.) Sch. Bip. subsp. achillae (L.) Greuter	+	.	.	.	.	+	.	.	.	.	2
MEDIT.	Teucrium chamaedrys L. subsp. chamaedrys	+	.	.	.	.	+	.	.	.	.	2
S EUROP.	Peucedanum oreoselinum (L.) Moench	.	+	.	+.2	.	.	.	.	.	.	2
EURASIAT.	Prunella vulgaris L. subsp. vulgaris	.	.	+.2	.	.	.	.	+.3	.	.	2
	Accidental species	8	1	1	2	0	1	0	0	0	0	

ping morphologies and on brown soil. *Populus tremula* is a relatively sun-loving and pioneer species, and in the study area it comprises mainly preforestal formations of the watershed edaphomesophilous beech forest of the association *Lathyro veneti-Fagetum sylvaticae*. From the phytosociological point of view, the communities of *Populus tremula* that were investigated (Table 4) are referred to the association *Melico uniflorae-Populetum tremulae* Pedrotti 1995 em. Taffetani 2000, which is widespread in the supratemperate bioclimatic belt of the Central Apennines (Pedrotti, 1995), and is included in the alliance *Corylo-Populion tremulae,* suballiance *Aceri obtusati-Populenion tremulae*. The S*alix apennina* variant (Table 4, rels. 2, 3) of the association *Melico uniflorae-Populetum tremulae* is also highlighted, which indicates the connection between the poplar wood and the high-shrub willow woods of the association *Salicetum apenninae* in the territory investigated.

SALICETUM APENNINAE Pedrotti, Spada & Conti 1996 (rels. 1-3)

eupatorietosum cannabini Allegrezza, Mentoni & Tesei 2010 (rel. 1)

salicetosum apenninae Allegrezza, Mentoni & Tesei 2010 (rels. 2-3) (Table 5, group 1).

In the area under study, the *Salix apennina* and *S. purpurea* willow woods (Table 5) develop by the water sources and within the watersheds. These are mostly pioneer forest communities of limited extension and with high-shrub growth that rarely exceeds 5 m in height. From the phytosociological perspective, these communities should be referred to the association *Salicetum apenninae* Pedrotti Spada & Conti 1996 in Pe-

Tab. 4 - *Melico uniflorae-Populetum tremulae* Pedrotti 1995 em. Taffetani 2000 (rels. 1-3); *Salix apennina* variant (rels. 2-3).

	Relevé number	1	2	3	
	Relevé number from dendrogram Fig. 5	4	6	5	
	Cluster	2	2	2	
Chorotype	Altitude (m a.s.l.)	1370	1330	1330	Presences
	Aspect	SE	SE	SSE	
	Slope (°)	15	20	10	
	Coverage (%)	100	95	85	
	Area (m2)	70	200	300	
	Number of species x relevé	21	24	40	
	Charact. and diff. species of the *Melico uniflorae-Populetum tremulae* ass., *Aceri obtusati-Populenion tremulae* suball. , *Corylo-Populion tremulae* all. and *Betulo pendulae-Populetalia tremulae* ord.				
EUROSIB.	Populus tremula L.	2.3	4.4	4.5	3
EUROP.	Corylus avellana L.	4.5	2.2	3.4	3
SE EUROP.	Lonicera caprifolium L.	1.1	1.2	+	3
SE EUROP.	Ostrya carpinifolia Scop.	+.2	+.2	+.2	3
EUROP. MONT.	Sorbus aria (L.) Crantz subsp. aria	1.2	+.2	.	2
SE EUROP.	Acer opalus Mill. subsp. obtusatum (Waldst. et Kit. ex Willd.) Gams	.	.	+.2	1
EUROP.-W ASIAT.	Prunus avium L. subsp. avium	.	.	+	1
	Species of *Salix apennina* variant				
APENN.-ALP.	Salix apennina A.K. Skvortsov	.	1.2	1.2	2
COSMOPOL.	Equisetum ramosissimum Desf.	.	.	+.3	1
EURASIAT.	Eupatorium cannabinum L. subsp. cannabinum	.	.	+.2	1
	Charact. species of the *Querco-Fagetea* class				
EUROP.-W ASIAT.	Sanicula europaea L.	+.2	+	2.3	3
EUROP.	Viola reichenbachiana Jord. *ex* Boreau	1.2	.	1.2	2
EURASIAT.	Cephalanthera longifolia (L.) Fritsch	.	+	1.1	2
EUROP.	Epipactis muelleri Godfery	.	+.2	+.2	2
EUROP.	Fagus sylvatica L. subsp. sylvatica	.	+.2	.	1
EUROP.	Hepatica nobilis Schreb.	+.2	.	.	1
S EUROP.	Cyclamen hederifolium Aiton subsp. hederifolium	+.2	.	.	1
MEDIT.	Viola alba Besser subsp. dehnhardtii (Ten.) W. Becker	+	.	.	1
EURASIAT.-N AMER.	Geranium robertianum L.	+	.	.	1
EURASIAT.	Listera ovata (L.) R. Br.	.	1.2	.	1
EUROP.-W ASIAT.	Hieracium murorum L. (*s.l.*)	.	1.2	.	1
EURASIAT.	Lactuca muralis (L.) Gaertn.	.	.	+	1
EURASIAT.	Campanula trachelium L. subsp. trachelium	.	.	+	1
EUROP.-W ASIAT.	Carex sylvatica Huds. subsp. sylvatica	.	.	1.2	1
EUROSIB.	Neottia nidus-avis (L.) Rich.	.	.	+	1
EUROP.	Arum maculatum L.	.	.	+	1
EURASIAT.	Rubus caesius L.	.	.	+	1
	Others species				
EUROP.	Brachypodium rupestre (Host) Roem. *et* Schult.	+.2	1.2	2.3	3
EUROP.-W ASIAT.	Viburnum lantana L.	+	+.2	+.2	3
SUBENDEM.	Digitalis lutea L. subsp. australis (Ten.) Arcang.	1.1	+.2	1.1	3
SE EUROP. MONT.	Pinus nigra Arnold subsp. nigra	+	+.2	+.2	3
S EUROP. MONT.	Rosa montana Chaix	+	+.2	+	3
EURASIAT.	Fragaria vesca L. subsp. vesca	1.2	.	+.2	2
SE EUROP. MONT.	Rhamnus alpina L. subsp. fallax (Boiss.) Maire *et* Petimg.	+.2	.	+.2	2
S EUROP.	Cruciata glabra (L.) Ehrend. subsp. glabra	+	.	+	2
MEDIT.	Cytisophyllum sessilifolium (L.) O. Lange	.	+	+	2
EUROP.	Clematis vitalba L.	.	+	+.2	2
EURASIAT.-N AMER.	Juniperus communis L. subsp. communis	.	1.2	1.2	2
	Accidental species	2	3	4	

drotti & Gafta 1996, which has been described in the mountain and sub-montane sector of Abruzzo (Pedrotti Spada & Conti in Pedrotti & Gafta 1996) and was confirmed by Pirone (2000) for the northern slopes of Gran Sasso. For this, as well as its typical and pioneering aspect in subassociation *salicetosum apeninnae* (Table 5, rels. 2, 3), the subassociation *eupatorietosum cannabini* Allegrezza *et al*. ex Allegrezza, Mentoni & Tesei 2013 (Table 5, rel. 1) has been recognized under conditions with water stagnation and accumulation of organic matter (Allegrezza *et al*., 2010).

Tab. 5 - *Salicetum apenninae* Pedrotti, Spada & Conti 1996 (rels. 1-3); subass. *eupatorietosum cannabini*, Allegrezza, Mentoni & Tesei 2010 (rel. 1); subass. *salicetosum apenninae* Allegrezza, Mentoni & Tesei 2010 (rels. 2-3).

	Relevè number	1	2	3	
	Relevé number from dendrogram Fig. 5	1	2	3	
	Cluster	1	1	1	
Chorotype	Altitude (m a.s.l.)	1340	1340	1350	Presences
	Aspect	SSE	SSE	SSE	
	Slope (°)	15	30	40	
	Coverage (%)	90	100	100	
	Area (m^2)	80	80	80	
	Number of species x relevé	27	22	10	
	Charact. and diff. species of the ass. and *salicetosum apenninae* subass				
APENN.-ALP.	Salix apennina A.K. Skvortsov	4.4	2.3	1.2	3
EUROP.	Clematis vitalba L.	1.1	2.3	3.3	3
	Diff. species of the *eupatorietosum cannabini* subass.				
EURASIAT.	Eupatorium cannabinum L. subsp. cannabinum	2.3	.	.	1
EURASIAT.	Campanula trachelium L. subsp. trachelium	+	.	.	1
	Charact. species of the *Salicion elaeagni* all., *Salicetalia purpureae* ord. and *Salici-Populetea nigrae* class				
EURASIAT.	Salix purpurea L.	2.2	4.4	5.5	3
COSMOPOL.	Equisetum ramosissimum Desf.	+.2	.	.	1
EURASIAT.	Petasites hybridus (L.) P. Gaertn., B. Meyer *et* Scherb. subsp. hybridus	+	.	.	1
	Others species				
EUROP.	Corylus avellana L.	2.2	1.2	+.2	3
EUROP.	Brachypodium rupestre (Host) Roem. *et* Schult.	2.3	1.2	+.2	3
MEDIT.	Daucus carota L. subsp. carota	+	+	+	3
S EUR. MONT.	Cirsium erisithales (Jacq.) Scop.	+	+	.	2
SUBENDEM.	Digitalis lutea L. subsp. australis (Ten.) Arcang.	+.2	+	.	2
S EUR. MONT.	Rosa montana Chaix	+	+	.	2
MEDIT.	Cytisophyllum sessilifolium (L.) O. Lange	+	+.2	.	2
EUROSIB.	Trifolium repens L. subsp. repens	.	+	+	2
EURASIAT.	Tussilago farfara L.	.	+.2	1.1	2
	Accidental species	13	10	2	

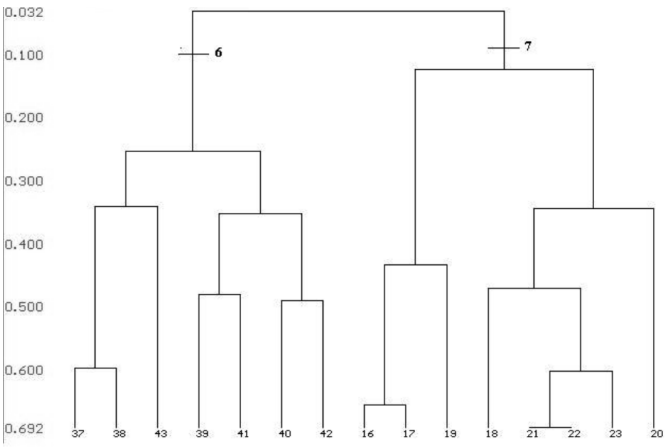

Fig. 7 – Dendrogram from the phytosociological relevés to compare the shrub communities of the study area. (group 6 – *Amelanchier ovalis* shrubs communities; group 7 – *Juniperus communis* subsp. *nana* and *Juniperus communis* subsp. *hemispherica* shrubs communities).

Shrub plant communities

Shrubberies are common in the eastern sector of the area under study, at the base of the rockfalls and on the limestone debris layer that is subjected to water run-off. The dendrogram obtained from the classification of the relevés on the shrub communities detected (Figure 7) separates the preforestal coenoses of *Berberidion vulgaris* suballiance *Berberidenion* with the community of *Amelanchier ovalis* subsp. *ovalis* (group 6) from those of the class *Junipero sabinae-Pinetea sylvestris* with the shrubberies of *Juniperus communis* subsp. *nana* (group 7).

RHAMNO ALPINAE-AMELANCHIERETUM OVALIS (Pedrotti 1994) em. Cutini, Stanisci & Pirone 2002

cytisophylletosum sessilifolii Cutini, Stanisci & Pirone 2002; rels. 1-5

rhamnetosum fallacis subass. nova hoc loco subass. *typicum* (holotypus rel. 4 of Table 1 in Cutini *et al*., 2002) (rels. 6-7) (Table 6, group 6).

This is a preforestal shrub community with a dominance of *Amelanchier ovalis* and *Rhamnus alpina* subsp. *fallax* that is present in the territory under study at altitudes between 1,350 m and 1,500 m a.s.l., on steep slopes that correspond to the stabilized collapsed metre-sized limestone clasts, at the base of rockfalls. The shrubbery with *A. ovalis* that grows in the upper supratemperate belt of the Sibillini Mountain range and in the territory under study have already been investigated by Pedrotti (1994), and were included in the association *Rhamno alpinae-Amelanchieretum ovalis* Pedrotti 1994. The association has subsequently been amended and redefined in the syntaxonomic revision of the vegetation mantles of the alliance *Berberidion vulgaris* (Cutini *et al*., 2002) and included in the suballiance *Berberidenion vulgaris*. Within the association *Rhamno alpinae-Amelanchieretum ovalis* (Pedrotti 1994) em. Cutini, Stanisci & Pirone 2002, which is widespread on the highest mountains of Abruzzo (Maiella, Gran Sasso, Velino), the sub-association *cytisophylletosum sessilifolii* Cutini, Stanisci & Pirone 2002 was recognized on the basis of relevés carried out by the authors in the Abruzzo region: the coenosis present in the territory under study is here referred to this subassociation. In Table 6, there are two unpublished relevés that were carried out with the present study (rels. 1, 2) as well as five relevees that were published in Pedrotti (Pedrotti, 1994; Table 1, rels. 1-5). The following are considered to be the differential and characteristic species: *Amelanchier ovalis* subsp. *ovalis, Rhamnus alpina* subsp. *fallax, Cotoneaster integerrimus* and *Cytisophyllum sessilifolium*. Under the most stable conditions (Table 6, rels. 1, 2) the association is connected to

the hop hornbeam wood of the association *Viburno lantanae-Ostryetum carpinifoliae amelanchieretosum ovalis* subass. described above, while in situations in which the persistence of rockfalls prevents the further evolution of the vegetation, the association *Rhamno alpinae-Amelanchieretum ovalis*, subassociation *cytisophylletosum sessilifolii*, can be considered durable. The subassociation *cytisophylletosum sessilifolii* indicates the thermophilous aspect of the association *Rhamno alpinae-Amelanchieretum ovalis* (rels. 1-5), which is typical of higher altitudes. Therefore, the subassociation type of the association *Rhamno alpinae-Amelanchieretum ovalis* is here indicated with the epithet *rhamnetosum fallacis* subassociation nova hoc loco subassociation *typicum* (holotypus rel. 4 of Table 1 in Cutini *et al*., 2002) (rels. 6-7), as already hypothesized by Cutini & Blasi (2002).

SORBO ARIAE-JUNIPERETUM NANAE ass. nova hoc loco (rels. 1-8: holotypus rel. 6)
juniperetosum nanae subass. nova hoc loco (holotypus rel. 6; subass. *typicum*)
cytisophylletosum sessilifolii subass. nova hoc loco (rels. 1-4: holotypus rel. 2) (Table 7, group 7).

In the area under study, the communities made up of prostrate shrubs of *Juniperus communis* subsp.

Tab. 6 - *Rhamno alpinae-Amelanchieretum ovalis* (Pedrotti 1994) em. Cutini, Stanisci & Pirone 2002 *cytisophylletosum sessilifolii* Cutini, Stanisci & Pirone 2002 (rels. 1-5); *rhamnetosum fallacis* subass. nova hoc loco subass. *typicum* (holotypus rel. 4 of Table 1 in Cutini *et al*., 2002) (rels. 6-7); rels. 3-7: from Tab. 1 - rels. 1-5 in Pedrotti (1994).

	Relevé number	1	2	3	4	5	6	7	
	Relevé number from dendrogram Fig. 7	37	38	39	40	42	43	41	
	Cluster	6	6	6	6	6	6	6	
Chorotype	Altitude (m a.s.l.)	1460	1500	-	-	-	-	-	Presences
	Aspect	ESE	ESE	E	SE	O	N	SE	
	Slope (°)	30	45	45	20	30	50	20	
	Coverage (%)	90	80	90	90	95	80	90	
	Area (m^2)	30	20	30	20	20	10	20	
	Number of species x relevé	15	16	17	24	18	18	14	
	Charact. and diff. species of the ass.								
EUROP.-SW ASIAT.	Amelanchier ovalis Medik. subsp. ovalis	4.5	3.4	4.4	4.4	4.4	3.3	4.4	7
SE EUROP. MONT.	Rhamnus alpina L. subsp. fallax (Boiss.) Maire *et* Petimg.	2.3	1.2	1.1	2.2	+	2.2	1.1	7
EUROP.-SW ASIAT.	Cotoneaster integerrimus Medik.	.	.	.	+	.	1.1	+	3
	Diff. species of the *cytisophylletosum sessilifolii* subass.								
MEDIT.	Cytisophyllum sessilifolium (L.) O. Lange	1.1	1.1	1.1	1.1	1.1	.	.	5
	Charact. and diff. species of the *Berberidion* all., *Prunetalia* ord. and *Rhamno-Prunetea* class								
EUROP. MONT.	Sorbus aria (L.) Crantz subsp. aria	1.2	2.2	+	+	+	1.1	1.1	7
EUROP.-W ASIAT.	Viburnum lantana L.	1.2	.	.	+	.	.	.	2
EUROSIB.	Cytisus hirsutus L. subsp. polytrichus (M. Bieb.) Hayek	.	.	.	.	1.1	.	+.2	2
CIRCUMBOR.	Juniperus communis L. subsp. communis	.	.	+.2	.	.	.	.	1
EURASIAT.	Rosa spinosissima L.	+.2	.	.	.	.	.	.	1
MEDIT.	Juniperus oxycedrus L.	.	.	+.2	.	.	.	.	1
OROF. S-EUROP.	Lonicera alpigena L.	.	.	.	.	.	.	+	1
S EUROP:-W ASIAT.	Berberis vulgaris L.	.	.	.	.	.	+.2	.	1
	Charact. species of the *Junipero sabinae-Pinetea sylvestris* class								
NE-MEDIT.-MONT.	Daphne oleoides Schreber	+.2	+.2	+	.	+	+	.	5
(CIRCUM.)ART.ALP.	Arctostaphylos uva-ursi (L.) Sprengel	1.2	1.2	.	+.2	1.2	1.2	.	5
MEDIT.-MONT.	Juniperus communis L. subsp. hemisphaerica (J. Presl et C. Presl) Nyman	+.2	+.2	.	.	.	.	.	2
EUROSIB.-N AMER.	Juniperus communis L. subsp. nana Syme	.	.	.	+.2	.	+.2	.	2
	Others species								
ILLIR.-APENN.	Globularia meridionalis (Podp.) O. Schwarz	+.2	+.2	+.2	1.2	+.2	+	1.2	7
ENDEM.	Sesleria nitida Ten. (*s.l.*)	+.2	+.2	2.2	+.2	1.2	.	3.4	6
ENDEM.	Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti et Gubellini	+.2	1.1	+	+	.	+	.	5
ILLIR.-APENN.	Sesleria juncifolia Suffren subsp. juncifolia	.	+	+.2	1.2	+.2	1.2	.	5
EUROP.-W ASIAT.	Hieracium murorum L. (*s.l.*)	.	.	.	+	+	.	1.1	3
MEDIT.	Teucrium chamaedrys L. subsp. chamaedrys	.	+	.	1.2	.	.	+.2	3
SUBENDEM.	Carex macrolepis DC.	.	.	.	1.1	+	+	1.2	4
SE EUROP.-SW ASIAT.	Polygala major Jacq.	.	.	1.1	+	+	.	+	4
MEDIT.	Helianthemum oelandicum (L.) Dum. Cours. subsp. incanum (Willk.) G. López	.	.	1.1	+	.	1.2	1.1	4
SE EUROP.	Gentiana dinarica Beck	.	.	.	1.1	1.1	+	.	3
	Accidental species	3	4	3	6	4	5	2	

Life form	Chorotype											
		Relevé number	1	2+	3	4	5	6*	7	8	9	10	11
		Relevé number from dendrogram Fig. 8	16	17	18	19	20	21	22	23	1	2	3
		Cluster	II	II	II	II	II	II	II	II	III	III	III
		Altitude (m a.s.l.) x 10	155	144	151	146	148	145	149	148	191	193	182
		Aspect	S	ESE	SE	ESE	SE	SE	S	S	E	S	S
		Slope (°)	40	25	30	20	25	20	25	20	10	5	20
		Coverage (%)	100	100	100	100	100	100	100	100			
		Area (m^2)	80	80	80	80	70	60	60	60	30	16	60
		Number of species x relevé	12	15	13	19	18	21	14	21	12	11	16
		Charact. and diff. species of the *Sorbo ariae-Juniperetum nanae* ass. ass. nova and *juniperetosum nanae* subass.											
NP	EUROSIB.-N AMER.	Juniperus communis L. subsp. nana Syme	.	1	5	.	4	5	4	4	3	2	4
NP	MEDIT. MONT.	Juniperus communis L. subsp. hemisphaerica (J. Presl *et* C. Presl) Nyman	4	4	.	+	3	1	1	.	.	.	.
P caesp	EUROP. MONT.	Sorbus aria (L.) Crantz subsp. aria	.	.	+	+	+	+	+	+	.	.	.
P caesp	SE EUROP.	Ostrya carpinifolia Scop.	.	+	.	+	.	1	1	1	.	.	.
P caesp	SE EUROP. MONT.	Rhamnus alpina L. subsp. fallax (Boiss.) Maire *et* Petimg.	.	+	+	+	+	+	.	+	.	.	.
Ch suffr	ENDEM.	Cerastium tomentosum L.	.	.	.	.	.	+	+	+	.	.	.
NP	EUROP.-SW ASIAT.	Cotoneaster integerrimus Medik.	.	.	.	+	.	.	.	+	.	.	.
		Species of the c*ytisophylletosum sessilifolii* subass. nova											
P caesp	MEDIT.	Cytisophyllum sessilifolium (L.) O. Lange	1	1	1	1	.	.	.	.	.	.	.
H scap	SUBENDEM.	Digitalis lutea L. subsp. australis (Ten.) Arcang.	+	+	.	.	+	+	.	.	.	.	.
Ch suffr	EUROSIB.	Cytisus hirsutus L. subsp. polytrichus (M. Bieb.) Hayek	.	+	.	.	.	.	.	.	.	.	.
		Charact. and diff. species of the *Chamaecytiso spinescentis - Arctostaphyletum uva-ursi* ass.											
Ch suffr	SUBENDEM.	Cytisus spinescens C. Presl	.	.	.	.	.	.	.	.	1	.	+
Ch suffr	MEDIT.	Helianthemum oelandicum (L.) Dum. Cours. subsp. incanum (Willk.) G. López	.	.	+	.	.	.	.	+	1	+	1
Ch suffr	EUROP.-W ASIAT.	Helianthemum nummularium (L.) Mill. subsp. glabrum (Koch) Wilczek	.	.	.	.	.	.	.	.	.	+	1
Ch suffr	SE EUROP.	Genista januensis Viv.	.	.	.	.	.	.	.	.	.	.	.
		Daphno oleoidis-Juniperion alpinae all., *Junipero sabinae-Juniperetalia sylvestris* ord. and *Junipero sabinae-Pinetea sylvestris* class											
Ch suffr	EUROSIB.-N AMER.	Arctostaphylos uva-ursi (L.) Spreng.	3	3	2	4	1	2	3	1	5	5	5
Ch frut	C ASIAT.-MED. MONT.	Daphne oleoides Schreb.	.	1	+	1	.	.	.	.	.	.	.
NP	S EUROP. MONT.	Rosa montana Chaix	.	.	.	.	1	+	.	.	.	.	.
P scap	SE EUROP. MONT.	Pinus nigra Arnold subsp. nigra	.	.	.	.	.	+	1	2	.	.	.
NP	S EUROP. MONT.	Cotoneaster tomentosum (Aiton) Lindl.	.	.	.	.	.	.	.	.	.	.	.
NP	S EUROP. MONT.	Rosa pendulina L.	.	.	.	.	.	.	.	.	.	.	.
H scap	S EUROP. MONT.	Gentiana lutea L. subsp. lutea	.	.	.	.	.	.	.	.	.	.	.
		Charact. species of the *Festuco-Brometea* class											
H caesp	ENDEM.	Sesleria nitida Ten. (*s.l.*)	1	+	+	+	.	+	1	1	.	.	3
H caesp	EUROP.	Bromopsis erecta (Huds.) Fourr. subsp. erecta	.	.	.	.	+	+	+	.		+	+
H caesp	SUBENDEM.	Carex macrolepis DC.	.	.	+	+	+	+	+	.	.	.	+
Ch rept	ILLIR.-APENN.	Globularia meridionalis (Podp.) O. Schwarz	.	.	.	+	.	.	+	+	.	.	+
H caesp	EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	.	.	.	.	.	.	.	.	1	.	.
H scap	ENDEM.	Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti *et* Gubellini	+	.	.	+	.	+	.	+	+	.	.
H scap	EUROP.	Asperula cynanchica L.	.	.	.	.	.	.	.	.	+	+	+
Ch suffr	MEDIT.	Coronilla minima L. subsp. minima	.	.	.	.	.	.	.	.	.	.	.
H scap	MEDIT.	Galium lucidum All.	.	.	.	+	.	.	.	.	.	.	.
H scap	SE EUROP.-SW ASIAT.	Polygala major Jacq.	.	.	.	.	.	.	.	.	.	.	.
H caesp	EUROP.	Brachypodium rupestre (Host) Roem. *et* Schult.	.	+	.	.	+	+	.	.	.	.	.
H scap		Dianthus sylvestris Wulfen (*s.l.*)	.	.	.	.	.	.	.	.	.	+	+
H ros	S EUROP. MONT.	Carlina acaulis L. subsp. caulescens (Lam.) Schübl. *et* G. Martens	.	.	.	.	+	.	+	+	.	.	.
H caesp	ENDEM.	Festuca robustifolia Mgf.-Dbg.	.	.	.	.	.	.	.	.	3	1	+
G bulb	EUROP.	Dactylorhiza sambucina (L.) Soó	.	.	.	.	.	.	.	.	+	.	+
H caesp	EURASIAT.	Carex humilis Leyss.	.	.	.	.	.	.	.	.	.	.	.
		Others species											
H caesp	ILLIR.-APENN.	Sesleria juncifolia Suffren subsp. juncifolia	+	.	+	+	.	+	.	+	+	1	.
Ch suffr	MEDIT. MONT.	Anthyllis montana L. subsp. atropurpurea (Vuk.) Pignatti	+	.	.	.	.	.	.	.	1	1	2
H scap	ENDEM.	Campanula micrantha Bertol.	+	.	.	.	+	.	.	.	.	.	.
H scap	EURASIAT.-AFR.	Lotus corniculatus L. subsp. corniculatus	.	.	.	.	.	.	.	.	.	.	+
P scap	EUROP.	Fagus sylvatica L. subsp. sylvatica pl.	+	1	1	.	.	+	.	.	.	.	.
H scap	EURASIAT.	Echinops sphaerocephalus L. subsp. sphaerocephalus	.	.	+	.	+	+	.	.	.	.	.
P caesp	EUROP.	Corylus avellana L.	.	.	.	.	1	.	1	+	.	.	.
H scap	S EUROP. MONT.	Senecio doronicum (L.) L.	.	.	.	.	.	.	.	.	.	.	.
P caesp	EUROP.-W ASIAT.	Viburnum lantana L.	.	.	.	.	1	+	.	+	.	.	.
		Accidental species	2	3	1	5	3	2	0	5	7	4	6

12	13	14	15	16	17	18	19	20	21	22	23	
4	5	6	7	8	9	10	11	12	13	14	15	
III	III	III	III	III	III	III	III	III	III	III	III	
155	150	150	150	170	180	174	185	190	152	155	152	
W	S	S	S	W	SE	S	S	SE	SE	SE	S	Presences
30	15	0	20	33	15	30	25	20	25	25	15	
20	50	12	9	5	100	5	10	10	60	12	15	
15	12	10	13	8	11	13	11	8	12	12	12	
3	5	3	3	5	3	5	3	4	5	3	.	20
.	.	.	.	.	.	.	.	.	.	.	.	6
1	.	.	.	.	.	.	.	.	.	.	.	7
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1	2	3	1	+		2	+	.	.	.	2	10
.	+	.	1	.	1	.	.	1	.	.	1	10
.	+	.	.	.	.	.	.	.	.	.	.	3
+	+	.	.	.	.	.	.	.	.	.	.	2
5	3	4	3	2	3	2	3	3	2	4	4	23
.	.	.	+	.	.	.	.	.	1	2	.	6
.	.	.	.	.	.	.	.	.	.	.	.	2
.	.	.	.	.	.	.	.	.	.	.	.	3
2	.	.	.	.	.	.	.	.	2	.	.	2
.	2	.	.	.	.	.	.	.	.	.	.	1
.	.	.	.	.	1	1	.	.	.	.	.	2
1	.	1	.	+	1	.	+	.	1	1	1	16
.	+	+	+	.	+	.	.	2	2	+	.	12
.	+	+	.	.	.	1	+	.	.	.	.	10
1	.	.	+	.	.	1	1	1	.	.	+	10
1	+	.	+	.	.	+	+	3	2	1	.	9
+	.	.	.	+	.	.	.	.	1	.	.	8
.	.	.	.	.	.	.	+	.	.	.	+	5
.	.	+	+	.	.	.	+	.	.	+	+	5
+	.	.	.	.	+	.	.	.	1	1	.	5
.	.	.	.	+	.	+	+	.	.	+	+	5
.	.	.	.	.	.	.	.	.	.	.	.	3
.	.	.	+	.	.	.	.	.	.	.	+	4
.	.	.	.	.	.	.	.	.	.	.	.	3
.	.	.	.	.	.	.	.	.	.	.	.	3
.	.	.	.	.	.	+	.	.	.	.	.	3
.	.	+	+	.	.	.	.	.	.	.	+	3
.	.	.	.	+	+	+	.	+	.	.	.	11
+	.	.	.	.	.	.	.	.	.	+	.	6
.	.	+	.	.	.	.	.	.	.	.	+	4
+	+	.	.	.	.	.	.	.	+	.	.	4
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.	.	.	.	.	.	.	.	.	.	.	.	3
+	.	.	+	.	.	+	.	.	.	.	.	3
.	.	.	.	.	.	.	.	.	.	.	.	3
10	2	2	0	0	3	2	5	5	3	4	3	

Tab. 7 - *Sorbo ariae-Juniperetum nanae* ass. nova hoc loco (rels. 1-8 of Tab. 7 holotypus rel. 6), subass. *juniperetosum nanae* subass. nova hoc loco (holotypus rel. 6; subass. *typicum*), subass. *cytisophylletosum sessilifolii* subass. nova hoc loco (rels. 1-4: holotypus rel. 2), *Chamaecytiso spinescentis - Arctostaphyletum uva-ursi* Blasi, Gigli & Stanisci 1991 ex Stanisci 1997 (rels. 9-23 of Tab. 7: from Tab. 5 rels. 1-15 in Stanisci, 1997).

nana are very common. These are found at the edges of the forest formations of the beech woods and hop hornbeam woods, and in the form of islands that are particularly dense and extended on slopes occupied by xerophilous grasslands, where they constitute nuclei of variable sizes. They are also found on debris falls, showing their great colonizing ability. These shrub nuclei can sometimes act as 'nurseries', as when they increase in size, some of them 'collapse' in the middle, which allows shrubs of forest and preforest deciduous species to become established in the internal areas. These are in any case edaphophilic coenoses that are durable in relation to the frequent water run-off. Sometimes the presence of spontaneous isolated specimens of *Pinus nigra* subsp. *nigra* gives the landscape the typical appearance of the class J*unipero sabinae-Pinetea sylvestris*, which is widely represented on the mountain ranges of the orotemperate bioclimatic belt of the Iberian Peninsula, as also reported by Biondi (1996). In the past, the pine forests of autochthonous pines, and in particular of *Pinus nigra* subsp. *nigra* and *Pinus mugo*, occupied large parts of the internal and warm aspects of the central Apennines, as has been shown by pollen analyses carried out also in the neighbouring territories of the study area (Marchesoni 1957, 1958; Paganelli, 1958, 1982). Of particular ecological and biogeographical interest, *Juniperus communis* subsp. *hemisphaerica* was present in the coenoses under study here, at altitudes between 1300 m and 1500 m a.s.l.. This is a relatively thermophilous species of the high-mountain environment, which is novel for the Marche region and relatively rare in the Apennines, and is still not completely understood. Currently, there is only one published syntaxon for the Apennines that describes this association of *Juniperus communis* subsp. *nana* and *J. communis* subsp. *hemisphaerica*. This is a report where this was indicated for the upper supratemperate bioclimatic belt of Gran Sasso of Italy (Biondi *et al*., 1999), with the sub-association *juniperetosum hemisphaericae* Biondi, Ballelli, Allegrezza, Taffetani, Frattaroli, Guitian & Zuccarello 1999 of the association *Helianthemo grandiflori-Juniperetum alpinae* (Blasi, Abbate, Gigli & Stanisci 1989) Stanisci 1997, ass. *typus* of the alliance *Daphno oleoidis-Juniperion nanae* order *Junipero-Pinetalia*, for which a single phytosociological relevé was reported. The coenoses of *Juniperus communis* subsp. *hemisphaerica* are instead widespread in the Mediterranean basin in

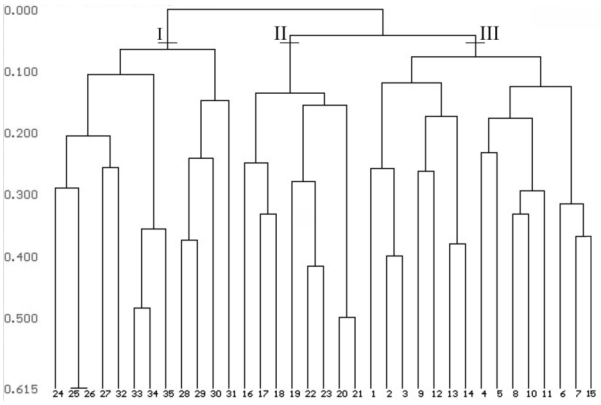

Fig. 8 – Dendrogram from the *Juniperus communis* ssp. *nana* and *Juniperus communis* subsp. *hemisphaerica* shrubs community phytosociological relevés, and published relevés as comparison. (I – *Rhamno alpinae-Juniperetum alpinae* (in Stanisci, 1997); II – *Sorbo ariae-Juniperetum nanae* ass. nova (area study); *Chamaecytiso spinescentis-Arctostaphyletum uvae-ursi* (in Stanisci, 1997).

the supra-oromediterranean bioclimatic belt, and are included in different alliances within the order *Juniperetalia hemisphaericae* (Rivas-Mart. *et al*., 2001; Brullo *et al*., 2001). In the syntaxonomic revision of the class *Junipero sabinae-Pinetea sylvestris* for the central and southern Apennines (Stanisci 1997), three phytosociological relevés were also considered that were carried out in the territory under study, although at altitudes above 1,500 m. These showed *Juniperus communis* subsp. *hemisphaerica* as absent and they were included in the association *Chamaecytiso spinescentis-Arctostaphyletum uva-ursi*, even if this represents a relatively depleted aspect of the association due to the absence of most of the species that are considered to be characteristic and differential for the association, such as: *Chamaecytisus spinescens, Helianthemum glabrum* and *Genista januensis*. To determine the possible similarities and differences between the coenoses that were found here and those described in the literature that are floristically and ecologically most similar, a comparison was carried out between the relevés and the associations *Chamaecytiso spinescentis-Arctostaphyletum uva-ursi* of the alliance *Daphno-Juniperion alpine* and *Rhamno fallacis-Juniperetum alpinae* of the alliance *Berberidion vulgaris*. The dendrogram in Figure 8 separates the coenoses of *Rhamno fallacis-Juniperetum alpinae* Stanisci 1997 of the alliance *Berberidion* (Cluster I) from those of the class *Junipero sabinae-Pinetea sylvestris*, whereby there is clear separation of the coenoses under study (cluster II) from those of the association *Chamaecytiso spinescentis-Arctostaphyletum uva-ursi* (Cluster III). In Table 7, it can be seen that the coenoses under study differ from those of the association *Chamaecytiso spinescentis-Arctostaphyletum uva-ursi* across a large contingent of species, including: *Juniperus communis* subsp. *hemisphaerica, Sorbus aria* subsp. *aria, Ostrya carpinifolia, Rhamnus alpina* subsp. *fallax, Cotoneaster integerrimus, Cytisophyllum sessilifolius,* among others. A new association is therefore proposed here of *Sorbo ariae-Juniperetum nanae* association nova hoc loco (Table 7, rels. 1-8; holotypus rel. 6), for which the characteristic and differential species are: *Juniperus communis* subsp *nana, Juniperus communis*. subsp. *hemisphaerica, Sorbus aria* subsp. *aria, Ostrya carpinifolia, Rhamnus alpina* subsp. *fallax, Cotoneaster integerrimus*, and *Cerastium tomentosum*. Two new subassociations are recognized for this new association: juniperetosum nanae subassociation nova hoc loco (Table 7 - holotypus rel. 6 subassociation typicum) and *cytisophylletosum sessilifolii* subassociation nova hoc loco (Table 7 – rels. 1-4: holotypus rel. 2), for which the differential species are: *Cytisophyllum sessilifolius, Digitalis lutea* subsp. *australis, Cytisus hirsutus* subsp. *polytrichus* which indicates the contact between the juniper shrubbery of *Sorbo ariae-Juniperetum nanae* with the preforestal coenoses of *Berberidion*. The new association *Sorbo ariae-Juniperetum nanae*, which is included in the alliance *Daphno oleoidis-Juniperion*

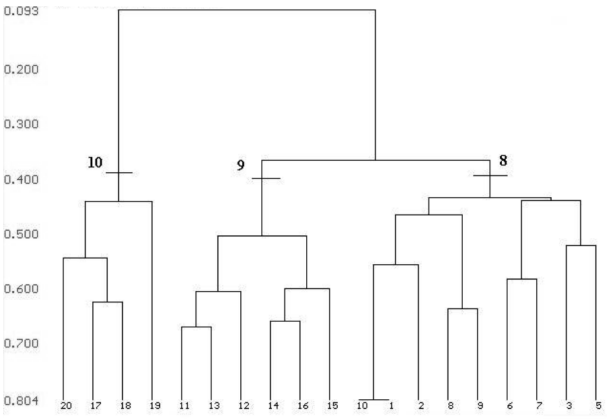

Fig. 9– Dendrogram from the grasslands phytosociological relevés of the study area. (group 8 – *Sesleria nitida* grassland communities; group 9 – *Globularia meridionalis* grassland communities; group 10 – *Arrhenatherum elatius* grassland communities).

alpinae, represents the durable edaphoxerophilous vegetation of the supratemperate bioclimatic belt that is typical of the southern slopes of the calcareous peaks of the Apennines with a sub-Mediterranean and subsubcontinental influence and subjected to continuous morphogenic processes (water run-off), which actually prevent the evolution of the juniper shrubbery to forestal coenoses. This trend can only be effective under the most stable conditions at the edge of the forest coenoses, where the juniper shrubbery of the subassociation *cytisophylletosum sessilifolii* connects with the

coenoses of the alliance *Berberidion*. The new association *Sorbo ariae-Juniperetum nanae*, subassociation *juniperetosum nanae*, can be considered to be the most advanced, although durable, stage of the association *Chamaecytiso spinescentis-Arctostaphyletum uva-ursi*, with a positively chamaephytic habitus and a more pioneering character that grows at higher altitudes.

Grassland communities

In the area under study, the grasslands are exclusively in the eastern sector, on layers of limestone debris. These are used as pasture for the grazing of sheep, with a load calculated for 2010 of 0.27 UBA (unità bestiame adulto; adult livestock units)/ha. The dendrogram obtained from the classification of the phytosociological relevés (Figure 9) identified three types of grassland: grasslands with *Sesleria nitida* (group 8), *Globularia meridionalis* (group 9) and *Arrhenatherum elatius* (group 10).

CERASTIO TOMENTOSI-SESLERIETUM NITIDAE ass. nova hoc loco (holotypus rel. 1)
cerastietosum tomentosi subass. nova hoc loco (holotypus rel. 1 subass. *typicum*)
caricetosum humilis subass. nova hoc loco (holotypus n. 8) (Table 8, group 8).

This is discontinuous xerophilous hemicryptophytic grassland that is often terraced and has a dominance of *Sesleria nitida* (Table 8). It develops on the steep slopes of the peaks and on the superficial limestone debris layers that are subjected to water run-off, and it is found in most of the territory under study, between 1,300 m and 1,600 m a.s.l.. In the highest sectors (above 1,500 m a.s.l.), where the conditions of high edaphic instability join those of cryoturbation, these grasslands typically constitute durable coenoses that are penetrated mainly by rare, small and isolated nuclei of *Juniperus communis* subsp. *nana*, *Arctostaphylos uva-ursi* and *Cytisophyllum sessilifolium*. Below 1,500 m a.s.l., the *S. nitida* grasslands of the new association create a mosaic with the shrub coenoses of *J. communis* subsp. *nana* of the association *Sorbo ariae-Juniperetum nanae*. The connection with the forest vegetation is realized only at the edges of the woods, under more stable conditions from the edaphic point of view. From the phytosociological point of view, these moor grasses under study have floristic analogies with those of the association *Polygalo majoris-Seslerietum nitidae* Biondi, Ballelli, Allegrezza & Zuccarello 1995. This association has been described for the upper supratemperate belt of Campo Imperatore (Biondi *et al*., 1995, 1999) and it was then indicated for some high-mountain sectors of the Sibillini Mountain range and the Marche Apennines, although in an impoverished form (Catorci *et al*. 2008; Catorci & Gatti, 2007). The dendrogram obtained from the comparison of the relevés (Fig. 10) shows the autonomy of the coenoses under study, which are differentiated by the presence of a group of mostly transgressive species of the classes *Thlaspietea rotundifolii* and *Kobresio-Seslerietea coeruleae*, such as: *Cerastium tomentosum, Asperula purpurea* subsp. *purpurea, Bupleurum falcatum* subsp. *cernuum, Arctostaphylos uva-ursi, Epipactis atrorubens, Senecio squalidus* subsp. *squalidus, Sesleria juncifolia* subsp. *juncifolia, Edraianthus graminifolius* subsp. *graminifolius, Lomelosia graminifolia* subsp. *graminifolia, Campanula micrantha, Hieracium tomentosum* subsp. *tomentosum, Leucopoa dimorpha,* among others. Therefore, the new association *Cerastio tomentosi-Seslerietum nitidae* association nova hoc loco (Table 8, holotypus rel. 1) is recognized, for which the characteristic and differential species are: *Sesleria nitida*, *Cerastium tomentosum, Asperula purpurea* subsp. *purpurea, Bupleurum falcatum* subsp. *cernuum, Sesleria juncifolia* subsp. *juncifolia, Campanula micrantha, Laserpitium siler* subsp. *siculum, Euphrasia italica, Linum tenuifolium, Epipactis atrorubens, Hieracium tomentosum* subsp. *tomentosum, Leucopoa dimorpha, Edraianthus graminifolius* subsp. *graminifolius* and *Senecio squalidus* subsp. *squalidus*. For the new association *Cerastio tomentosi-Seslerietum nitidae*, two new subassociations are described: *cerastietosum tomentosi* subassociation nova hoc loco (Table 8, holotupus rel. 1, of subassociation typicum) and *caricetosum humilis* subassociation nova hoc loco (Table 8, rels. 6-9: holotupus rel. 8). These are differentiated by: *Brachypodium rupestre, Anthyllis vulneraria* subsp. *pulchella, Cota triumfettii* and *Carex humilis*, and can be found in the lower sectors (below 1500 m a.s.l.) in contact with the garrigues of *Globularia meridionalis* of the association *Gentiano dinaricae-Globula-*

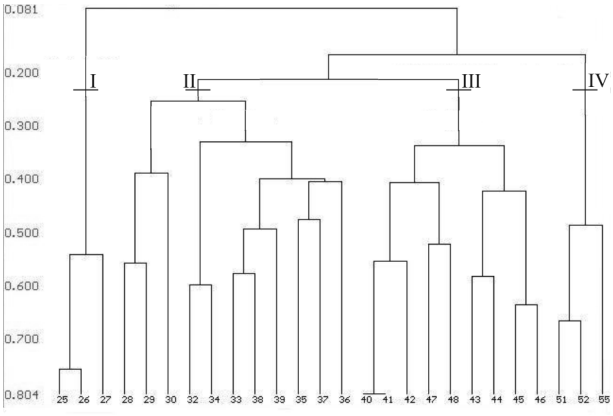

Fig. 10 - Dendrogram from the *Sesleria nitida* grassland community phytosociological relevés, and published relevés as comparison. (I – *Seslerio nitidae-Brometum erecti* (from Allegrezza, 2003); II - *Polygalo majoris-Seslerietum nitidae* (from Catorci et al., 2010 and from Biondi et al., 1999); *Cerastio tomentosi-Seslerietum nitidae* ass. nova (area study); *Astragalo sempervirentis-Seslerietum nitidae* (from Biondi & Ballelli, 1995).

Tab. 8 - *Cerastio tomentosi-Seslerietum nitidae* ass. nova hoc loco (holotypus rel. 1) *cerastietosum tomentosi* subass. nova hoc loco (holotypus rel. 1 subass. *typicum*), *caricetosum humilis* subass. nova hoc loco (holotypus n. 8).

	Relevé number	1*	2	3	4	5	6	7	8°	9
	Relevé number from dendrogram Fig. 10	10	1	2	6	7	8	9	3	5
	Cluster	8	8	8	8	8	8	8	8	8
	Altitude (m a.s.l.)	1550	1570	1560	1525	1535	1480	1490	1480	1490
Chorotype	Aspect	S	S	S	S	S	S	S	SE	SE
	Slope (°)	38	37	40	35	40	45	40	30	40
	Coverage (%)	60	65	70	70	85	75	65	70	80
	Area (m^2)	100	90	90	100	90	80	90	80	90
	Number of species x relevé	43	44	45	45	30	36	32	64	46
	Charact. and diff. species of the ass.									
ENDEM.	Sesleria nitida Ten. (*s.l.*)	3.3	3.3	2.3	4.4	3.3	3.4	4.4	3.3	3.4
ENDEM.	Cerastium tomentosum L.	+.2	+.2	+	+.2	+	+	+.2	+.2	+.2
SE EUROP.	Asperula purpurea (L.) Ehrend. subsp. purpurea	1.2	1.2	+.2	2.2	1.1	1.1	1.2	1.2	1.2
S EUROP. MONT.	Bupleurum falcatum L. subsp. cernuum (Ten.) Arcang.	+	+	+	+	.	.	.	+	+
MEDIT.	Linum tenuifolium L.	+	+	+.2	+	.	.	.	+	.
ILLIR.-APENN.	Sesleria juncifolia Suffren subsp. juncifolia	1.2	1.2	2.3	.	1.2	+.2	.	.	.
ENDEM.	Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti *et* Gubellini	+.2	+.2	+	+	.	+.2	.	.	.
ENDEM.	Campanula micrantha Bertol.	+	+	.	+	+	.	.	+	.
EURASIAT.	Epipactis atrorubens (Hoffm. *ex* Bernh.) Besser	+.2	.	+	.	.	.	.	+	+
ENDEM.	Edraianthus graminifolius (L.) A. DC. subsp. graminifolius	+	+	+	.	.	.	.	+.2	.
ENDEM.	Euphrasia italica Wettst.	+	.	.	+	+	+	.	.	.
S EUROP. MONT.	Lomelosia graminifolia (L.) Greuter *et* Burdet subsp. graminifolia	+	+	+	.	.	.	.	.	.
W ALP.-APENN.	Hieracium tomentosum L. subsp. tomentosum	+.2	+.2	+	.	.	.	.	.	.
ENDEM.	Leucopoa dimorpha (Guss.) H. Scholz *et* Foggi	+.2	+.2	.	.	.	.	.	.	.
SE EUROP. MONT.	Senecio squalidus L. subsp. squalidus	.	.	.	1.1	+.2	.	.	.	.
	Diff. species of the *caricetosum humilis* subass.									
EUROP.	Brachypodium rupestre (Host) Roem. *et* Schult.	.	.	+.2	+	+	+	.	+	+.2
SE EUROP.	Anthyllis vulneraria L. subsp. pulchella (Vis.) Bornm.	.	.	.	.	.	2.2	1.1	+	+
EURASIAT.	Carex humilis Leyss.	.	.	.	.	.	+.2	+.2	+	.
S EUROP.-W ASIAT.	Cota triumfettii (L.) J. Gay	.	.	.	.	.	.	+	+	+
	Charact. and diff. species of the *Phleo ambigui-Bromion erecti* all. and *Brachypodenion genuensis* suball.									
SUBENDEM.	Carex macrolepis DC.	2.2	+.2	+.2	.	+	1.2	2.2	1.2	+.2
ILLIR.-APENN.	Globularia meridionalis (Podp.) O. Schwarz	+.2	+.2	+.2	+.3	2.2	2.3	1.2	2.1	+.2
MEDIT.	Helianthemum oelandicum (L.) Dum. Cours. subsp. incanum (L.) G. López	2.3	2.3	1.2	2.3	2.3	1.2	1.2	1.2	1.2
S EUROP.	Teucrium montanum L.	1.2	1.2	+.2	+.2	1.2	1.1	+.2	+	+.2
ENDEM.	Avenula praetutiana (Parl. *ex* Arcang.) Pignatti	1.2	1.1	.	+.2	1.1	1.2	.	1.2	+.2
MEDIT. MONT.	Dianthus sylvestris Wulfen subsp. longicaulis (Ten.) Greuter *et* Burdet	+	+	+	+.2	+	.	1.1	.	.
S EUROP. MONT.	Carlina acaulis L. subsp. caulescens (Lam.) Schübl. *et* G. Martens	+	+	.	+	+.2	.	.	+	+
MEDIT.	Eryngium amethystinum L.	.	1.1	.	+.2	.	+	+	+.2	+
S EUROP. MONT.	Paronychia kapela (Hacq.) A. Kern. subsp. kapela	.	.	.	+.2	+.2	+.2	.	+.2	+.2
ENDEM.	Centaurea ambigua Guss. (*s.l.*)	+	+	.	.	.	1.2	1.1	+	.
MEDIT.	Allium sphaerocephalon L.	+	+	.	.	.	+	+	+	.
MEDIT.	Alyssum montanum L. subsp. montanum	+.2	+.2	.	.	.	+.2	+	+.2	.
ENDEM.	Phleum hirsutum Honck. subsp ambiguum (Ten.) Tzvelev	.	.	+.2	+	.	+.2	.	+.2	.
ENDEM.	Silene notarisii Ces.	.	.	+	.	.	.	.	+	+
SE EUR.-SW ASIAT.	Polygala major Jacq.	+.2	+.2	+.2	.	.	.	.	.	+
EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	+.2	+.2	.	.	.	.	.	.	+.2
SW EUROP. MONT.	Knautia purpurea (Vill.) Borbás	.	.	.	+	.	+	.	+	.
W ALP.-APENN.	Cerastium arvense L. subsp. suffruticosum (L.) Ces.	.	.	.	.	.	1.2	1.1	.	.
ENDEM.	Dianthus brachycalyx Huet *ex* Bacch., Brullo, Casti *et* Giusso	.	.	.	.	.	.	.	+	+.2
EURIMEDIT.	Festuca circummediterranea Patzke	+.2	+	.	.	.	.	.	.	.
MEDIT.	Helianthemum apenninum (L.) Mill. subsp. apenninum	.	.	+	.	.	.	.	+.2	.
E ALP.-APENN.	Stachys recta L. subsp. grandiflora (Caruel) Arcang.	.	.	.	.	.	.	+	+	.
S EUROP.	Arabis collina Ten.	.	.	.	+	.	.	.	.	.
S EUROP. MONT.	Acinos alpinus (L.) Moench subsp. alpinus	.	.	.	.	.	.	.	+	.
ENDEM.	Erysimum pseudorhaeticum Polatschek	.	.	.	.	.	.	.	+	.
S EUROP.	Galium corrudifolium Vill.	.	.	.	.	.	.	.	+.2	.
SE EUROP. MONT.	Minuartia verna (L.) Hiern subsp. collina (Neilr.) Domin	.	.	.	.	.	.	.	+	.
S EUROP. MONT.	Silene ciliata Pourr. subsp. graefferi (Guss.) Nyman	.	.	.	.	.	.	+	.	.
MEDIT. MONT.	Trifolium montanum L. subsp. rupestre (Ten.) Nyman	.	.	.	.	.	.	.	.	+
	Charact. and diff. species of the *Scorzonero-Chrysopogonetalia* ord. and *Festuco-Brometea* class									
EUROP.	Bromopsis erecta (Huds.) Fourr. subsp. erecta	1.2	1.2	+.2	+.2	+.2	+.2	1.2	+.2	+.2
MEDIT.	Coronilla minima L. subsp. minima	1.2	1.2	+.2	1.1	+.2	+.2	1.1	+.2	+.2

MEDIT.	Teucrium chamaedrys L. subsp. chamaedrys	+.2	+.2	+	+.2	1.2	+	+.2	+.2	.	8
EUROP.	Euphorbia cyparissias L.	+	+	+	+.2	.	.	+	+	+	7
EUROSIB.	Pilosella officinarum Vaill.	+.2	+.2	+	+.2	+.2	.	.	+	.	6
EUROP.	Asperula cynanchica L.	+	+	.	+	.	.	+	+	.	5
S EUROP.	Thymus longicaulis C. Presl subsp. longicaulis	.	1.2	+.2	+.2	.	+.2	.	+	.	5
EUROSIB.	Gymnadenia conopsea (L.) R. Br.	+	+	+	.	.	.	.	+	+	5
EUROP.	Hippocrepis comosa L. subsp. comosa	+.2	+.2	+.2	.	.	.	.	+.2	+	5
S EUROP.	Leontodon crispus Vill. subsp. crispus	1.1	1.1	+	.	.	.	.	+	.	4
EUROP.	Dactylorhiza sambucina (L.) Soó	.	+.2	.	.	.	.	.	+	.	2
S EUROP. MONT.	Plantago argentea Chaix subsp. argentea	.	.	+	.	.	.	.	+	.	2
S EUROP. MONT.	Thymus glabrescens Willd. cfr subsp. decipiens (Heinr. Braun) Domin	1.2	.	.	.	+.2	.	.	.	.	2
EURASIAT.	Campanula glomerata L.	.	.	.	+.2	.	.	.	.	+	2
MEDIT.	Urospermum dalechampii (L.) F.W. Schmidt	.	.	.	+.2	+.2	.	.	.	.	2
W EUROP.-MEDIT.	Anacamptis pyramidalis (L.) Rich.	.	.	.	.	.	.	.	+	+	2
EUROP.-W ASIAT.	Helianthemum nummularium (L.) Mill. subsp. obscurum (Celak.) Holub	.	.	.	.	.	.	.	+	+	2
EURASIAT.	Orobanche caryophyllacea Sm.	.	.	.	+	+	.	.	.	.	2
S EUROP.	Orobanche gracilis Sm.	.	.	.	.	.	.	.	+	+	2
MEDIT. MONT.	Nepeta nepetella L. subsp. nepetella	.	.	.	.	.	.	.	+	.	1
EUROP.	Avenula pratensis (L.) Dumort.	.	.	+	.	.	.	.	.	.	1
EUROSIB.	Euphrasia stricta D. Wolff *ex* J.F. Lehm.	.	+	.	.	.	.	.	.	.	1
EUROP.	Orchis mascula (L.) L. subsp. mascula	.	.	.	+	.	.	.	.	.	1
EUROP.	Orchis morio L.	.	.	.	.	.	+	.	.	.	1
S EUROP. MONT.	Linum viscosum L.	.	.	.	.	.	.	.	+	.	1
MEDIT.	Polygala nicaeensis W.D.J. Koch subsp. mediterranea Chodat	.	.	.	.	.	.	.	+	.	1
EUROSIB.	Orchis ustulata L.	.	.	.	.	.	.	.	.	+	1
	Others species										
EURASIAT.	Echinops sphaerocephalus L. subsp. sphaerocephalus	.	.	+	1.1	+	+	+	+	+	7
SE-EUROP. MONT.	Gentiana dinarica Beck	+.3	+.3	+.2	+	+.3	.	.	+.2	+.2	7
MEDIT. MONT.	Anthyllis montana L. subsp. atropurpurea (Vuk.) Pignatti	.	.	+	+	+	+.2	+.2	+.2	+.2	7
EUROSIB.-N AMER.	Arctostaphylos uva-ursi (L.) Spreng.	+.2	+.2	+.2	+.2	.	+.2	.	.	+.2	6
S EUROP. MONT.	Biscutella laevigata L. subsp. laevigata	+	+	+	.	.	.	+	+.2	+	6
MEDIT.	Cytisophyllum sessilifolium (L.) O. Lange	.	+.2	+	+.2	.	.	+.2	.	+	5
EUROP.	Sedum rupestre L. subsp. rupestre	.	.	.	+.2	.	+.2	+	+	+	5
EUROSIB.-N AMER.	Juniperus communis L. subsp. nana Syme	+.2	+.2	+	.	+.2	.	.	.	.	4
EURASIAT.-AFR.	Lotus corniculatus L. subsp. corniculatus	.	+	.	.	.	.	.	+	+	3
ENDEM.	Digitalis lutea L. subsp. australis (Ten.) Arcang.	.	.	+	+	.	.	.	+	.	3
MEDIT. MONT.	Juniperus communis L. subsp. hemisphaerica (J. Presl *et* C. Presl) Nyman	.	.	.	+.2	+	1.2	.	.	.	3
EUROSIB.	Cytisus hirsutus L. subsp. polytrichus (M. Bieb.) Hayek	+.2	.	+	.	.	.	.	.	+	3
	Accidental species	1	1	4	5	2	2	2	7	6	

rietum meridionalis, and with the juniper shrubberies of the association *Sorbo ariae-Juniperetum nanae*. The new association is included in the alliance *Phleo ambigui-Bromion erecti*, suballiance *Brachypodenion genuensis*, and expresses the xerophilous durable and edaphophilic character of the moor grasses of the southern slopes of the limestone peaks of the upper supratemperate belt under conditions of high edaphic instability. This takes up an ecological meaning similar to that of the association *Carici macrolepis-Seslerietum apenninae* that has been described for the summit sectors (average altitudes of 1150 m a.s.l.) of the Mount Cucco mountain group in the Umbria-Marche Apennines (Biondi *et al*., 2004).

GENTIANO DINARICAE-GLOBULARIETUM MERIDIONALIS ass. nova hoc loco (rels. 1-6: holotypus rel. 1)
globularietosum meridionalis subass. nova hoc loco (holotypus rel. 1 subass. *typicum*)
seslerietosum nitidae subass. nova hoc loco (rels. 4-6: holotypus rel. 4) (Table 9, group 9).

This pioneer, discontinuous, xerophilous, chamaephytic vegetation with a dominance of the globe daisy

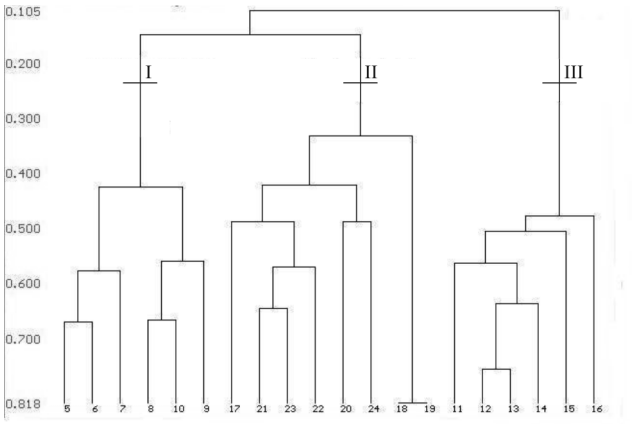

Fig. 11 - Dendrogram from the *Globularia meridionalis* grassland community phytosociological relevés, and published relevés as comparison. (I – *Gentiano dinaricae-Globularietum meridionalis* ass. nova (area study); II – *Plantago holostei-Helianthemetum cani* (from Biondi & Ballelli, 1995); III – *Potentillo cinereae-Brometum erecti* (from Biondi *et al*., 2004).

Tab. 9 - *Gentiano dinaricae-Globularietum meridionalis* ass. nova hoc loco (rels. 1-6: holotypus rel. 1) subass. *globularietosum meridionalis* subass. nova hoc loco (holotypus rel. 1 subass. *typicum*), subass. *seslerietosum nitidae* subass. nova (rels. 4-6: holo typus rel. 4).

	Relevé number	1*	2	3	4°	5	6	
	Relevé number from dendrogram Fig. 10	11	13	12	14	15	16	
	Cluster	9	9	9	9	9	9	
Chorotype	Altitude (m a.s.l.)	1480	1480	1480	1405	1420	1455	Presences
	Aspect	S	S	S	S	S	S	
	Slope (°)	30	15	30	35	35	30	
	Coverage (%)	80	60	70	70	70	70	
	Area (m^2)	40	50	60	60	80	60	
	Number of species x relevé	36	41	44	29	33	28	
	Diff. species of the ass.							
ILLIR.-APENN.	Globularia meridionalis (Podp.) O. Schwarz	4.4	3.4	3.3	4.4	4.4	3.4	6
MEDIT.	Coronilla minima L. subsp. minima	+.2	+.2	+.2	+.2	+.2	1.2	6
SUBENDEM.	Carex macrolepis DC.	1.1	1.2	1.2	1.2	1.2	2.2	6
SE-EUROP. MONT.	Gentiana dinarica Beck	+.3	+.2	+	+.3	.	+.2	5
SE EUROP.	Asperula purpurea (L.) Ehrend. subsp. purpurea	+.2	+.2	.	1.2	3.3	2.2	5
S EUR.-SW ASIAT.	Fumana procumbens (Dunal) Gren. *et* Godr.	+.2	+.2	+.2	1.1	.	.	4
ENDEM.	Festuca inops De Not.	+.2		+.2	1.2	1.1	.	4
S EUROP. MONT.	Biscutella laevigata L. subsp. laevigata	+.2	+.2	+	.	.	.	3
MEDIT.	Ononis pusilla L. subsp. pusilla	+.2	+	+	.	.	.	3
	Diff. species of the *seslerietosum nitidae* subass.							
ENDEM.	Sesleria nitida Ten. (*s.l.*)	.	.	.	1.2	1.1	1.2	3
ENDEM.	Cerastium tomentosum L.	.	.	.	+.2	+.2	.	2
	Charact. and diff. species of the *Phleo ambigui-Bromion erecti* all. and *Brachypodenion genuensis* suball.							
S EUROP.	Teucrium montanum L.	2.2	1.2	2.2	+.3	2.2	1.2	6
MEDIT.	Helianthemum oelandicum (L.) Dum. Cours. subsp. incanum (L.) G. López	2.3	2.2	2.3	2.3	2.2	2.2	6
ENDEM.	Centaurea ambigua Guss. (*s.l.*)	+	+	+	+	+	1.1	6
MEDIT. MONT.	Dianthus sylvestris Wulfen subsp. longicaulis (Ten.) Greuter et Burdet	+.2	+	+	1.1	1.1	1.2	6
MEDIT.	Eryngium amethystinum L.	+	+	+	+	1.1	+	6
ENDEM.	Avenula praetutiana (Parl. *ex* Arcang.) Pignatti	1.1	.	+	+.2	1.2	+.2	5
S EUROP. MONT.	Paronychia kapela (Hacq.) A. Kern. subsp. kapela	1.2	+.3	.	1.2	+.2	+.2	5
ENDEM.	Koeleria splendens C. Presl subsp. grandiflora (Bertol. ex Schultes) Domin	+.2	+	.	1.1	1.1	.	4
S EUROP.	Galium corrudifolium Vill.	1.1	1.1	+	.	.	.	3
OROF. SW-EUROP.	Festuca laevigata Gaudin subsp. laevigata	1.1	+.2	1.2	.	.	.	3
SE EUROP. MONT.	Minuartia verna (L.) Hiern subsp. collina (Neilr.) Domin	.	+	+	.	+.2	.	3
S EUROP. MONT.	Carlina acaulis L. subsp. caulescens (Lam.) Schübl. *et* G. Martens	+	.	.	+.2	+.2	.	3
SW EUROP. MONT.	Knautia purpurea (Vill.) Borbás	.	+	.	.	+.2	.	2
MEDIT.	Linum tenuifolium L.	.	+	+.2	.	.	.	2
ENDEM.	Phleum hirsutum Honck. subsp ambiguum (Ten.) Tzvelev	.	.	+.2	.	+.2	.	2
MEDIT.	Helianthemum apenninum (L.) Mill. subsp. apenninum	.	.	+.2	.	.	.	1
SE EUR.-SW ASIAT.	Polygala major Jacq.	.	.	+.2	.	.	.	1
MEDIT. MONT.	Trifolium montanum L. subsp. rupestre (Ten.) Nyman	.	.	+.2	.	.	.	1
ENDEM.	Anthemis cretica L. subsp. columnae (Ten.) Franzèn	.	.	+	.	.	.	1
SE EUROP. MONT.	Trinia glauca (L.) Dumort. cfr subsp. carniolica (A. Kern. ex Janh.) H. Wolff	.	.	+	.	.	.	1
S EUROP.-W ASIAT.	Cota triumfettii (L.) J. Gay	.	.	.	.	+	.	1
MEDIT.	Alyssum montanum L. subsp. montanum	.	.	.	.	.	+.2	1
ENDEM.	Silene notarisii Ces.	.	+	.	.	.	.	1
S EUROP.	Arabis collina Ten.	.	.	.	.	+	.	1
	Charact. species of the *Scorzonero-Chrysopogonetalia* ord. and *Festuco-Brometea* class							
EUROP.	Bromopsis erecta (Huds.) Fourr. subsp. erecta	+.2	1.1	1.1	+.2	1.1	+.2	6
MEDIT.	Plantago holosteum Scop.	1.1	+.2	1.1	+.2	+.2	1.2	6
EUROP.	Brachypodium rupestre (Host) Roem. *et* Schult.	.	+.2	+.2	+	+	+	5
EUROSIB.	Pilosella officinarum Vaill.	+.2	+	+	.	+.2	+	5
EUROP.	Asperula cynanchica L.	1.1	+	.	1.1	.	+.2	4
MEDIT.	Teucrium chamaedrys L. subsp. chamaedrys	+.2	+.2	.	+.2	2.2	.	4
S EUROP.	Thymus longicaulis C. Presl subsp. longicaulis	1.1	+.2	1.2	.	+.2	.	4
S EUROP.	Leontodon crispus Vill. subsp. crispus	+.2	+	+	.	.	.	3
SE EUROP.	Anthyllis vulneraria L. subsp. pulchella (Vis.) Bornm.	.	.	+	+.2	.	+	3
EUROP.-W ASIAT.	Linum catharticum L. subsp. catharticum	+	+	.	.	.	.	2
EUROP.	Hippocrepis comosa L. subsp. comosa	+.2	.	+.2	.	.	.	2
EUROP.-W ASIAT.	Helianthemum nummularium (L.) Mill. subsp. obscurum (Celak.) Holub	+.2	.	.	.	+.2	.	2
EURASIAT.	Carex caryophyllea Latourr.	.	1.1	1.2	.	.	.	2
EUROSIB.	Gymnadenia conopsea (L.) R. Br.	.	+.2	+	.	.	.	2
EUROSIB.	Euphrasia stricta D. Wolff *ex* J.F. Lehm.	+.2	.	.	.	.	.	1
EUROP.	Avenula pratensis (L.) Dumort.	.	+.2	.	.	.	.	1

SW EUROP. MONT.	Anthyllis vulneraria L. subsp. vulnerarioides (All.) Arcang.	.	.	+	.	.	.	1
EUROP.	Dactylorhiza sambucina (L.) Soó	.	.	+	.	.	.	1
S EUROP.	Orobanche gracilis Sm.	.	.	+	.	.	.	1
S EUROP. MONT.	Armeria canescens (Host) Ebel	.	.	.	.	+.2	.	1
S EUROP. MONT.	Thymus glabrescens Willd. cfr subsp. decipiens (Heinr. Braun) Domin	.	.	.	+.2	.	.	1
	Other species							
MEDIT. MONT.	Anthyllis montana L. subsp. atropurpurea (Vuk.) Pignatti	1.2	1.2	1.2	2.3	+.2	1.2	6
ENDEM.	Edraianthus graminifolius (L.) A. DC. subsp. graminifolius	+	+	+.2	.	.	.	3
EURASIAT.	Echinops sphaerocephalus L. subsp. sphaerocephalus	+	+	.	.	.	+	3
EUROSIB:-N AMER.	Poa alpina L. subsp. alpina	+.2	.	.	+.2	1.1	.	3
SE-EUROP. MONT.	Trinia dalechampii (Ten.) Janch.	1.1	+	.	.	.	.	2
S EUROP. MONT.	Androsace villosa L. subsp. villosa	.	1.2	+.2	.	.	.	2
ILLIR.-APENN.	Sesleria juncifolia Suffren subsp. juncifolia	.	.	+.2	+.2	.	.	2
EUROSIB.-N AMER.	Juniperus communis L. subsp. nana Syme	.	+	+	.	.	.	2
SE EUROP. MONT.	Pinus nigra Arnold subsp. nigra	.	+	.	.	.	1.1	2
MEDIT. MONT.	Juniperus communis L. subsp. hemisphaerica (J. Presl *et* C. Presl) Nyman	.	.	.	+.3	.	1.1	2
	Accidental species	0	1	2	0	2	4	

Globularia meridionalis (Table 9) can be found on the slopes, where there are accumulations of medium-fine limestone debris with a clay matrix, under conditions where the water run-off is partially stable, on thin soil that is also compacted by the trampling of grazing cattle. This vegetation is often in a mosaic with the juniper shrubberies of the association *Sorbo ariae-Juniperetum nanae*. The large contingent of chamaephytes gives the community under study the appearance of a real mountain garrigue. From the syntaxonomic point of view, this coenosis shows floristic and structural similarities with the association *Plantago holostei-Helianthemetum cani* Biondi, Ballelli, Allegrezza, Frattaroli & Taffetani 1992 nom. invers. prop. Biondi & Ballelli 1995, which has been described for the upper supratemperate belt of Campo Imperatore (Biondi *et al*., 1992). It was then described for the summit sectors of Mount Coscerno in the Umbria-Marche Apennines, where the association is redefined in terms of its characteristic and differential species (Biondi & Ballelli, 1995). The comparison of the relevés (Figure 11) shows the autonomy of the garrigue with *Globularia meridionalis* which was studied for the presence of a contingent of species that contributes to the originality of the floristic combination, which includes: *Coronilla minima* subsp. *minima, Carex macrolepis, Gentiana dinarica, Asperula purpurea* subsp. *purpurea, Festuca inops, Biscutella laevigata* subsp. *laevigata, Fumana procumbens*, and *Ononis pusilla* subsp. *pupilla*, among others. Therefore, the new association *Gentiano dinaricae-Globularietum meridionalis* association nova hoc loco (Table 9, holotypus rel. 1) is proposed here, within the alliance *Phleo ambigui-Bromion erecti*, suballiance *Brachypodenion genuensis*, for which the characteristic and differential species are: *Globularia meridionalis, Coronilla minima* subsp. *minima, Carex macrolepis, Gentiana dinarica, Asperula purpurea* subsp. *purpurea, Festuca inops, Biscutella laevigata* subsp. *laevigata, Fumana procumbens, Ononis pusilla* subsp. *pusilla*. This describes the edaphophilic pioneer chamaephytic garrigue of the southern slopes of the upper supratemperate bioclimatic belt, on loose substrate that is partially consolidated by a clay matrix and is subjected to water run-off. This is in chain contact with the coenoses of the class *Kobresio-Seslerietea coeruleae*, and in dynamic connection with the juniper shrubberies of the association *Sorbo ariae-Juniperetum nanae*. Within this new association, there are also two new sub-associations: *globularietosum meridionalis* subassociation nova hoc loco (Table 9, holotypus rel. 1; subassociation *typicum*) and *seslerietosum nitidae* subassociation nova hoc loco (Table 9, rels. 3-6: holotypus rel. 4). The *seslerietosum nitidae* subassociation is differentiated by *Sesleria nitida* (s.l.) and *Cerastium tomentosum*, which for the positions with greater instability, indicates the connection between the mountain garrigue and the moor grasses of the new association *Cerastio tomentosi-Seslerietum nitidae*.

FESTUCO CIRCUMMEDITERRANEAE-ARRHENATHERETUM ELATIORIS Allegrezza 2003 (rels. 4, 5) *Bromopsis erecta* variant (rels. 1, 2), facies a *Eryngium amethystinum* (rels. 1-4) (Table 10, group 10).

The continuous hemicryptophitic grasslands with a dominance of *Arrhenatherum elatius* (Table 10) are found for subplain morphologies, or for those that are slightly concave, at the bottom of the valleys, on well developed and deep soil. The great proliferation of thorny species that characterizes the coenosis under study is a result of the excessive load and its prolonged use for livestock, which has resulted in its drying up and the deterioration of the coenosis, with the risk of losing this reference habitat. These false oat-grass grasslands are extremely rare for the Apennine limestone ridges (Pedrotti, 1976; Allegrezza 2003; De Sillo *et al*., 2012), where the single association *Festuco circummediterraneae-Arrhenatheretum elatioris* Allegrezza 2003 is currently indicated. This was described for the ridge of Mount San Vicino in the Marche Apen-

nines (Allegrezza, 2003), subsequently recognized in other relevés of the central Apennines, and recently included in the Apennine alliance *Ranuncolo neapolitani-Arrhenatherion elatioris* (Allegrezza & Biondi, 2011). Based on the floristic comparison, the false oat-grass grasslands in the area under study can be related to the association *Festuco circummediterraneae-Arrhenatheretum elatioris*, for which the characteristics and differential species are: *Festuca circummediterranea, Onobrychis viciifolia* and *Centaurea scabiosa* subsp. *scabiosa* here present in the facies with *Eryngium amethystinum*. These facies with *Eryngium amethystinum* are differentiated by *Eryngium amethystinum, Echinops sphaerocephalon* and *Cynosurus echinatus*, which indicate the disturbance to which the grassland has been subjected, which has been accompanied by its drying up, as shown by the strong contingent of species of the class *Festuco-Brometea*. In particular, *Cynosurus echinatus* is a species that frequently forms the facies in the Apennine montane grasslands often determined by the effects of the fungal mycelia (Bonanomi *et al*., 2012).

Floristic evidence

During the surveying, species that are either rare or of biogeographic interest were found, such as: *Asarum europaeum* L., *Moneses uniflora* (L.) A. Gray, *Centranthus angustifolius* (Mill.) DC. subsp. *angustifolius, Goodyera repens* (L.) R. Br., *Gypsophila repens* L., *Astragalus danicus* Retz, *Astragalus vesicarius* L. subsp. *vesicarius, Juniperus communis* L. subsp. *hemisphaerica* (J. Presl & C. Presl) Nyman. The Sibillini Mountain range is a major biogeographic hub; here, *Goodyera repens* reaches its southern distribution limit, *Gypsophila repens* reaches its south-eastern distribution limit, *Astragalus danicus* reaches its north-eastern distribution limit, and finally, *Juniperus communis* subsp. *hemisphaerica* reaches its northern distribution limit for the Apennines, and is also described for the first time in the Marche region. Among the rare species that were found, *Moneses uniflora* deserves a mention, as it is present in the Marche region exclusively in the Sibillini Mountain range, and it has been indicated in this area only one other time before the present study (Taffetani *et al*. 2004).

According to the Italian interpretation manual of the 92/43/EEC Habitats Directive (Biondi *et al*., 2009), four habitats in the area under study are recognized to be of European Community interest and to include five of the associations that have been found, as indicated in parentheses: 9210 * "Apennine beech forests with Taxus and Ilex" (*Lathyro veneti-Fagetum sylvaticae*); 4060 "Alpi-

Tab. 10 - *Festuco circummediterraneae- Arrhenatheretum elatioris* Allegrezza 2003 (rels. 4, 5) *Bromopsis erecta* variant (rels. 1, 2), facies a *Eryngium amethystinum* (rels. 1-4).

	Relevé number	1	2	3	4	
	Relevé number from dendrogram Fig. 10	20	17	18	19	
	Cluster	10	10	10	10	
Chorotype	Altitude (m a.s.l.)	1450	1430	1430	1420	
	Aspect	ESE	E	E	E	
	Slope (°)	10	10	3	3	
	Coverage %	150	100	100	100	
	Area (m^2)	100	150	100	100	
	Number of species x relevé.	31	54	41	24	
	Charact. and diff. species of the *Festuco circummediterraneae-Arrhenatheretum elatioris* ass. and the *Ranunculo neapolitani-Arrhenatherion elatioris* all.					
EUROP.-W ASIAT.	Arrhenatherum elatius (L.) P. Beauv. *ex* J. *et* C. Presl subsp. elatius	+.2	1.2	4.4	5.5	4
MEDIT.	Ranunculus neapolitanus Ten.	+	+	+	+.2	4
SE EUROP.	Onobrychis viciifolia Scop.	+	+	+	.	3
EUROSIB.	Achillea millefolium L. subsp. millefolium	.	1.2	+.2	1.1	3
EURASIAT.	Centaurea scabiosa L. subsp. scabiosa	.	.	+	.	1
MEDIT.	Festuca circummediterranea Patzke	.	.	.	+.2	1
	Diff. species of *Bromopsis erecta* variant					
EUROP.	Bromopsis erecta (Huds.) Fourr. subsp. erecta	1.1	2.2	.	.	2
EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	2.2	2.2		.	2
MEDIT.	Helianthemum apenninum (L.) Mill. subsp. apenninum	+.2	+.2	.	.	2
ENDEM.	Koeleria splendens C. Presl subsp. grandiflora (Bertol. *ex* Schultes) Domin	.	+	.	.	1
	Diff. species of *Eryngium amethystinum* facies					
MEDIT.	Eryngium amethystinum L.	4.2	4.2	3.2	2.1	4
EURASIAT.	Echinops sphaerocephalus L. subsp. sphaerocephalus	1.1	1.1	1.1	+	4
MEDIT.	Cynosurus echinatus L.	2.2	2.2	1.1	1.1	4
	Charact. species of the *Arrhenatheretalia* ord. and the *Molinio-Arrhenatheretea* class					
EUROSIB.	Trifolium repens L. subsp. repens	+	+.2	+	+	4
EURASIAT.	Bromus hordeaceus L. subsp. hordeaceus	2.2	2.2	1.1	2.2	4
EURASIAT.	Poa pratensis L.	.	2.3	2.2	4.4	3
EURASIAT.	Dactylis glomerata L. subsp. glomerata	+.2	+.2	+.2	.	3
EUROSIB.	Trifolium pratense L. subsp. pratense	.	1.1	+	+.2	3
EURASIAT.-AFR.	Lotus corniculatus L. subsp. corniculatus	.	1.1	1.1	+	3
EURASIAT.	Plantago lanceolata L.	.	+	+	+	3
EURASIAT.	Cynosurus cristatus L.	+	1.1	.	.	2
EURASIAT.	Lolium perenne L.	.	+.2	.	+.2	2
SE EUR.-W ASIAT.	Inula hirta L.	.	.	+	.	1
EUROP.	Phleum pratense L.	.	.	.	+.2	1
	Charact. species of the *Festuco-Brometea* class					
SE EUROP.	Asperula purpurea (L.) Ehrend. subsp. purpurea	1.2	2.3	+.2	+.2	4
ENDEM.	Phleum hirsutum Honck. subsp ambiguum (Ten.) Tzvelev	1.2	+.2	+.2	+.2	4
OROF. SW-EUR.	Festuca laevigata Gaudin subsp. laevigata	1.2	2.2	1.2	+.2	4
W ALP.-APENN.	Cerastium arvense L. subsp. suffruticosum (L.) Ces.	+.2	+.2	+.2	+.2	4
S EUROP.	Galium corrudifolium Vill.	.	2.2	+.2	+	3
S EUROP. MONT.	Armeria canescens (Host) Ebel	+	1.1	+	.	3
EUROP.-W ASIAT.	Helianthemum nummularium (L.) Mill. subsp. obscurum (Celak.) Holub	1.1	+.2	+	.	3
SUBCOSMOPOL.	Sanguisorba minor Scop. subsp. balearica (Bourg. *ex* Nyman) Muñoz Garm. *et* C. Navarro	+	+	+.2	.	3
MEDIT. MONT.	Trifolium montanum L. subsp. rupestre (Ten.) Nyman	+	.	+	.	2
MEDIT.	Ononis pusilla L. subsp. pusilla	+	+	.	.	2
MEDIT. MONT.	Dianthus sylvestris Wulfen subsp. longicaulis (Ten.) Greuter *et* Burdet	.	+	+	.	2
ENDEM.	Centaurea ambigua Guss. (*s.l.*)	.	+	+	.	2
S EUROP.	Thymus longicaulis C. Presl subsp. longicaulis	.	+.2	+.2	.	2
EUROSIB.	Pilosella officinarum Vaill.	.	+.2	+.2	.	2
EUROP.	Asperula cynanchica L.	.	+	+	.	2
EUROP.	Euphorbia cyparissias L.	+.2	.	.	.	1
S EUROP.	Leontodon crispus Vill. subsp. crispus	.	+	.	.	1
SW EUROP.	Bunium bulbocastanum L.	.	+	.	.	1

Presences

EUROP.	Allium vineale L.	.	+	.	.	1
SW EUR. MONT.	Knautia purpurea (Vill.) Borbás	.	+	.	.	1
ENDEM.	Senecio tenorei Pignatti	.	+	.	.	1
EURASIAT.	Campanula glomerata L.	.	.	.	+	1
EURASIAT.	Scabiosa columbaria L. subsp. columbaria	.	.	+	.	1
S EUR. MONT.	Silene ciliata Pourr. subsp. graefferi (Guss.) Nyman	.	.	+	.	1
SE EUR. MONT.	Trinia glauca (L.) Dumort. cfr subsp. carniolica (A. Kern. *ex* Janh.) H. Wolff	.	+	.	.	1
	Others species					
S EUROP.	Arenaria serpyllifolia L. subsp. serpyllifolia	+	+	+	.	3
ENDEM.	Cerastium tomentosum L.	+.2	+.2	+.2	.	3
S EUROP.	Petrorhagia saxifraga (L.) Link subsp. saxifraga	+.2	1.1	+.2	.	3
EURASIAT.	Bromus tectorum L. subsp. tectorum	+.2	+.2	.	+.2	3
MEDIT.	Daucus carota L. subsp. carota	+	+	.	.	2
MEDIT.	Helianthemum salicifolium (L.) Mill.	+	+	.	.	2
EURAS.-N AMER.	Juniperus communis L. subsp. communis	.	+	+	.	2
MEDIT.	Cruciata pedemontana (Bellardi) Ehrend.	.	+	+	.	2
MEDIT.	Trifolium scabrum L. subsp. scabrum	.	+	+	.	2
MEDIT.	Veronica arvensis L.	.	+	+	.	2
	Accidental species	2	4	2	2	

ne and Boreal heaths" (*Sorbo ariae-Juniperetum nanae*), 6210* Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchid sites) (*Cerastio tomentosi-Seslerietum nitidae, Gentiano dinaricae-Globularietum meridionalis*,); 6510 "Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)" (*Festuco circummediterraneae-Arrhenatheretum elatioris*). The conservation status of these habitats in this area is generally quite good, with the exception of the bottom-valley grasslands of the association *Festuco circummediterraneae-Arrhenatheretum elatioris* (Habitat 6510). As indicated above, the load and prolonged use for livestock is leading to the degradation of these grasslands, which combined with the drying up, has resulted in the risk of losing the habitat itself.

Discussion

The geomorphological complexity and the effects of current and previous morphogenic processes that have shaped the territory under study have resulted in great environmental variability that explains the high phytocoenotic diversity that is evident here. This has also been demonstrated by recent studies in other areas (e.g., Allegrezza *et al*., 2010; Biondi *et al*., 2011, 2012) and by the nine plant associations that are found here, five of which belong to the Habitats of Community interest. The temperature factor that is associated with the southern exposure of the peaks has a fundamental role on the pedogenesis, and therefore on the vegetation (Agnelli *et al*., 2008). This has also promoted an increase in Mediterranean and mediterraneo-montane species that are typical of the mesotemperate bioclimatic belt, thus assuming the significance of differential species in high-mountain vegetation contexts, which are definitely original from the floristic and phytogeographic points of view. Indeed, the combination of species in the different plant communities is often determined by the interpenetration of elements that are typical of the mesotemperate belt with those of the supratemperate and orotemperate belts. This might also be the answer to the ongoing climate change due to the increase in average temperatures over the past 30 years, which suggests that similar floristic and vegetation contexts in the areas which are more vulnerable from the topoclimatic point of view will be increasingly common over time. The comparison between the weighted chorological spectra for the various associations that were detected (Table 11) shows that as well as characterizing the different coenoses under study, the Mediterranean chorotype is nevertheless more strongly represented in the edaphophilic phytocoenoses that settle in the edaphoxerophilous positions of the sectors that are subjected to water run-off. The highest values were for the edaphoxerophilous grasslands of the association *Gentiano dinaricae-Globularietum meridionalis*, while the lowest values were for the association *Salicetum apenninae* in the watershed positions, and for which the highest values of Eurasian species are recorded. The coenoses of the association *Sorbo ariae-Juniperetum nanae* are of particular interest, for which the

Tab. 11 - Chorological weighted spectra of the plant associations relevated.

Identified associations	Chorological weighted spectra						
	Endem.	Medit.	Euras.	Orof.	Boreal	Exositc	Cosmop.
Lathyro veneti-Fagetum sylvaticae	3,8	2,7	80,5	6,0	6,5	0,6	/
Viburno lantanae-Ostryetum carpinifoliae	13,0	6,9	63,4	11,2	5,1	0,4	/
Reforestation	12,5	3,6	40,3	6,5	1,5	35,6	0,2
Melico uniflorae-Populetum tremulae	6,9	0,8	60,8	2,8	28,1	0,5	0,2
Salicetum apenninae	17,1	0,9	80,0	0,9	0,8	0,2	0,2
Rhamno-Amelanchieretum ovalis	17,1	9,3	50,8	17,7	5,0	0,1	/
Sorbo ariae-Juniperetum nanae	5,0	22,4	11,1	2,2	56,1	3,3	/
Cerastio tomentosi-Seslerietum nitidae	53,1	19,5	20,8	4,5	2,0	0,1	/
Gentiano dinaricae-Globularietum meridionalis	38,8	27,4	24,9	6,7	1,6	0,8	/
**Festuco circummediterraneae-Arrhenatheretum elatioris*	1,2	20,9	66,4	8,2	3,1	/	0,2

* Chorological weighted spectrum on relevé 4, 5 from Tab. 10

highest values were recorded for the Boreal chorotype, followed by the Mediterranean one, thus emphasizing the originality of its floristic combination. Finally, the endemic element reaches the highest percentages in the coenoses that are most affected by natural and anthropic disturbance, such as the grasslands of the slopes, the hop hornbeam wood, and the reforestation. As for the acidophilous species that are typical of the coenoses of the flysh of the Laga Mountains, these species are mainly concentrated in the reforestation, and in particular in those with a dominance of *Abies alba* at the most extensive outcrops of the *siliciclastic substratum*. This is a context that is, however, still dominated by the influence of the limestone superficial layer. As for the plant landscape, we can consider that the perpetuation across the centuries of the effects of the interactions between the different ecological factors, which include the strong anthropic use, have led to the loss of soil and the subsequent regression and change in the pre-existing vegetational and dynamic arrangements, thus favouring the presence of durable associations and/or of edaphoxerophilous series with a durable nature.

In conclusion, the results of this study have broadened our knowledge of the flora and vegetation of the National Park of Monti Sibillini. They have also contributed to the clarification of the vegetation and landscape context of a representative sector of this important Apennine district. As far as the reforestation is concerned, which has until now been little investigated from the phytosociological point of view, the results obtained in this study will be useful as a basis for silvicultural interventions for the renaturation of the area, as well as providing important ecological information. Finally, the results of interdisciplinary studies in progress on the groups of juniper that colonize the grasslands of the western slopes of the area (Bonanomi, Allegrezza, Cocco and Corti, unpublished data), will deepen our knowledge of the specific interactions, and thus on the autoecology and the synecology of the species involved.

Syntaxonomical scheme

JUNIPERO SABINAE-PINETEA SYLVESTRIS Rivas-Martinez 1965 nom. inv.
Junipero sabinae-Pinetalia sylvestris Rivas-Martinez 1965 nom. inv.
Daphno oleoidis-Juniperion alpinae Stanisci 1997
Sorbo ariae-Juniperetum nanae ass. nova
juniperetosum nanae subass. nova
cytisophylletosum sessilifolii subass. nova

QUERCO-FAGETEA Br.-Bl. & Vlieger in Vlieger 1937
Fagetalia sylvaticae Pawlowski in Pawlowski, Sokolowski & Wallisch 1928
Geranio versicoloris-Fagion sylvaticae Gentile 1970
Doronico orientalis-Fagenion sylvaticae (Ubaldi, Zanotti, Puppi, Speranza & Corbetta ex Ubaldi 1995) Di Pietro, Izco & Blasi 2004
Lathyro veneti-Fagetum sylvaticae Biondi et al. ex Biondi Casavecchia, Pinzi, Allegrezza & Baldoni 2013
amelanchieretosum ovalis subass. nova
fraxinetosum excelsioris subass. nova
Cytisophyllum sessilifolium and *Pinus nigra* subsp. *nigra* variant
Betulo pendulae-Populetalia tremulae Rivas-Martinez, Fernandez-Gonzalez, Loidi, Lousa & Penas 2001
Corylo-Populion tremulae (Br.-Bl. ex O. Bolos 1973) Rivas-Martinez & Costa 1998
Aceri obtusati-Populenion tremulae Taffetani 2000
Melico uniflorae-Populetum tremulae Pedrotti 1995 em. Taffetani 2000
Quercetalia pubescentis Klika 1933
Carpinion orientalis Horvat 1958
Laburno anagyroidis-Ostryenion carpinifoliae (Ubaldi 1981) Poldini 1990
Viburno lantanae-Ostryetum carpinifoliae ass. nova
viburnetosum lantanae subass. nova
amelanchieretosum ovalis subass. nova
Salix apennina variant

SALICI PURPUREAE-POPULETEA NIGRAE (Rivas-Martínez & Cantó ex Rivas-Martínez, Báscones, T.E. Díaz, Fernández-González & Loidi 1991) Rivas-Martínez & Cantó in Rivas-Martínez, Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002
Salicetalia purpureae Moor 1958

Salicion eleagni Aichinger 1933 nom. mut. propos. Rivas-Martínez, Diaz, Fernandez-Gonzalez, Izco, Loidi, Lousã & Penas 2002
Salicetum apenninae Pedrotti, Spada & Conti in Pedrotti & Gafta 1996
salicetosum apenninae Allegrezza et al. ex Allegrezza, Mentoni & Tesei 2013
eupatorietosum cannabini Allegrezza et al. ex Allegrezza, Mentoni & Tesei 2013

RHAMNO-PRUNETEA Rivas-Goday & Borja ex Tuxen 1962
Prunetalia spinosae R. Tüxen 1952
Berberidion vulgaris Br.-Bl. 1950
Berberidenion vulgaris Géhu, Foucault & Delelis-Dusollier 1983
Rhamno alpinae-Amelanchieretum ovalis (Pedrotti 1994) em. Cutini, Stanisci & Pirone 2002
cytisophylletosum sessilifolii Cutini, Stanisci & Pirone 2002
rhamnetosum fallacis subass. nova

FESTUCO-BROMETEA Br.-Bl. & Tüxen ex Br.-Bl. 1949
Scorzonero-Chrysopogonetalia Horvatic & Horvat in Horvatic 1963
Phleo ambigui-Bromion erecti Biondi, Allegrezza & Zuccarello ex Biondi & Galdenzi 2012
Brachypodenion genuensis Biondi, Ballelli, Allegrezza & Zuccarello 1995 ex Biondi & Galdenzi 2012
Cerastio tomentosi-Seslerietum nitidae ass. nova
cerastietosum tomentosi subass. nova
caricetosum humilis subass. nova
Gentiano dinaricae-Globularietum meridionalis ass. nova
globularietosum meridionalis subass. nova
seslerietosum nitidae subass. nova

MOLINIO-ARRHENATHERETEA Tüxen 1937
Arrhenatheretalia Tüxen 1931
Ranuncolo neapolitani-Arrhenatherion elatioris Allegrezza & Biondi 2011
Festuco circummediterraneae-Arrhenatheretum elatioris Allegrezza 2003 facies a *Eryngium amethystinum*

Bibliographic references

AA.VV., 1991. L'ambiente fisico delle Marche, Geologia - Geomorfologia - Idrogeologia. Regione Marche - Giunta Regionale - Assessorato Urbanistica e Ambiente.

Aeschimann D., Lauber K., Moser D.M. & Theurillat J.P., 2004. Flora alpina. Voll. 1-3. Zanichelli.

Agnelli A., Allegrezza M., Biondi E., Cocco S., Corti G. & Pirchio F., 2008. Pedogenesi e paesaggio vegetale: il ruolo dell'esposizione. Fitosociologia, 45 (1): 23-28.

Allegrezza M., 2003. Vegetazione e paesaggio vegetale della dorsale del Monte San Vicino (Appennino centrale). Fitosociologia, 40 (1) suppl. 1: 1-118.

Allegrezza M. & Biondi E., 2011. Syntaxonomic revision of the *Arrhenatheretum elatius* grassland of central Italy. Fitosociologia, 48 (1): 23-40.

Allegrezza M., Biondi E., Formica E. & Ballelli S., 1997. La vegetazione dei settori rupestri calcarei dell'Italia centrale. Fitosociologia, 32: 91-120.

Allegrezza M., Biondi E. & Mentoni M., 2008. Iso-orogeosigmeta e iso-orogeoserie nella dorsale calcarea del Monte San Vicino (Appennino centrale). Fitosociologia, 45 (1): 29-37.

Allegrezza M., Mentoni M. & Tesei G., 2010. Geomorfologia e paesaggio vegetale: l'esempio della grande frana di Pescacci (Comune di Serra San Quirico - Appennino centrale). Fitosociologia, 47 (2): 57-97.

Anderberger M.R., 1973. Cluster Analysis for Application. Academic Press, New York.

Ballelli S., Biondi E. & Pedrotti F., 1982. L'associazione *Scutellario-Ostryetum* dell'Appennino centrale. In: Pedrotti, Guide-Itinéraire. Excursion Internationale de Phytosociologie en Italie centrale (2-11 juillet 1982). Univ. Camerino: 565-569.

Ballelli S., Lucarini D. & Pedrotti F., 2005. Catalogo dell'erbario dei Monti Sibillini di Vittorio Marchesoni. Braun-Blanquetia, 38: 3-259.

Biondi E., 1996. La geobotanica nello studio ecologico del paesaggio. Estratto da Annali dell'Accademia Italiana di Scienze Forestali. Vol. XLV: 3-39.

Biondi E., 2011. Phytosociology today: Methodological and conceptual evolution. Plant Biosystems, 145, suppl. September 2011: 19-29.

Biondi E., Allegrezza M., Mentoni M., 2011. Vegetational and geomorphological analyses of a small biotope particularly important for biodiversity in Central Apennine. Fitosociologia vol. 48 (2): 109-

122.

Biondi E., Allegrezza M., Mentoni M., 2012. Geosynphytosociological analysis of the plant landscape of an area with high geomorphology variability on the central Italian Adriatic coast. Acta Botanica 159(2):187-200.

Biondi E., Allegrezza M., Ballelli S., Calandra R., Crescente M.F., Frattaroli A.R., Gratani L., Rossi A. & Taffetani F., 1992. Indagini per una cartografia fitoecologica dell'altipiano di Campo Imperatore (Gran Sasso d'Italia). Bollettino dell'A.I.C., 86: 85-98.

Biondi E., Ballelli S., Allegrezza M. & Zuccarello V., 1995. La vegetazione dell'ordine *Brometalia erecti* Br.-Bl. 1936 nell'Appennino (Italia). Fitosociologia, 30: 3-45.

Biondi E., Allegrezza M. & Zuccarello V., 2005. Syntaxonomic revision of the Apennine grasslands belonging to *Brometalia erecti*, and an analysis of their relationships with the xerophilous vegetation of *Rosmarinetea officinalis* (Italy). Phytocoenologia, 35 (1): 129-163.

Biondi E. & Ballelli S., 1973. Osservazioni su due rimboschimenti a *Pinus nigra* subsp. *nigra* nella zona di Fabriano (Marche). Tipografia Valbonesi-Forlì.

Biondi E. & Ballelli S., 1995. Le praterie del Monte Coscerno e Monte di Civitella (Appennino umbro-marchigiano - Italia centrale). Fitosociologia, 30: 91-121.

Biondi E., Ballelli S., Allegrezza M., Taffetani F., Frattaroli A. R., Guitian J. & Zuccarello V., 1999. La vegetazione di Campo Imperatore (Gran Sasso d'Italia). Braun-Blanquetia, 16: 53-116.

Biondi E., Casavecchia S., Pinzi M., Allegrezza M. & Baldoni M., 2002. The syntaxonomy of the mesophilus woods of the Central and Northern Apennines (Italy). Fitosociologia, 39 (2): 71-93.

Biondi E., Casavecchia S., Frattaroli A.R., Pirone G., Pesaresi S., Di Martino L., Galassi, S., Paradisi L., Ventrone F., Angelini E. & Ciaschetti G., 2008. Forest vegetation of the Upper Valley of the Vomano River (central Italy). Fitosociologia, 45 (1): 117-160.

Biondi E, Blasi C, Burrascano S, Casavecchia S, Copiz R, Del Vico E, Galdenzi D, Gigante D, Lasen C, Spampinato G, Venanzoni R, Zivkovic L (2009) Italian interpretation manual of the 92/43/EEC Directive Habitats. Available: http://vnr.unipg.it/ habitat/index.jsp.

Biondi E., Feoli E. & Zuccarello V., 2004a. Modelling Environmental Responses of Plant Associacions: A Review of Some Critical Concepts in Vegetation Study. Critical Reviews in Plant Sciences, 23 (2): 149-156.

Biondi E. & Galdenzi D., 2012. Phytosociological analysis of the grasslands of Montagna dei Fiori (central Italy) and syntaxonomic review of the class *Festuco-Brometea* in the Apennines. Plant Sociology, 49 (1): 91-112.

Biondi, E., Pinzi M. & Gubellini L., 2004. Vegetazione e paesaggio vegetale del massiccio del Monte Cucco (Appennino centrale, dorsale Umbro-Marchigiana). Fitosociologia, 41 (2) suppl. 1: 3-81.

Blasi C., Di Pietro R. & Filesi L., 2004. Syntaxonomical revision of *Quercetalia pubescenti-petraeae* in the Italian Peninsula. Fitosociologia 41 (1): 87-164.

Blasi C., Gigli M.P., Abbate G. & Stanisci A., 1989. Le cenosi a *Juniperus nana* Willd. nel Lazio (Italia centrale). Annali di Botanica, suppl. 6 al XLVII: 135-148.

Bonanomi G., Mingo A., Incerti G., Mazzoleni S. & Allegrezza M., 2012. Fairy rings caused by a killer fungus foster plant diversity in species-rich grassland. Journal of Vegetation Science 23: 236-248.

Brullo S., Giusso del Galdo G. & Guarino R., 2001. The orophilus communities of the *Pino-Juniperetea* class in the Central and Eastern Mediterranean area. Feddes Repertorium, 112: 261-308.

Burba N., Feoli E., Malaroda M. & Zuccarello V., 1992. Un Sistema Informativo per la Vegetazione. Manuale di utilizzo del Package. Collana Quaderni CETA N.2, Udine.

Cantalamessa G., Centamore E., Chiocchini U., Di Lorito L., Micarelli A. & Potetti M., 1983. I depositi terrigeni neogenico-quaternari affioranti tra il F. Potenza e il F. Tronto. Studi Geol. Camerti, Numero Speciale, Riun. del Gruppo di Sedim. del C.N.R., Camerino-S. Benedetto del Tronto, 26-29 settembre 1983.

Cantalamessa, G., Centamore E., Chiocchini U., Colalongo M.L., Micarelli A., Nanni T., Pasini G., Potetti M. & Ricci Lucchi F., 1986. Il plio-pleistocene delle Marche. Studi Geologici Camerti. Numero speciale: 61-81.

Castroviejo S., Laìniz M., López González G., Montserrat P., Muñoz Garmendia F., Paiva J. & Villar L. 1986. Flora iberica. Plantas vasculares de la Península Ibérica e Islas Baleares. Vol. 1 Lycopodiaceae-Papaveraceae. Real Jardín Botánico, C.S.I.C.

Catorci A., Ballelli S., Gatti R. & Vitanzi A., 2008. Studio fitosociologico delle praterie della Valle dell'Ambro (Parco Nazionale dei Monti Sibillini, Italia Centrale). Inform. Bot. Ital., 40 (2): 193-241.

Catorci A. & Gatti R., 2007. Le praterie montane dell'Appennino maceratese. Braun-Blanquetia, 42: 39-45.

Catorci A., Vitanzi A. & Ballelli S., 2010. Phytosociological study of beech and beech-mixedwoods in Monti Sibillini National Park (Central Apennines, Italy). Hacquetia, 9 (1): 23-75.

Conti F., Abbate G., Alessandrini A. & Blasi C., 2005. An annotated checklist of the italian vascular flora. Palombi, Roma.

Conti F., Alessandrini A., Bacchetta G., Banfi E., Bar-

berís G., Bartolucci F., Bernardo L., Bonacquisti S., Bouvet D., Bovio M., Brusa G., Del Guacchio E., Foggi B., Frattini S., Galasso G., Gallo L., Gangale C., Gottschlich G., Grünanger P., Gubellini L., Iriti G., Lucarini D., Marchetti D., Moraldo B., Peruzzi L., Poldini L., Prosser F., Raffaelli M., Santangelo A., Scalsellati E., Scortegagna S., Selvi F., Soldano A., Tinti D., Ubaldi D., Uzunov D. & Vidali M., 2007. Integrazioni alla checklist della flora vascolare italiana. Natura Vicentina, 10: 5-74.

Cutini M. & Blasi C., 2002. Contributo alla definizione sin tassonomica e sin dinamica dei mantelli di vegetazione della fascia collinare-submontana dell'Appennino centrale (Italia centrale). Fitosociologia, 39 (1) suppl. 2: 97-120.

Cutini M., Stanisci A. & Pirone G., 2002. L'alleanza *Berberidion vulgaris* in Appennino centrale (Italia centrale). Fitosociologia, 39 (2): 31-50.

De Sillo R., De Sanctis M., Bruno F. & Attorre F., 2012. Vegetation and landscape of the Simbruini mountains (Central Apennines). Plant Sociology, 49 (1), Suppl. 1: 3-64.

Di Pietro R., 2011. New dry grassland associations from the Musoni-Aurunci mountains (central Italy). Syntaxonomical updating and discussion on the higher rank syntaxa. Hacquetia 10/2 : 183-231.

Ellemauer T. & Mucina L., 1993. Anthropogene Vegetation. In: Mucina L., Grabher G. & Ellemauer T."Die Pflanzengesellschaften Oesterreichs", Teil. 1: 340-401. Fischer Verlang, Jena, Stuttgart, New York.

Géhu J.M., 1991. L'analyse symphytosociologique et géosymphytosociologique de l'espace. Théorie et méthodologie. Coll. Phytosoc., XVII, 11-46.

Géhu J.M., 2006. Dictionnaire de Sociologie et Synecologie végétales. Berlin-Stuttgart: J Cramer. p. 900.

Géhu J.M. & Rivas-Martinez S., 1981. Notions fondamentales de phytosociologie. In: Syntaxonomie. H. Dierschke (ed.), Ber. Int. Symp. Int. Vereinigung Vegetationsk. J. Cramer, Vaduz, 5-33.

Jalas J. & Suominen J., 1972-1994. Atlas Florae Europaeae. Distribution of vascular plants in Europe. Voll. 1-10. Helsinki.

Lausi D., Gerdol R. & Piccoli F., 1982. Syntaxonomy of the *Ostrya carpinifolia* woods in the southern Alps (N-Italy) based on the numerical methods. Studia Geobot., 2: 41-58.

Longhitano N. & Ronsisvalle G.A., 1974. Osservazioni sulle faggete dei Monti della Laga (Appennino centrale). Not. Fitosoc. 9: 55-82.

Marchesoni V., 1957. Storia climatico-forestale dell. Appennino umbro-marchigiano. Ann. Bot., 25 25:459-497.

Marchesoni V., 1958. Importanza del pino nero, dell'abete, del tasso e dell'agrifoglio nella storia climatico forestale dell.Appennino umbro-marchigiano. Monti e Boschi, 9: 535-540.

Miyawaki A., 1986. Vegetationsokologiske Betrachtung mittel-Japans unter den Aspekt der geomorphologie. Coll. Phytosoc., XIII, 27-40.

Moscatelli M., Milli S., Stanzione O., Marini M., Gennari G., Vallone R., con contributi di Artoni A., Bigi S., Lugli S. (2004) - I depositi torbiditici del Messiniano inferiore dell'Appennino centrale: bacini del Salto-Tagliacozzo e della Laga (Lazio, Abruzzo, Marche). Congresso GeoSed, Ass. It. per la Geologia del Sedimentario, Escursione post-congresso, Roma, 25 - 28 settembre 2004.

Oberdorfer E., 1994. Pflanzensoziologische Exkursionsflora. 7 Auflage. Stuttgart: Ulmer 1050p.

Oksanen J., Guillaume Blanchet F., Kindt R., Legendre P., Minchin P. R., O'Hara R. B., Simpson G.L., Solymos P., Henry M., Stevens H. and Wagner H., 2012. vegan: Community Ecology Package. R package version 2.0-4. http://CRAN.R-project.org/package=vegan.

Orlóci L., 1978. Multyvariate analysis in vegetation research. 2nd ed. Junk, The Hague.

Paganelli A., 1958. Cicli forestali post-glaciali del piano montano dell'Appennino umbro-marchigiano attraverso l'analisi pollinica del deposito lacustre dei Pantani. (m 1589). Nuovo Giorn. Bot. Ital., 65: 202-213.

Paganelli A., 1982. Histoire paléobotanique. In: In Guide-Itinéraire Excursion Internat. Phytosoc. Italie centrale (ed. F. Pedrotti): 39-74. Universitá degli Studi, Camerino.

Pedrotti F., 1994. Associazioni dell'ordine Prunetalia dell'Appennino centrale. In: Guida all'Escursione della Società Italiana di Fitosociologia in Trentino (1-5 luglio 1994). Dip.to di Botanica ed Ecologia, Università di Camerino:146-148.

Pedrotti F., 1995. I pioppeti di Pioppo tremulo dell'Appennino centrale. Studi Trentini di Scienze Naturali, Acta Biologica, 70: 99-105.

Pedrotti F., 2001. Environmental systems, vegetation belts and potential vegetation of the Monti Sibillini (Central Italy). Oecologia Montana, 10: 13 - 18

Pedrotti F. & Gafta D., 1996. Ecologia delle foreste ripariali e paludose dell'italia, L'uomo e l'ambiente, Camerino, 23: 3-165.

Pirone G., 2000. La vegetazione ripariale nei versanti nord-orientali del Gran Sasso d'Italia e dei Monti della Laga (Abruzzo, Italia). Fitosociologia, 37 (2): 65-86.

Pignatti S., 1982. Flora d'Italia. Voll. 1-3. Edagricole.

Podani J. 2007. Analisi ed esplorazione multivariata dei dati in ecologia e biologia. Liguori Editore, Napoli.

Poldini L., 1978. La vegetazione petrofila dei territori carsici nordadriatici. Mitt. Ostalp.-Din. Ges. Vegetationsk. Lubiana, 14: 297-324.

Poldini L., 1982. *Ostrya carpinifolia* - reiche Wälder und Gebüsche von Friaul-Julisch-Venetien (NO-Italien) und Nachbargebieten. Studia Geobot. 2: 69-122.

Poldini L., 1989. La vegetazione del Carso isontino e triestino. Edizioni LINT, Trieste.

Pott R., 2011. Phytosociology: A modern geobotanical method, Plant Biosystem – An International Journal Dealing with all Aspects of Plant Biology, 145 sup1, 9-18.

Regione Marche, 2001. Carta Geologica Regionale, Progetto CARG, Sezione 325160 "Monte Vettore", Scala 1:10.000.

Regione Marche, 2001. Carta Geologica Regionale, Progetto CARG, Sezione 337040 "Arquata del Tronto", Scala 1:10.000.

Rivas-Martinez S., 2005. Notions on dynamic-catenal phytosociology as a basis of landscape science. Plant Biosystems, 139 (2): 135-144.

Rivas-Martinez S., 2008 - Global Bioclimatics (Clasificaciòn Bioclimàtica de la Tierra). http://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 Geobotanica 14: 1-300.

Rodwell J.S., Schamine J.H.J., Mucina L., Pignatti S., Dring J. & Moss D., 2002. The diversity of European Vegetation. The overview of phytosociological alliances and their relationship to EUNIS habitat.

Stanisci A., 1997. Gli arbusteti alto montani dell'Appennino centrale e meridionale. Fitosociologia, 34: 3-46.

Taffetani F., 2000. Serie di vegetazione del complesso geomorfologico del Monte Ascensione (Italia centrale). Fitosociologia, 37 (1): 93-151.

Taffetani F., Brecciaroli M., Macchi J., Fava F., Gubellini L., Lancioni A., Rismondo M., Zitti S., 2004. Contributo floristico della Val di Bove e della Val di Panico nel Parco Nazionale dei Monti Sibillini. PDF on-line.

Theurillat J.P., 1992. Etude ed cartographie du paysage végétal (symphytocoenologie) dans la Ragion d'Aletsch (Valais, Suisse). Centre Alpin del Phytocoenographie, Champex et Conservatoire et Jardin botaniques de la ville de Genéve, Krypto, Teufen.

Tutin T.G., Heywood V.H., Burges N.A., Moore D.M., Valentine D.H., Walters S.M. & Webb D.A. (EDS.) (1964-80): Flora Europaea. Voll. 1-5. 1st ed. Cambridge University Press.

Tutin T.G., Burges N.A., Chater A.O., Edmondson J.R., Heywood V.H. Moore D.M., Valentine D.H., Walters S.M. & Webb D.A., 1993. Flora Europaea. I. 2nd ed. Cambridge, University Press.

Tüxen R., 1978. Bemerkungen zur historischen, begrifflichen und methodischen Grundtagen der Synsoziologie. In: Assoziationskomplexe (Rinteln). Ber. Intern. Symposion 1997 in Rinteln: 3-12.

Ubaldi D., 1995. Tipificazione di syntaxa forestali appenninici e siciliani. Studi sul territorio. Ann. Bot. (Roma), 51 (I parte): 113-126.

Van der Maarel E., 1979. Transformation of cover-abundance values in phytosociology and its effect on community similarità. Vegetatio, 39: 97-114.

Westhoff V. & Van der Maarel E., 1978. The Braun-Blanquet approach. In Whittaker R.H. (ed.), Classification of Plant Communities: 287-399. W.Junk, The Hague, NL.

Appendix: Sporadic species

Table. 1:

Rel. 1: MEDIT.-W ASIAT. Silene italica (L.) Pers. subsp. italica (+), EUROP. Laserpitium latifolium L. (+), EURASIAT.-N AMER. Asplenium trichomanes L. subsp. quadrivalens D.E. Mey. (+), S EUROP.-W ASIAT. Ceterach officinarum Willd. subsp. officinarum (+), EURASIAT. Silene vulgaris (Moench) Garcke subsp. vulgaris (+.2), ENDEM. Cerastium tomentosum L. (+). Rel. 2: MEDIT.-W ASIAT. Silene italica (L.) Pers. subsp. italica (+), EUROP. Laserpitium latifolium L. (+.3), ENDEM. Centaurea ambigua Guss. (s.l.) (+), EUROP. Bromopsis erecta (Huds.) Fourr. subsp. erecta (+), EUROSIB. Cytisus hirsutus L. subsp. polytrichus (M. Bieb.) Hayek (+.2). Rel. 3: MEDIT. Tanacetum corymbosum (L.) Sch. Bip. subsp. achillae (L.) Greuter (+), EURASIAT.-N AMER. Asplenium trichomanes L. subsp. quadrivalens D.E. Mey. (+), SE EUROP. Gentiana dinarica Beck (+), S EUROP. MONT. Leucanthemum adustum (W.D.J. Koch) Gremli (+), S EUROP. MONT. Carlina acaulis L. subsp. caulescens (Lam.) Schübl. et G. Martens (+), EUROSIB. Cytisus hirsutus L. subsp. polytrichus (M. Bieb.) Hayek (+.2). Rel. 4: MEDIT. Tanacetum corymbosum (L.) Sch. Bip. subsp. achillae (L.) Greuter (+), MEDIT.-W ASIAT. Silene italica (L.) Pers. subsp. italica (+). Rel. 5: S EUROP. MONT. Senecio doronicum (L.) L. (+). Rel. 6: S EUROP. Peucedanum oreoselinum (L.) Moench (+). Rel. 8: Senecio doronicum (L.) L. (+). Rel. 9: MEDIT. MONT. Juniperus communis L. subsp. hemisphaerica (J. Presl et C. Presl) Nyman (+), SW EUROP. MONT. Knautia purpurea (Vill.) Borbás (+), MEDIT. Teucrium chamaedrys L. subsp. chamaedrys (+.2), ENDEM. Seseli tommasinii Rchb. f. (+). Rel. 10: EUROP. Brachypodium rupestre (Host) Roem. et Schult. (1.2), EUROP. Euphorbia cyparissias L. (+), EURASIAT. Dactylis glomerata L. subsp. glomerata (+.2). Rel. 11: EUROP. Brachypodium rupestre (Host) Roem. et Schult. (1.2), MEDIT. Tanacetum corymbosum (L.) Sch. Bip. subsp. achillae (L.) Greuter (+). Rel. 12: MEDIT. Veronica arvensis

L. (+), EURASIAT. Fragaria vesca L. subsp. vesca (+). Rel. 13: EUROP.-W ASIAT. Crataegus monogyna Jacq. (+). Rel. 14: EURASIAT.-N AMER. Juniperus communis L. subsp. communis (+). Rel. 15: EUROP. Laserpitium latifolium L. (+), EURASIAT. Campanula glomerata L. (+), EURASIAT. Galium aparine L. (+).

Table 2:
Rel. 1: EUROSIB.-N AMER. Arctostaphylos uva-ursi (L.) Spreng. +.3; S EUROP. MONT. Senecio doronicum (L.) L. (+), MEDIT. Teucrium chamaedrys L. subsp. chamaedrys (+), ENDEM. Seseli tommasinii Rchb. f. (+), ENDEM. Cerastium tomentosum L. (+), EUROP.-SW ASIAT. Rumex scutatus L. subsp. scutatus (+.2). Rel. 2: EUROSIB.-N AMER. Arctostaphylos uva-ursi (L.) Spreng. +.2; SE EUROP. Gentiana dinarica Beck (+).. Rel. 3: EUROSIB.-N AMER.Juniperus communis L. subsp. nana Syme (+.2); EUROP. Euphorbia cyparissias L. (+), EUROP. Laserpitium latifolium L. (1.1), EUROP. MONT. Brachypodium genuense (DC.) Roem. et Schult. (+). Rel. 4: EURASIAT. Fragaria vesca L. subsp. vesca (+), S EUROP. Vicia villosa Roth subsp. varia (Host) Corb. (+), EUROP. Euphorbia cyparissias L. (+). Rel. 5: EUROP. Brachypodium rupestre (Host) Roem. et Schult. (1.2), S EUROP. MONT. Abies alba Mill. c (+). Rel 6: EUROSIB. Gymnadenia conopsea (L.) R. Br. (+); Rel. 7: EURASIAT. Fragaria vesca L. subsp. vesca (+.2), S EUROP. Vicia villosa Roth subsp. varia (Host) Corb. (+), MEDIT. Tanacetum corymbosum (L.) Sch. Bip. subsp. achillae (L.) Greuter (+), EUROSIB. Gymnadenia conopsea (L.) R. Br. (+), EUROP. Bromopsis erecta (Huds.) Fourr. subsp. erecta (+), EURASIAT. Dactylis glomerata L. subsp. glomerata (+.2), EURASIAT.-N AMER. Clinopodium vulgare L. subsp. vulgare (+), MEDIT. MONT. Trifolium montanum L. subsp. rupestre (Ten.) Nyman (+), EURASIAT. Lathyrus pratensis L. subsp. pratensis (+.2), EUROP. Chaerophyllum temulum L. (+), S EUROP. MONT. Bupleurum falcatum L. subsp. cernuum (Ten.) Arcang. (+.2), MEDIT. Polygala nicaeensis W.D.J. Koch subsp. mediterranea Chodat (+).

Table 3:
Rel. 1: EUROP. Euphorbia cyparissias L. (+), EUROP.-W ASIAT. Helianthemum nummularium (L.) Mill. subsp. obscurum (Celak.) Holub (+),MEDIT. Stellaria media (L.) Vill. subsp. media (+.2), EURASIAT. Campanula glomerata L. (+.2), EURASIAT. Lathyrus pratensis L. subsp. pratensis (+), EUROSIB. Trifolium pratense L. subsp. pretense (+), S EUROP. MONT. Acinos alpinus (L.) Moench subsp. alpinus (+), SUBENDEM. Carex macrolepis DC. (+.2). Rel. 2: EUROP. Bromopsis erecta (Huds.) Fourr. subsp. erecta (+). Rel. 3: EUROP. Ranunculus lanuginosus L. (+). Rel. 4: S EUROP. Galium corrudifolium Vill. (+), MEDIT. MONT. Trifolium montanum L. subsp. rupestre (Ten.) Nyman (+). Rel. 6: ENDEM. Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti et Gubellini. (+).

Table 4:
Rel. 1: S EUROP. Vicia villosa Roth subsp. varia (Host) Corb. (+), C EUROP. Rubus hirtus (group) (1.1). Rel. 2: MEDIT. MONT. Trifolium montanum L. subsp. rupestre (Ten.) Nyman (+), SUBENDEM.
Carex macrolepis DC. (+.2), EURASIAT. Tussilago farfara L. (+). Rel. 3: EURASIAT. Dactylis glomerata L. subsp. glomerata (+.2), EURASIAT. Scabiosa columbaria L. subsp. columbaria (+), Rubus caesius L. (+), S EUROP. MONT. Cotoneaster tomentosum (Aiton) Lindl. (+.2).

Table 5:
Rel. 1: EUROP. Viola reichenbachiana Jord. ex Boreau (2.2), EURASIAT. Lactuca muralis (L.) Gaertn. (+), EUROSIB. Galium odoratum (L.) Scop. (+), EUROP.-W ASIAT. Carex sylvatica Huds. subsp. sylvatica (1.2), EUROP. Melittis melissophyllum L. subsp. melissophyllum (+), EUROP.-W ASIAT. Viburnum lantana L. (+.2), EUROP.-W ASIAT. Sanicula europaea L. (3.3), EUROP.-W ASIAT. Rubus caesius L. (1.1), EUROP. Bromopsis ramosa (Huds.) Holub subsp. ramosa (+), EURASIAT. Fragaria vesca L. subsp. vesca (+.2), EUROSIB. Hypericum montanum L. (+), EURASIAT. Agrostis capillaris L. (+.2), W EUROP.-MEDIT. Primula vulgaris Huds. subsp. vulgaris (+). Rel. 2: S EUROP. MONT. Euonymus latifolius (L.) Mill. (+.2), EUROP. MONT. Sorbus aria (L.) Crantz subsp. aria (+.2), EUROSIB.-N AMER. Solidago virgaurea L. subsp. virgaurea (+), EUROP. Arum maculatum L. (+), EUROP. Cephalanthera damasonium (Mill.) Druce (+), SE EUROP. Ostrya carpinifolia Scop. (1.2), SE EUROP. MONT. Pinus nigra Arnold subsp. nigra (+.2), EUROP. Euphorbia cyparissias L. (+), EURASIAT. Scabiosa columbaria L. subsp. columbaria (+), EUROP.-W ASIAT. Arrhenatherum elatius (L.) P. Beauv. ex J. et C. Presl subsp. elatius (+.2). Rel. 3: EUROP.-W ASIAT. Helianthemum nummularium (L.) Mill. subsp. obscurum (Celak.) Holub (+), ENDEM. Cerastium tomentosum L. (+).

Table 6:
Rel. 1: SE EUROP. Ostrya carpinifolia Scop. (+.2), EUROP. Brachypodium rupestre (Host) Roem. et Schult. (+.2), EUROP. Euphorbia cyparissias L. (+.2). Rel. 2: SE EUROP. Ostrya carpinifolia Scop. (+.2), SE EUROP.Asperula purpurea (L.) Ehrend. subsp. purpurea (+), ENDEM. Cerastium tomentosum L. (+), SE EUROP. MONT. Pinus nigra Arnold subsp. nigra (+.2). Rel. 3: SE EUROP. MONT. Carex kitaibeliana

Degen ex Bech. subsp. kitaibeliana (1.1), S EUROP. Teucrium montanum L. (+.2), EURASIAT.-N AMER. Arabis glabra (L.) Bernh. (+). Rel. 4: EUROP. Fagus sylvatica L. subsp. sylvatica (+), EUROSIB.-N AMER. Solidago virgaurea L. subsp. virgaurea (+), EURASIAT. Lilium martagon L. (+), EUROP.-W ASIAT. Acer campestre L. (+), EUROP. Corylus avellana L. (+), S EUROP. Galium corrudifolium Vill. (1.2), SE EUROP. Gentiana dinarica Beck (1.1). Rel. 5: EUROP. Fagus sylvatica L. subsp. sylvatica (+), EUROSIB.-N AMER. Solidago virgaurea L. subsp. virgaurea (+), EURASIAT. Polygonatum odoratum (Mill.) Druce (+), EUROP. Hepatica nobilis Schreb. (+). Rel. 6: S EUROP. MONT. Polygala chamaebuxus L. (+), SE EUROP. MONT. Bellidiastrum michelii Cass. (+), ENDEM. Stachys alopecuros (L.) Benth. subsp. divulsa (Ten.) Grande (+), EURASIAT. Lilium martagon L. (1.1), EUROP.-W ASIAT. Daphne mezereum L. (+). Rel. 7: EUROP. Brachypodium rupestre (Host) Roem. et Schult. (+), SE EUROP. MONT. Carex kitaibeliana Degen ex Bech. subsp. kitaibeliana (+.2).

Table 7:
Rel. 1: H scap SW EUROP. MONT. Knautia purpurea (Vill.) Borbás (+), NP EURASIAT. Rosa spinosissima L. (+). Rel 2: H bienn MEDIT. Arabis turrita L. (+), G rhiz EUROP. Hepatica nobilis Schreb. (+), H bienn MEDIT. Pimpinella peregrina L. (+). Rel. 3: Ch suffr S EUROP. MONT. Lomelosia graminifolia (L.) Greuter et Burdet subsp. graminifolia (+). Rel. 4 : P caesp EUROP.-SW ASIAT. Amelanchier ovalis Medik. subsp. ovalis (1), H caesp ENDEM. Avenula praetutiana (Parl. Ex Arcang.) Pignatti (+), Ch suffr MEDIT. Aethionema saxatile (L.) R. Br. subsp. saxatile (+), G rhiz EURASIAT. Polygonatum multiflorum (L.) All. (+),H scap EUROSIB.-N AMER. Solidago virgaurea L. subsp. virgaurea (+). Rel. 5: P scap SE EUROP. Acer opalus Mill. subsp. obtusatum (Waldst. et Kit. ex Willd.) Gams (+), H scap ENDEM. Centaurea ambigua Guss. (s.l.) (+), P scap S EUROP.-W ASIAT. Fraxinus ornus L. subsp. ornus (+), Rel. 6: P scap SE EUROP. Acer opalus Mill. subsp. obtusatum (Waldst. et Kit. ex Willd.) Gams (+),H scap MEDIT. Eryngium amethystinum L. (+).Rel. 8: P caesp EUROP.-SW ASIAT. Amelanchier ovalis Medik. subsp. ovalis (+), H scap MEDIT. Eryngium amethystinum L. (+), Ch suffr SE EUROP. Asperula purpurea (L.) Ehrend. subsp. purpurea (+), H scap EUROP. Euphorbia cyparissias L. (+), Ch suffr S EUROP. Helichrysum italicum (Roth) G. Don subsp. italicum (+). Rel. 9: H scap NE MEDIT. MONT. Carum heldreichii Boiss. (1), H scap ENDEM. Viola eugeniae Parl. subsp. eugeniae (+), Ch suffr ENDEM. Edraianthus graminifolius (L.) A. DC. subsp. graminifolius (+), H scap ENDEM. Leucanthemum tridactylites (Kern. et Huter) Huter, Porta et Rigo (+), Ch suffr SE EUROP. MONT. Linum capitatum Kit. ex Schult. subsp. serrulatum (Bertol.) Hartvig (+), G rhiz SE EUROP. MONT. Ranunculus brevifolius Ten. (+). Rel. 10: H caesp ENDEM. Avenula praetutiana (Parl. Ex Arcang.) Pignatti (1), H scap NE MEDIT. MONT. Carum heldreichii Boiss. (+), H ros SE EUROP. Gentiana dinarica Beck (+), H scap S EUROP. MONT. Pedicularis comosa L. (+). Rel 11: H scap S EUROP. MONT. Pedicularis comosa L. (+), Ch rept S EUROP. Thymus longicaulis C. Presl subsp. longicaulis (+), H scap SE EUROP. MONT. Anthyllis vulneraria L. subsp. pulchella (Vis.) Bornm. (+), H scap S EUROP. MONT. Galium anisophyllon Vill. (+), Ch suffr EUROP. MONT. Minuartia verna (L.) Hiern. subsp. verna (+), H ros MEDIT.-MONT. Pilosella hoppeana (Schult.) F.W. Schultz et Sch. Bip. subsp. hoppeana (+). Rel. 12: H scap MEDIT. MONT. Asperula aristata L. f. (+), H scap S EUROP. MONT. Bupleurum falcatum L. subsp. cernuum (Ten.) Arcang. (+), Ch suffr S EUROP. MONT. Helianthemum nummularium (L.) Mill. subsp. grandiflorum (Scop.) Schinz et Thell. (1), H scap S EUROP. MONT. Scabiosa holosericea Bertol. (+), Ch succ EUROP. Sedum rupestre L. subsp. rupestre (+), H scap S EUROP. MONT. Biscutella laevigata L. subsp. laevigata (+), H caesp EUROP. Luzula sylvatica (Huds.) Gaudin subsp. sylvatica (+), Ch suffr S EUROP. Teucrium montanum L. (+), G rad SE EUROP. Thesium linophyllon L. (+), H scap Vicia cracca L. (s.l.) (+). Rel. 13: Ch succ EUROP. Sedum rupestre L. subsp. rupestre (+), NP EUROSIB. Rubus idaeus L. (1). Rel. 14 : H scap SW-EUROP. MONT. Carduus carlinifolius Lam. subsp. carlinifolius (+), H scap S ALP.-APENN. Leucanthemum heterophyllum (Willd.)DC. (+). Rel. 17 : Ch rept S EUROP. Thymus longicaulis C. Presl subsp. longicaulis (+), Ch suffr MEDIT. Alyssum montanum L. subsp. montanum (+), H scap S EUROP. MONT. Campanula scheuchzeri Vill. subsp. scheuchzeri (+). Rel. 18: H scap SE EUROP. MONT. Grafia golaka (Hacq.) Rchb. (+), Ch suffr S EUROP. MONT. Helianthemum oelandicum (L.) Dum. Cours. subsp. alpestre (Jacq.) Ces. (+). Rel. 19: H caesp S EUROP. MONT. Silene ciliata Pourr. subsp. graefferi (Guss.) Nyman (+), H ros SE EUROP. MONT. Bellidiastrum michelii Cass. (+), H scap ENDEM. Viola eugeniae Parl. subsp. eugeniae (+), H scap S EUROP. MONT. Pulsatilla alpina (L.) Delarbre subsp. millefoliata (Bertol.) D.M. Moser (+), H scap S EUROP. MONT. Bupleurum falcatum L. subsp. cernuum (Ten.) Arcang. (+). Rel. 20: Ch suffr S EUROP. MONT. Helianthemum nummularium (L.) Mill. subsp. grandiflorum (Scop.) Schinz et Thell. (1), H caesp SE EUROP. MONT. Bellardiochloa variegata (Lam.) Kerguélen subsp. variegata (+), H scap EURASIAT. Campanula glomerata L. (+), H caesp SE EUROP. MONT. Carex kitaibeliana Degen ex Bech. subsp. kitaibeliana (1), H caesp S EUROP.-S SIBER. Nardus stricta L. (+). Rel. 21: P caesp MEDIT. Cytisus

villosus Pourr. (2), H caesp MEDIT.-TURAN. Festuca bosniaca Kumm. et Sendtn. subsp. bosniaca (+), P scap EURASIAT. Salix caprea L. (+). Rel. 22: Ch suffr MEDIT. Teucrium chamaedrys L. subsp. chamaedrys (+), H ros SE EUROP. Gentiana dinarica Beck (+), P caesp MEDIT. Cytisus villosus Pourr. (+), H scap MEDIT. MONT. Asperula aristata L. f. (+). Rel. 23: H scap S EUROP. MONT. Scabiosa holosericea Bertol. (+), Ch suffr MED.-TURAN. Pimpinella tragium Vill. (+), G bulb EURSIB. Gymnadenia conopsea (L.) R. Br. (+).

Table 8:

Rel. 1: W ALP.-APENN. Astragalus sempervirens Lam. (+.2). Rel. 2 : W ALP.-APENN. Astragalus sempervirens Lam. (+.2). Rel. 3 : ENDEM. Campanula tanfanii Podlech (+.3), EUROP. Hieracium bifidum Hoernem. (s.l.) (+.2), S EUROP. MONT. Androsace villosa L. subsp. villosa (+) SE EUROP. *Ostrya carpinifolia* Scop. (+). Rel. 4: MEDIT.-SW ASIAT. Melica ciliata L. subsp. ciliata (+.2), SE EUROP. MONT. Pinus nigra Arnold subsp. nigra (+.2), EUROP.-SW ASIAT. Amelanchier ovalis Medik. subsp. ovalis (+.2), C ASIAT.-MEDIT. MONT. Daphne oleoides Schreb. (+), SE EUROP. MONT. Rhamnus alpina L. subsp. fallax (Boiss.) Maire et Petimg (+.2). rel. 5: SE EUROP. MONT. Pinus nigra Arnold subsp. nigra (+), EUROP.-SW ASIAT. Amelanchier ovalis Medik. subsp. ovalis (+). Rel. 6: S EUROP. MONT. Silene saxifraga L. (+.2), S EUROP. Helichrysum italicum (Roth) G. Don subsp. italicum (+.2). Rel. 7: EUROSIB:-N AMER. Poa alpina L. subsp. alpina (1.2), SE EUROP. Thesium linophyllon L. (+.3). Rel. 8: EUROP. Anthericum liliago L. (+), (+), MEDIT. Arabis turrita L. (+), EUROP.-SW ASIAT. Rumex scutatus L. subsp. scutatus (+.2), MEDIT. Tanacetum corymbosum (L.) Sch. Bip. subsp. achillae (L.) Greuter (+), OROF. SW-EUROP. Festuca laevigata Gaudin subsp. levigata (+.2), MEDIT. Ononis pusilla L. subsp. pupilla (+), S EUROP.-SW ASIAT. Fumana procumbens (Dunal) Gren. et Godr. (+.2). Rel. 9 : ENDEM. Campanula tanfanii Podlech (+), EUROP. Hieracium bifidum Hoernem. (s.l.) (+), S EUROP. MONT. Astragalus vesicarius L. subsp. vesicarius (+), S EUROP. MONT. Euphrasia salisburgensis Funk ex Hoppe (+), OROF. SW-EUROP. Festuca laevigata Gaudin subsp. laevigata (+.2), MEDIT. Ononis pusilla L. subsp. pupilla (+).

Table 9:

Rel. 2: S EUROP. MONT. Poa molineri Balb. (1.2). Rel. 3: EURASIAT.-AFR. Lotus corniculatus L. subsp. corniculatus (+), MEDIT. MONT. Colchicum lusitanum Brot. (+). Rel. 5: EUROP. Sedum rupestre L. subsp. rupestre (+), S EUROP. Petrorhagia saxifraga (L.) Link subsp. saxifraga (+.2). Rel. 6: S EUROP. MONT. Silene saxifraga L. (+.2), EUROSIB.-N AMER. Arctostaphylos uva-ursi (L.) Spreng. (+.2), ENDEM. Digitalis lutea L. subsp. australis (Ten.) Arcang. (+), ENDEM. Euphrasia italica Wettst (+.2).

Table. 10:

Rel. 1: EURASIAT. Medicago falcata L. subsp. falcata (+), S EUROP. MONT. Poa molineri Balb. (+.2). Rel. 2: S EUROP:-W ASIAT. Buglossoides arvensis (L.) I.M. Johnst. (+), EUROSIB:-N AMER. Rumex acetosella L. subsp. angiocarpus (Murb.) Murb. (+), MEDIT. Vicia sativa L. subsp. nigra (L.) Ehrh (+), MEDIT. MONT. Trifolium phleoides Willd. (+). Rel. 3: C EUROP. Cota tinctoria (L.) J. Gay subsp. australis (R. Fer.) Oberprieler et Greuter (+), EURASIAT. Veronica chamaedrys L. subsp. chamaedrys (+). Rel. 4: S EUROP.-W ASIAT. Convolvulus arvensis L. (+), MEDIT. MONT. Geranium pyrenaicum Burm. f. subsp. pyrenaicum.