

Vegetational and geomorphological analyses of a small biotope particularly important for biodiversity in Central Apennine.

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Abstract

We present here a case study of the application of vegetational and geomorphological analyses as good methodology for the identification of habitats according to Directive 92/43/CEE. This study relates to a biotope known as "Pian delle Melette", which is included in SICIT5210066 "Media Val Casana (Monti Coscerno-Civitella)", and it is realised through an integrated geomorphological and phytosociological approach. The results of this study have allowed its high phytocoenotic diversity to be revealed, which distinguishes this small biotope and increases the knowledge of this Site of Community Importance, recognising two habitats of community interest that have not been described in the previous habitat 6510 "Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)" represented by the associations: *Ranunculo neapolitani-Arrhenatheretum elatioris* subass. *ranunculetosum velutini* and *Centaureo neapolitanae-Arrhenatheretum elatioris* ass. nova hoc. loco and the habitat 91LO "Illyrian oak-hornbeam forests (*Erythronio-Carpinion*)" with *Acer pseudoplatanus* and *Allium ursinum* community. The analyses carried out are, moreover, to be considered of fundamental importance in that they identify the dynamic and chain relationships between the various communities that are fundamental elements for the conservation phase of the whole system through informed management, such that it can take into account the patterns of the communities in the area investigated. It is on this basis that it is necessary to plan the conservational management of these habitats and of the entire landscape that these define.

Key words: phytosociology, geomorphology, habitat conservation, vegetal landscape, vegetation, Natura 2000 network.

Riassunto

Analisi geomorfologiche e vegetazionali di un piccolo biotopo di particolare importanza dell'Appennino Umbro-Marchigiano: il Pian delle Melette, in provincia di Perugia (Italia centrale). Viene presentato un caso studio sull'applicazione delle analisi vegetazionali e geomorfologiche da realizzare come buona pratica per l'individuazione degli habitat sensu Direttiva 92/43/CEE. Lo studio ha riguardato il biotopo denominato Pian delle Melette, rientrante nel SICIT5210066 "Media Val Casana (Monti Coscerno-Civitella)", realizzato mediante un approccio integrato fitosociologico e geomorfologico. I risultati della ricerca hanno permesso di rilevare l'elevata diversità fitocenotica che contraddistingue questo piccolo biotopo e di ampliare le conoscenze del SIC in oggetto riconoscendovi due habitat di interesse comunitario non segnalati in precedenza: l'habitat 6510 "Praterie magre da fieno a bassa altitudine (*Alopecurus pratensis*, *Sanguisorba officinalis*)" rappresentato dalle associazioni: *Ranunculo neapolitani-Arrhenatheretum elatioris* subass. *ranunculetosum velutini* e *Centaureo neapolitanae-Arrhenatheretum elatioris* ass. nova hoc. loco e l'habitat 91LO "Illyrian oak-hornbeam forests (*Erythronio-Carpinion*)" con l'aggruppamento ad *Acer pseudoplatanus* e *Allium ursinum*. Le analisi condotte sono inoltre da ritenersi di fondamentale importanza in quanto individuano i rapporti dinamici e catenali tra le diverse comunità che risultano fondamentali elementi per la fase conservativa degli habitat dell'intero sistema attraverso una gestione consapevole in quanto informata sull'andamento delle comunità nello spazio indagato. E' su questa base che si ritiene necessario impostare la gestione conservativa degli habitat e dell'intero paesaggio che questi definiscono.

Parole chiave: fitosociologia, geomorfologia, conservazione degli habitat, paesaggio vegetale, vegetazione, Rete Natura 2000.

Introduction

The management of habitats as Sites of Community Importance (SCI) and Zones of Special Protection (ZSP) of the Natura 2000 network has the delicate task of recovering and conserving the biological diversity, under the express provisions of Art. 2 of Directive 92/43/EEC, better known as the Habitats Directive. This is the heart of European environmental policy, which has indeed marked a turning point in the prospects for the conservation of biodiversity of the territories of the European Union (EU), and has identified not only animal and vegetation species as subjects for conservation (listed in Annex II), but also the ecosystems, which are identified through their

habitats (Annex I). The conservative management of these has been proposed for the first time worldwide, and indirectly, of the landscapes of which they are a part. In this complex legislative framework, explicit reference is made to phytosociology as the science necessary for the identification and study of the habitats. This thus indirectly acknowledges this discipline as having the role of true synecology through which it indirectly enhances the ability to identify and characterise ecosystems (habitats), although in a vegetational perspective, also allowing a hierarchical classification (syntaxonomy). It should moreover be noted that the EU recognition comes at a time of maximum development of conceptual and methodological phytosociology, crowning its first

century of history. In this period, phytosociology has seen great epistemological development, passing from the study of communities (classical phytosociology) to that of dynamic sequences (synphytosociology), to arrive at analysis of the vegetal landscape (geosynphytosociology).

In this perspective, rare or endangered habitats must be thoroughly investigated regardless of their size and of their present state of conservation.

With this article, we want to focus on a small environment that falls within the SCI SICIT5210066 “*Media Val Casana (Monti Coscerno-Civitella)*”, which is important both in geomorphological-structural terms and in botanical-vegetational terms. Here, we consider hay meadows, which are characterised by high species and phytocoenotic diversity, and which have been conserved to this day due to the periodic cutting and fertilisation. In Italy, these grasslands are found mainly in the alpine and the central-eastern pre-alpine arc from the mesotemperate to the lower supratemperate belt, while they are very rare in central-southern Italy. This is mainly due to the abandonment of traditional cultural practices, which over time has affected vast areas and which has led to the depletion of these communities.

The aim of the present article is the study of the vegetal communities in the plain area of the biotope “*Pian delle Melette*” as a case study of the integrated approach between vegetal communities and the physical characteristics of the environment, in a geomorphological sense.

Environmental characteristics and land management

The area in question is located at an altitude of 579 m, in the village of Caso, in the Municipality of Sant’Anatolia di Narco (in the Province of Perugia), within the Val Casana, in a WNW-ESE direction, cut into the limestone spurs of Mt. Coscerno and Mt. Civitella (Biondi & Ballelli, 1995) in the limestone Umbria–Marche Apennines, within the hydrographic basin the Nera River (Fig. 1).

BIO-CLIMATE CHARACTERISTICS

For the bioclimate characterisation of the territory in question, the temperature and precipitation data that were available for the Norcia and Spoleto thermopluviometric stations were used, which are the closest to the study area. Moreover, the precipitation data from the Scheggino pluviometric station were

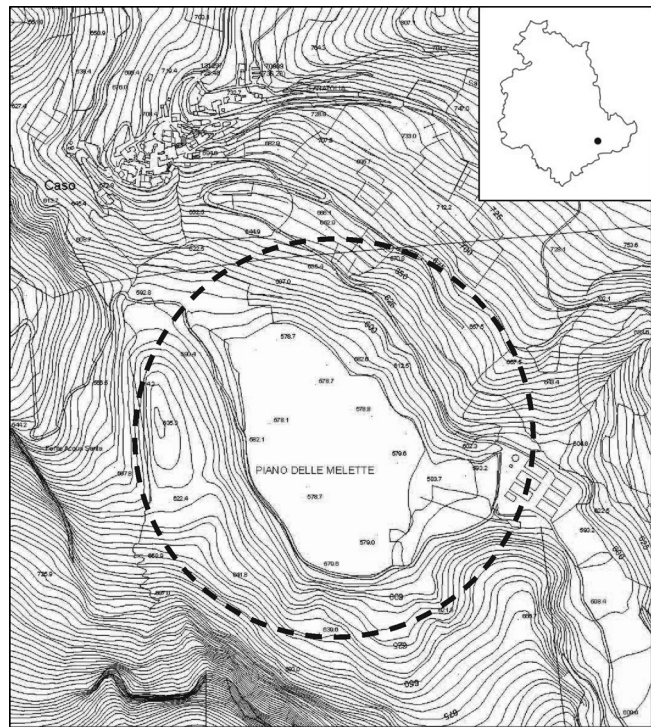


Fig. 1 - Study area.

considered (a 30-year series), which is located a few kilometres from the territory in question (Tab. 1).

As can be seen in the pluviothermic diagrams shown in Figure 2 for the meteorological stations considered, the highest rainfalls were recorded in the autumn and winter, with the lowest in summer. Spoleto station was seen to be the wettest, with 1119 mm of precipitation per year. For the temperature trends, these showed a minimum in winter, a gradual increase in spring, and a maximum in July. From an analysis of the diagrams of the water balance of Thornthwaite (Fig. 2), a water-deficit period can be seen, between 16th July and 11th September for the thermopluviometric station of Norcia, which was more attenuated for that of Spoleto (from 23rd July to 24th August).

According to the bioclimate classification of Rivas-Martinez (2008), the thermopluviometric stations of both Norcia and Spoleto are in the sub-Mediterranean variant of the temperate macroclimate with an oceanic bioclimate, and they are, respectively, in the lower supratemperate bioclimate belt with a lower humid ombrotype, and in the superior mesotemperate bioclimate belt with a lower humid ombrotype.

GEOLOGICAL ASPECTS

The characteristic stratigraphic series of the area is that typical of Umbria–Marche, which has a base of limestone of the carbonaceous platform (limestone

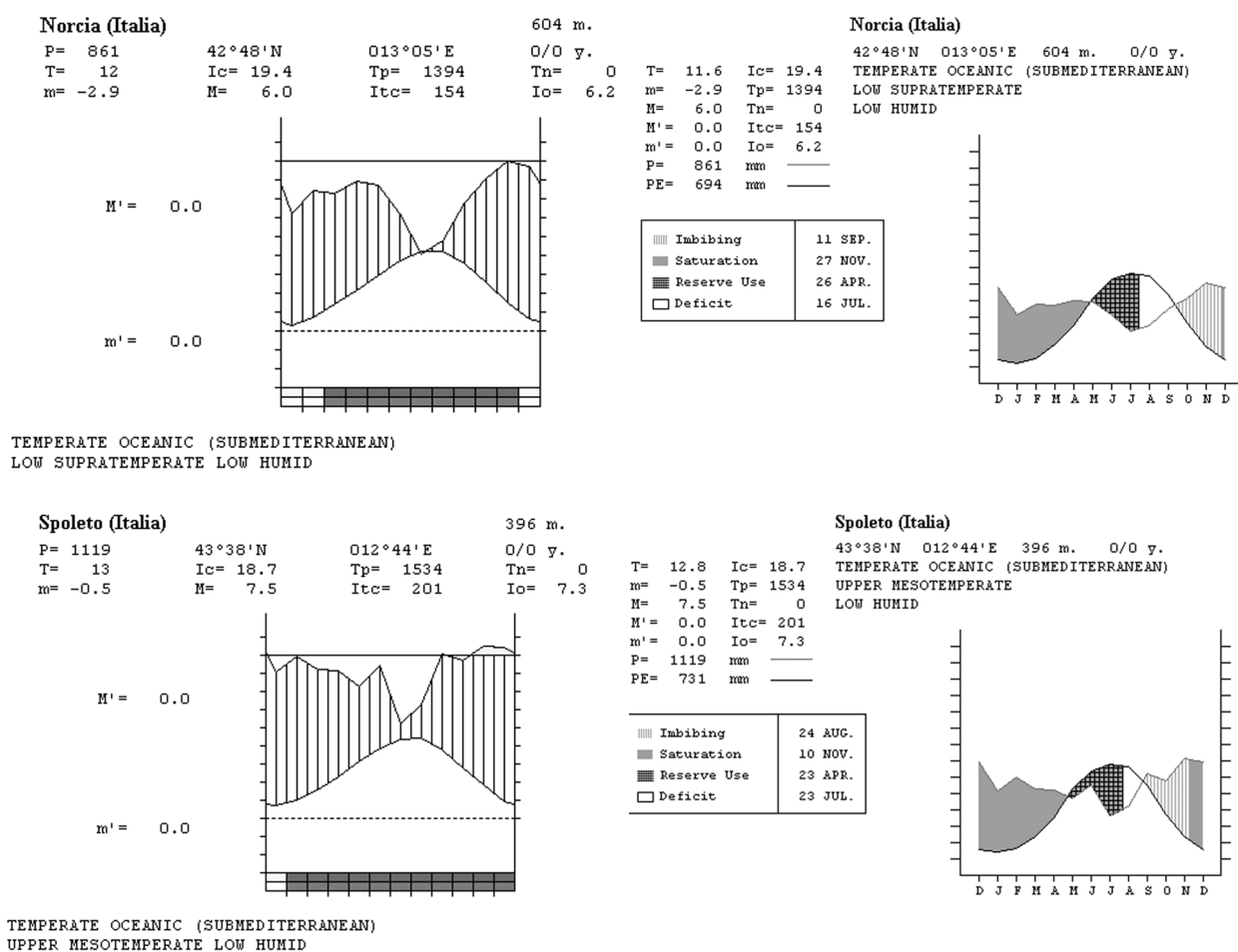
Monthly and yearly average precipitation in mm

Meteorological station	J	F	M	A	M	J	J	A	S	O	N	D	yearly
Norcia (604 m)	62	74	73	79	77	62	41	48	68	82	101	94	861
Spoletto (317 m)	82	98	85	83	73	88	52	63	106	94	152	143	1119
Scheggino (317 m)	61	81	97	101	85	68	31	38	79	111	119	84	955

Monthly and yearly average temperature in °C

Meteorological station	J	F	M	A	M	J	J	A	S	O	N	D	yearly
Norcia (604 m)	1.6	3.5	7.0	10.8	14.8	18.5	21.0	20.9	17.8	12.7	7.6	3.2	11.6
Spoletto (317 m)	3.5	5.1	7.7	11.5	15.6	19.3	21.9	22.2	18.8	13.8	9.3	4.7	12.8

Tab. 1 - Climate data for the Norcia and Spoletto thermopluviometric stations, and the rainfall data from the Scheggino pluviometric station.

Fig. 2 - Pluviothermic diagrams of the water balance and bioclimate classification for the thermopluviothermic stations of Norcia and Spoletto, according to Rivas-Martinez *et al.* (2001).

massif of the lower Lias), and a surface of calcareous-flint and calcareous-marl formations, which are well layered and of a pelagic environment, deposited in the interval between the mid-Lias and the Oligocene (Cornelian to Scaglia Cinerea formations).

From the tectonic point of view, the area is rather complex, being characterised by different asymmetric faulting structure with an eastern convergence, and

an axis in the Apennine direction (at an anticline to Mt. Coscerno, a syncline to Poggiodomo-Usigni, and an anticline to the Corno River). The major anticlines (Mt. Coscerno) are characterised by wide summit areas of sub-horizontal layers and sides from vertical to overturned (particularly on the eastern sides), sometimes overlaid on more recent layers along sub-horizontal planes.

The relaxing Pliocene-Quaternary tectonics gave rise to a system of raised and lowered blocks, as with the Val Casana graben, which were elongated in the direction of the Apennines for about 6.0 km, displacing the pre-existing compressive structures. The faults that were directly responsible for the Val Casana graben have obliquely sectioned the axial zone of the Mt. Coscerno anticline, interrupting the morphological continuity and creating an overall difference in height between the valley floor (Pian delle Melette, altitude 579 m a.s.l.) and the peaks of Mt. Civitella and Mt. Coscerno (1,565 m and 1,684 m a.s.l., respectively), which is comparable to the maximum vertical displacement (about 1,000 m) of the direct faults that border the valley (Fig. 3).

This remarkable height difference, together with the great steepness of the slopes, are factors highly predisposing to gravitational instability and erosion; in effect, the general layout and the morphological evolution of the graben of Val Casana were strongly affected by this height difference (Barchi *et al.*, 1993).

GEOMORPHOLOGICAL ASPECTS

In general, the geomorphological landscape is that typical of mountainous areas of the calcareous Apennine domain, which consists of ridges with wide and almost level summits (Mt. Coscerno, Mt. Civitella, Mt. dell'Eremita, Mt. Bacugno, etc.), that are separated by deep valleys with steep and straight slopes. The systems of direct faults of the graben of Val Casana have influenced the morphology and the drainage system in the area: the opening of the graben led to the formation of the narrow and deep Val Casana, which has a height difference of 1,000 m over less than 2 km horizontal distance and is home to several

gravitational phenomena (detritus flow, landslides, collapses, and deep gravitational deformations of the sides, etc.). There are also numerous active detritus cones in continuous growth, formed from the deposit of the detritus from the slopes that accumulates at the base of the slopes when there is particularly intense rainfall. Inside the Val Casana graben, the deep landslides of Caso, Gavelli and Pian delle Melette have been triggered and have developed (with the last classified as a rock avalanche): the Caso landslide represents complex multiple sliding, also with recent reactivation; the Gavelli landslides are deep slides, within which there were a few minor landslides later on.

Finally, the rock avalanche from the collapse of the detritus of Pian delle Melette is a special case: on the north-eastern slopes of Mt. Civitella (the "Muraglie") at a high angle reverse fault, a block of 2 to 3 million cubic metres detached. This comprised large rocks of the Majolica formation, which reached the valley floor and thus created a natural dam of about 60 to 70 metres in height that completely blocked the Val Casana at the level of the village of Caso (Barchi *et al.*, 1993). As this phenomenon created a trap for the sediment, this led to the formation of Pian delle Melette, which shows in its subcircular form a markedly calcareous substrata (*Formazione della Maiolica*), which can most probably also be related to a karst-like evolution (Figs. 4, 5, 6).

VEGETAL LANDSCAPE AND LAND MANAGEMENT

The vegetal landscape that is characterised by Mt. Coscerno and Mt. Civitella has extensive forest coenoses on the slopes of heights up to 1,560 m in altitude, and vast grasslands that are used for grazing

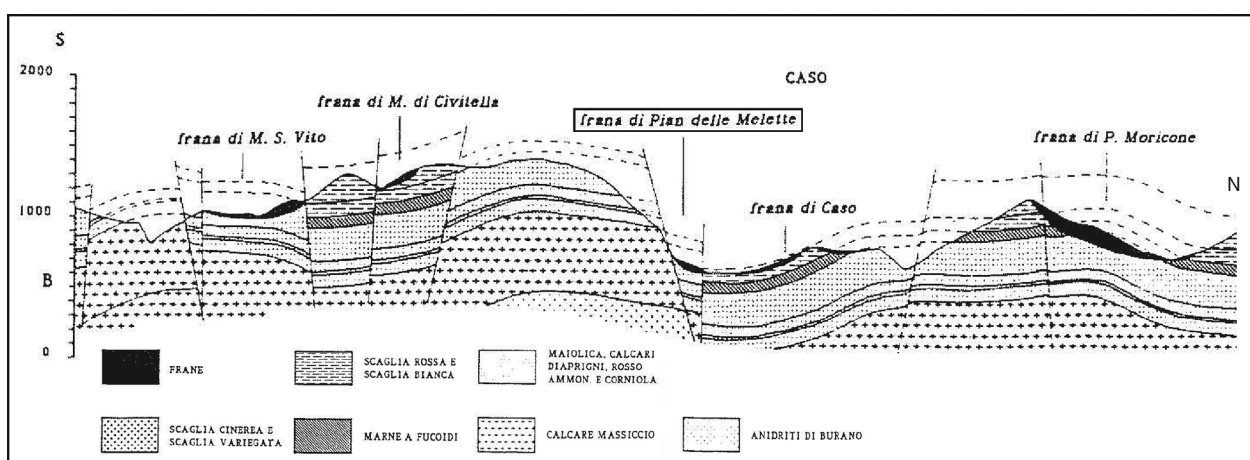


Fig. 3 - Geological section (M. Barchi *et al.*, 1993).



Fig. 4 - Overview of Valcasana from the village of Caso (centre, Pian delle Melette; right, large accumulation from the body of landslide that blocked the valley).

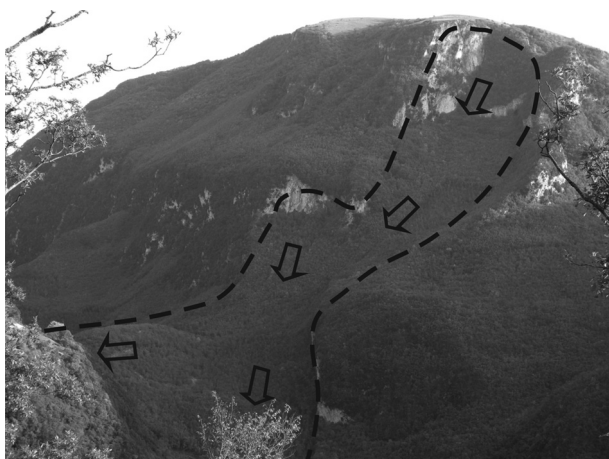


Fig. 5 - The landslide of Pian delle Melette.



Fig. 6 - Rocks of the Majolica formation, where they have accumulated at the foot of the landslide.

that are mainly at the tops of the heights, while the hay meadows are in close proximity to the plains, such as those of Gavelli and Pian delle Melette (Francalancia & Orsomando, 1981; Biondi & Ballelli, 1995). The forests of the hilly bioclimate belt are represented mainly by ash–hop hornbeam woods of the association *Scutellario-Ostryetum carpinifoliae*, everywhere mainly as copses that in the most sunny positions and on slope detritus are replaced by oak woods of *Quercus pubescens* of the sub-alliance *Cytiso-Quercenion pubescentis*. Again in the hilly bioclimate belt, on the less steep or almost flat morphology of the Gavelli Plains there are extended mesophilous turkey oak woods of *Quercus cerris* and *Carpinus betulus* of the association *Carici sylvaticae-Quercetum cerridis* that are sometimes are in contact with hornbeam woods of *Carpinus betulus*. The beech woods on Mt. Coscerno reach 1.560 m in altitude, and according to unpublished data and in agreement with what has been seen for the calcareous Umbria–Marche Apennines (Biondi *et al.*, 2002), they can be included in the associations: *Lathyto veneti-Fagetum sylvaticae* (lower supratemperate bioclimate belt) and *Cardamino kitaibelii-Fagetum sylvaticae* (upper supratemperate bioclimate belt). The grasslands are almost all of secondary origin, except in summit areas subject to cryoturbation, where there are formations of *Sesleria apennina* of the association *Carici humilis-Seslerietum apenninae*. The diversity of the grasslands is strictly linked to the geomorphology. On the rocky areas of the montane bioclimate belt, there are discontinuous meadows of *Sesleria nitida* of the association *Astragalo sempervirentis-Seslerietum nitidae*, and pioneer meadows with chamaephyte signs of the association *Plantago holostei-Helianthemum cani*. On the acidified soils of the flat or slightly depressed morphologies there are the acidophilous grasslands of the class *Nardetea strictae* that connect with the heaths of *Vaccinium myrtillus* of the association *Luzulo sieberi-Vaccinietum myrtilli*. These are represented by the dense grasslands of *Ranunculus pollinensis* of the association of *Senecio scopoli-Ranunculetum pollinensis* and by those of *Nardus stricta* of the association *Poo violaceae-Nardetum strictae*; these last show limited extension and are located in the most depressed morphologies. On the Gavelli Plains near the small lake and on the flat morphology with deep and wet soils there are the hay meadows of *Cynosurus cristatus* of the association *Colchico lusitanici-Cynosuretum cristati* that in the wetter areas are included in the subassociation *ranunculetosum velutini*. Finally, in the most flooded areas, there are the hygrophilous grasslands of the

association *Ranunculo acris-Caricetum hirtae* (Biondi & Ballelli, 1995).

Pian delle Melette in particular is included in a vegetation context of hop hornbeam woods of the association *Scutellario-Ostryetum carpinifoliae*, everywhere mainly as copses that are particularly large on the steep slopes of Mt. Civitella (the hydrographic slopes of the left side of the valley). Along the narrow and enclosed Val Casana that joins with Pian delle Melette and with the Gavelli plains, according to the particular microclimate conditions, the hop hornbeam woods are differentiated by the presence of nemoral species characteristic of the alliance *Tilio-Acerion*. On the slope detritus below the village of Caso at the foot of Mt. Coscerno (the hydrographic slopes of the right side of the valley), there are cultivated fields with small strips of oak woods. Currently, the abandonment of farming has triggered the natural dynamic processes of recovery of the forest vegetation through colonisation of the post-cultivation grasslands of the association *Centaureo bracteatae-Brometum erecti* by mesophilous shrubs from the vegetation mantle. Pian delle Melette below the village of Caso extends over an area of around 8.5 hectares, and it is covered by hay meadows that are divided into many small sections, as can be seen from the cadastral map (Fig. 7). These are natural meadows that are harvested for their hay once or twice a year, depending on the humidity of the summer season (Fig. 8). These activities are carried out by two companies, of which one provides provision for its own stalls. Manure is spread on the plain at the beginning of the winter, and from the late autumn Pian delle Melette is sometimes left for the grazing of livestock (Fig. 9). At the edges of the plain (on the left slopes of the valley) there are wood nuclei of long-trunked *Acer pseudoplatanus*.



Fig. 7 - Cadastral map of Pian delle Melette.



Fig. 8 - Late spring mowing of the meadows.



Fig. 9 - A small flock of sheep grazing on Pian delle Melette during late autumn. In the background the woods of *Acer pseudoplatanus* can be seen.

Materials and methods

The study of the vegetation was conducted according to the classical phytosociological method of the Sigmatista School of Zurich-Montpellier (Braun-Blanquet, 1928; Biondi 2011a), integrated with the most recent acquisitions. For the determination of species and for their biological and chorological characterisation, the following references were used: Flora of Italy (*Flora d'Italia*; Pignatti, 1982), the European Flora (*Flora Europea*; Tutin *et al.*, 1964-1980) and the recent Check-list of Vascular Flora of Italy (*Check-list della flora vascolare d'Italia*; Conti *et al.*, 2005), as appropriate. The chorological type groupings followed Buffa *et al.* (1997): Boreal (Circumbor., Eurosib.; Art-alp., N-Europ. NE-Europ.), Eurasian (Euras.; Paleotemp.; S-Europ.-S-Siber),

European (Europ. [C-S-CN-EC-CS]; Europ-Caucas.) Atlantic (Atl.; Sub-Atl., W and NW Europ., Medit-Atl.), Orophyte (Oroph.-Europ., Oroph. S-Europ.; Oroph. SE-Europ.; Oroph. SW-Europ.; Medit.-Mont.), Oriental (Pontic, Medit-Pontic; Illyrian, SE-Europ.; E-Europ., SE-Europ.-S-Siber.), Mediterranean (Eurimedit.; Stenomedit.; Medit.; Medit.-Turan.), Endemic (Endem.), Cosmopolitan (Cosmop., Subcosmop.), and Exotic (adventitious, cultivated species).

Results

THE MESOHYGROPHILOUS AND MESOPHILOUS HAY MEADOWS OF *ARRHENATHERUM ELATIUS*

Ranunculo neapolitani-Arrhenatheretum elatioris Allegrezza & Biondi 2011

ranunculetosum velutini Allegrezza & Biondi 2011

This is a mesohygrophilous and mesophilous dense hay meadow that can reach 1.5 m in height, with a dominance of *Arrhenatherum elatius* (Tab. 2) marked by the conspicuous cover of *Ranunculus velutinus*, *Salvia pratensis*, *Bellis perennis*, *Centaurea nigrescens* ssp. *neapolitana* and *Taraxacum officinale*. The actual biological spectrum (Fig. 10) shows high hemicryptophyte levels, followed by terophytes and by geophytes, with the other biological categories poorly represented. The actual chorological spectrum performed on the basis of the grouping of the categories indicated (Fig. 10), is seen as mainly the Eurasiatic group, followed by that Mediterranean, in analogy with what was shown for the whole of the phytocoenoses of *Arrhenatherum elatius* of central Italy (Allegrezza & Biondi, 2011).

The recent syntaxonomical revision of the grasslands of *Arrhenatherum elatius* in central Italy (Allegrezza & Biondi, 2011) allowed us to propose the alliance *Ranunculo neapolitani-Arrhenatherion elatioris*, vicariant in central Italy of the central-European alliance *Arrhenatherion elatioris* Koch 1926. For the alliance *Ranunculo neapolitani-Arrhenatherion elatioris*, the characteristic and differential species are considered as: *Arrhenatherum elatius*, *Ranunculus neapolitanus*, *Centaurea nigrescens* ssp. *neapolitana*, *Achillea collina*, *Pastinaca sativa* ssp. *urens*, *Ranunculus velutinus*, *Heracleum spondylium* ssp. *ternatum*, *Dasyphyrum villosum* and *Rhinanthus personatus*. For central Italy, its recognised associations are: *Ranunculo neapolitani-Arrhenatheretum elatioris*, *Festuco circummediterraneae-Arrhenatheretum elatioris* and *Pastinaco urentis-Arrhenatheretum elatioris*.

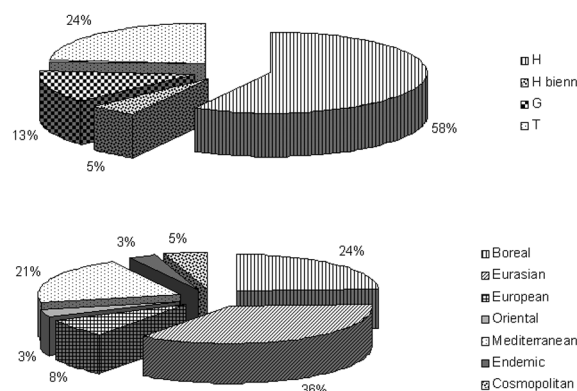


Fig. 10 - Biological and chorological spectrum related to the meadow under study.

The phytosociological relevés of the *Arrhenatherum elatius* grasslands of the study territory that were used in the syntaxonomical review, are included in the association *Ranunculo neapolitani-Arrhenatheretum elatioris*, which is considered *typus* of the alliance, and in the subassociation *ranunculetosum velutini*, which refers to the grasslands of *Arrhenatherum elatius* of the terrains subjected to prolonged water stagnation. The subassociation *ranunculetosum velutini* expresses the connection of the *Arrhenatherum elatius* grasslands of the association *Ranunculo neapolitani-Arrhenatheretum elatioris* with the flooded grasslands of *Ranunculus velutinus* of the alliance *Ranunculion velutini*.

FLOODED GRASSLANDS OF *RANUNCULUS VELUTINUS*

Centaureo neapolitanae-Ranunculetum velutini ass. nova hoc loco

(Table 3 rel. *typus* no. 2)

In the depressions of the plain that sometimes take on a dendroform morphology (a network of surface drainage) that perhaps follows the ancient channels that have not been cleared, the rainwater stagnates for most of the year. In these places there are dense flooded grasslands with a dominance of *Ranunculus velutinus* (Tab. 3) with *Centaurea nigrescens* ssp. *neapolitana*, *Bromus hordeaceus*, *Poa pratensis*, *P. trivialis*, *Trifolium repens*, *T. pratense*, *Carex hirta*, and *Equisetum telmateja*, etc.. The height of the vegetation varies from a few centimetres (Tab. 3, rel. 1) to about a metre (Tab. 3, rels. 2, 3), while the species diversity remains relatively low.

This vegetation is included in the new association *Centaureo neapolitanae-Ranunculetum velutini*, for which the characteristic species are *Ranunculus velutinus* and *Centaurea nigrescens* ssp. *neapolitana*,

Tab. 2 - *Ranunculo neapolitani-Arrhenatheretum elatioris* Allegrezza & Biondi 2011
subass. *ranunculetosum velutini* Allegrezza & Biondi 2011

Life form	Chorotype	Rel. n. Slope (°) Coverage (%) Area (m ²) n. sp. x rel. height (m)	1	2	3	P
			-	-	-	r
			100	100	100	e
			27	22	28	s
			1.20	1.20	1.50	
Charact. and diff. species of the ass. and the subass.						
H scap	EURI-MEDIT	<i>Salvia pratensis</i> L.	3.4	2.2	3.3	3
H ros	EUROP.-CAUC.	<i>Bellis perennis</i> L.	2.2	2.2	2.2	3
H ros	CIRCUMBOR.	<i>Taraxacum officinale</i> Weber (aggregato)	+2	1.1	1.1	3
H scap	EUROSIB.	<i>Tragopogon pratensis</i> L./orientale	1.1	+	+	3
T scap	EURASIAT.	<i>Geranium dissectum</i> L.	+	+	+	3
G rhiz	CIRCUMBOR.	<i>Equisetum telmateja</i> Ehrh.	2.3	2.2	.	2
G bulb	EURI-MEDIT	<i>Ornithogalum umbellatum</i> L.	2.2	+	.	2
Charact. and diff. species of the <i>Ranunculo neapolitani-Arrhenatherion elatioris</i> all.						
H caesp	PALEOTEMP.	<i>Arrhenatherum elatius</i> (L.) Presl	4.5	5.5	3.4	3
H scap	EURI-MEDIT	<i>Ranunculus velutinus</i> Ten.	2.2	2.2	2.2	3
H scap	ENDEM.	<i>Centaurea nigrescens</i> Willd. ssp. <i>neapolitana</i> (Boiss.) Dostal	2.2	1.2	3.3	3
Charact. species of the <i>Arrhenatheretalia</i> ord. and the <i>Molinio-Arrhenatheretea</i> class						
H scap	EUROSIB.	<i>Trifolium pratense</i> L.	3.4	2.3	2.3	3
H caesp	CIRCUMBOR.	<i>Lolium perenne</i> L.	2.2	+	2.3	3
H caesp	CIRCUMBOR.	<i>Poa pratensis</i> L.	3.4	2.2	4.5	3
H caesp	PALEOTEMP.	<i>Dactylis glomerata</i> L.	2.3	2.2	2.2	3
H ros	EURASIAT.	<i>Plantago lanceolata</i> L.	+	+	1.1	3
T scap	PALEOTEMP.	<i>Medicago lupulina</i> L.	1.2	1.2	+	3
T scap	SUBCOSMOP.	<i>Bromus hordeaceus</i> L.	3.4	2.3	.	2
H scap	EUROSIB.	<i>Leucanthemum vulgare</i> Lam.	+	.	+	2
T scap	EUROP.-CAUC.	<i>Myosotis arvensis</i> (L.) Hill	+	.	+	2
H scap	EUROSIB.	<i>Lychnis flos cuculi</i> L.	+	.	.	1
H scap	PALEOTEMP.	<i>Lotus corniculatus</i> L.	1.2	.	.	1
H caesp	EURASIAT.	<i>Poa trivialis</i> L.	.	2.2	.	1
H rept	PALEOTEMP.	<i>Trifolium repens</i> L.	.	.	2.2	1
G rhiz	EUROP.-CAUC.	<i>Carex hirta</i> L.	.	.	+	1
H caesp	CIRCUMBOR.	<i>Festuca rubra</i> L. gr.	.	.	2.2	1
Other species						
H scap	EURASIAT.	<i>Cruciata laevipes</i> Opiz	1.2	1.2	.	2
G rhiz	PALEOTEMP.	<i>Convolvulus arvensis</i> L.	1.1	+	.	2
H scap	EURASIAT.	<i>Medicago sativa</i> L.	2.2	+	.	2
T scap	EURI-MEDIT	<i>Sherardia arvensis</i> L.	+	.	+	2
H bienn	PALEOTEMP.	<i>Silene alba</i> (Miller) Krause	.	+	+	2
T scap	MEDIT.-TURAN.	<i>Vicia sativa</i> L.	+	.	.	1
H scap	SE-EUROP.	<i>Centaurea bracteata</i> Scop.	+	.	.	1
G bulb	EURI-MEDIT	<i>Leopoldia comosa</i> (L.) Parl.	.	.	+	1
H bienn	PALEOTEMP.	<i>Daucus carota</i> L.	.	.	+	1
T rept	COSMOP.	<i>Stellaria media</i> (L.) Vill.	.	.	+	1
T scap	EURI-MEDIT	<i>Trifolium nigrescens</i> Viv.	.	.	+2	1
T scap	PALEOTEMP.	<i>Trifolium campestre</i> Schreber	.	.	+	1
H scap	W-EURI-MEDIT.	<i>Potentilla hirta</i> L.	.	.	+	1

while *Poa trivialis* and *Trifolium repens* take on the role of the differential species with respect to the vegetation of *Arrhenatherum elatius*, to which there are of course added all of the species indicated as part of the specific complex that is characteristic of the association of this last type of vegetation.

From the phytosociological point of view, this community cannot be referred to the alliance *Ranunculion velutini*, in that there is a lack of all of the species of the order *Trifolio-Hordeetalia* identified in the flooded grasslands that occupying the bottom of the karst basins of Umbria and Marche (Pedrotti, 1976) and are widespread in other mountainous areas

of central Italy, under similar ecological conditions (Canullo *et al.* 1988, Pedrotti *et al.* 1992; Venanzoni, 1992). However, this vegetation still has a consistent group of species of the order *Arrhenatheretalia*, which allows this association to be included in this order and in the alliance *Ranunculo neapolitani-Arrhenatherion elatioris*.

RUDERAL GRASSLANDS OF *AGROPYRON REPENS*

Agropyro-Dactyletum Ubaldi 1976

In the investigated area, the grasslands of *Agropyron repens* (Tab. 4) occupy the positions on the plain with steeper slopes, where the substrata is subjected

Tab. 3 - *Centaureo neapolitanae-Ranunculetum velutini* ass. nova hoc loco (typus rel. n. 2)

Life form	Chorotype	Rel. n.	1	2*	3	P r e s
		Slope (°)	-	-	-	
		Coverage (%)	100	100	100	
		Area (m ²)	200	200	60	
		n. sp. x rel. height (m)	16	9	12	
			00.08	1.00	1.20	
		Charact. and diff. species of the ass. and the <i>Ranunculo neapolitani-Arrhenatherion elatioris</i> all.				
H scap	EURI-MEDIT.	Ranunculus velutinus Ten.	5.5	4.5	1.2	3
H scap	ENDEM.	Centaurea nigrescens Willd. ssp. neapolitana (Boiss.) Dostal	2.2	4.4	1.2	3
H caesp	EURASIAT.	Poa trivialis L.	1.1	.	5.5	2
H rept	PALEOTEMP.	Trifolium repens L.	.	3.3	3.4	2
		Charact. species of the <i>Arrhenatheretalia</i> ord. and the <i>Molinio-Arrhenatheretea</i> class				
H caesp	CIRCUMBOR.	Lolium perenne L.	2.2	2.3	2.2	3
H scap	EUROSIB.	Trifolium pratense L.	2.2	1.2	1.2	3
H caesp	CIRCUMBOR.	Poa pratensis L.	3.3	3.3	.	2
T scap	SUBCOSMOP.	Bromus hordeaceus L.	3.3	2.3	.	2
H caesp	PALEOTEMP.	Dactylis glomerata L.	2.2	.	2.3	2
H ros	CIRCUMBOR.	Taraxacum officinale Weber (aggregato)	.	1.1	1.1	2
H scap	EUROSIB.	Leucanthemum vulgare Lam.	+	.	.	1
G bulb	W-MEDIT.-MONT.	Colchicum lusitanum Brot.	+2	.	.	1
H caesp	EUROP.(SUBATL.)	Avenula pratensis (L.) Dumort.	+	.	.	1
H caesp	PALEOTEMP.	Arrhenatherum elatius (L.) Presl	+	.	.	1
H scap	EUROSIB.	Tragopogon pratensis L.	+	.	.	1
G rhiz	EUROP.-CAUC.	Carex hirta L.	.	2.2	.	1
H ros	EUROP.-CAUC.	Bellis perennis L.	.	.	1.2	1
		Other species				
G rhiz	CIRCUMBOR.	Equisetum telmateja Ehrh.	2.3	.	.	1
G rhiz	PALEOTEMP.	Convolvulus arvensis L.	+	.	.	1
T scap	SUBTROP.	Bromus rigidus Roth	+	.	.	1
T rept	COSMOP.	Stellaria media (L.) Vill.	.	.	+	1
H ros	EURASIAT.	Plantago media L.	.	.	1.2	1
H scap	EUROP.-CAUC.	Ranunculus lanuginosus L.	.	.	+	1

Tab. 4 - *Agropyro-Dactyletum* Ubaldi 1976

Life form	Chorotype	Rel. n.	1
		Slope (°)	-
		Coverage (%)	100
		Area (m ²)	80
		height (m)	0.65
		Charact. and diff. species of the ass.	
G rhiz	CIRCUMBOR.	Agropyron repens (L.) Beauv.	5.5
G rad	EURASIAT.	Cirsium arvense (L.) Scop.	1.2
H caesp	PALEOTEMP.	Dactylis glomerata L.	+
H scap	EUROSIB.	Picris hieracioides L.	+
H bienn	CENTRO-EUROP.	Anthemis tinctoria L.	+
H ros	PALEOTEMP.	Potentilla reptans L.	+
		Charact. and diff. species of the <i>Convolvulo-Agropyron repentis</i> all., the <i>Agropyretalia repentis</i> ord. and the <i>Artemisietea vulgaris</i> class	
H caesp	EURASIAT.	Poa trivialis L.	4.4
G rhiz	PALEOTEMP.	Convolvulus arvensis L.	2.2
H bienn	PALEOTEMP.	Silene alba (Miller) Krause	+
G bulb	EURI-MEDIT	Leopoldia comosa (L.) Parl.	+
H bienn	PALEOTEMP.	Daucus carota L.	+
		Charact. species of the <i>Molinio-Arrhenatheretea</i> class	
H scap	EURI-MEDIT	Ranunculus velutinus Ten.	1.2
H scap	ENDEM.	Centaurea nigrescens Willd. ssp. neapolitana (Boiss.) Dostal	2.3
H scap	EUROSIB.	Trifolium pratense L.	1.2
H caesp	CIRCUMBOR.	Lolium perenne L.	+
H caesp	CIRCUMBOR.	Poa pratensis L.	1.2
H ros	CIRCUMBOR.	Taraxacum officinale Weber (aggregato)	+
T scap	SUBCOSMOP.	Bromus hordeaceus L.	1.2
H scap	EUROSIB.	Leucanthemum vulgare Lam.	1.1
		Other species	
T scap	EURI-MEDIT	Sherardia arvensis L.	+
T scap	EURASIAT.	Geranium molle L.	+
T scap	PALEOTEMP.	Veronica arvensis L.	+
T scap	PALEOTEMP.	Trifolium campestre Schreber	+
H scap	W-EURI-MEDIT.	Potentilla hirta L.	+
P caesp	EUROP.-CAUC.	Ulmus minor Miller pl.	1.2

to a prolonged dry period. The dominant *Agropyron repens* is accompanied by post-cultivation ruderal species of the alliance *Convolvulo-Agropyron*, the order *Agropyretalia repentis*, to which the vegetation in question is referred. These include: *Convolvulus arvensis*, *Cirsium arvense*, *Picris hieracioides*, *Anthemis tintoria*, and *Silene alba*, etc., and numerous transgressives of the class *Molinio Arrhenatheretea*, which show chain contact with the *Arrhenatherum elatius* grassland.

On the basis of the only relevé carried out (Tab. 4), we can assume that this vegetation belongs to the association *Agropyro-Dactyletum*, as described by Ubaldi (1976) for the hilly areas of the province of Pesaro and Urbino, and in southern Romagna and around Bologna, even though here for Pian delle Melette there is the persistence of a consistent contingent of mesohygrophilous species of the *Arrhenatheretalia*. In effect, the *Agropyron repens* grassland of Pian delle Melette are generally made up of relatively stable communities, while the analogous formations of *Agropyron repens* on the land recently abandoned by farming below the village of Caso, on the eastern edge of Pian delle Melette, are in dynamic connection with grasslands of *Bromus erectus* of the association *Centaureo bracteatae-Brometum erecti*.

CONSIDERATIONS AROUND THE WET GRASSLANDS INVESTIGATED

From a structural point of view, Pian delle Melette is comparable to the karst plains of the central Apennines, with which it shares a similar flora and vegetational matrix, represented by the presence of wet and flooded hay grasslands. The study of these grasslands that are found at the bottom of the karst basins of Umbria and Marche (Pedrotti, 1976) has led to the definition of the alliance *Ranunculion velutini*, for which there is recognised the only characteristic species of *Ranunculus velutinus*, to which is linked with a certain consistently some characteristics species of the order *Trifolio Hordeetalia*, such as: *Gaudinia fragilis*, *Orchis laxiflora*, *Ophiogossum vulgatum*, *Oenanthe media*, *Festuca arundinacea*, *Trifolium patens*, and *T. fragiferum* (Pedrotti, 1976). From the same alliance, two associations are recognised: *Hordeo secalini-Ranunculetum velutini* and *Deschampsio-Caricetum distantis*. These are also found in other Apennine areas with analogous ecological conditions (Canullo *et al.* 1988, Pedrotti *et al.* 1992; Venanzoni, 1992). In the hay meadows of *Cynosurus cristatus* that develop on the deep and humid soils of the Gavelli Plains, and in the same mountain group in question,

although at higher altitudes, Ballelli & Biondi (1995) also found *Ranunculus velutinus*, although in a different ecological and floristic context, due to which they included these corresponding relevés in the subassociation *ranunculetosum velutini*, of the association *Colchico lusitanici-Cynosuretum cristati*, which therefore indicates the connection of the *Cynosurus cristatus* grasslands with the grasslands of the alliance *Ranunculion velutini* that cannot, however, be ascertained for the area. In the Pian delle Melette area, the morphological variations of the flat sections have created the ecological conditions of the water gradient that is essential to enable the development of distinct grassland phytocoenoses, represented by formations of *Arrhenatherum elatius*, similar to those revealed by Pedrotti (1963) in other flatlands of the central Apennines where there are, however, sporadic occurrences of *Ranunculus velutinus*.

In connection with the formations of *Arrhenatherum elatius*, in areas of the plain characterised by more depressed sections and therefore on terrain that remains flooded for longer periods of time, the populations that develop are those dominated by *Ranunculus velutinus*, reported for the association of *Centaureo neapolitanae-Ranunculetum velutini*, in which there is a lack of the characteristic species of the order *Trifolio-Hordeetalia*, while a consistent quota of species of *Arrhenatheretalia* is maintained, which is the order to which this association is referred.

THE TALL TREE FOREST VEGETATION OF *ACER PSEUDOPLATANUS* AND *ALLIUM URSINUM*

Acer pseudoplatanus and *Allium ursinum* community

In the area investigated, at the edge of the plain with the hay meadows, there is a wood of tall trees (about 25 m high) of various ages that is very dense and with a dominance of *Acer pseudoplatanus* with *A. campestre* and *Corylus avellana* (Tab. 5).

Although this covers only about 1.2 hectares, it is extremely relevant as it is very rare for the area of the central Apennines. In this wood, ivy is particularly abundant (*Hedera helix*), which is wrapped around the trees and tall shrubs. The herbaceous layer is characterised by a dense cover of nemoral species, dominant among which there is *Allium ursinum*, which is accompanied by: *Pulmonaria apennina*, *Milium effusum*, *Brachypodium sylvaticum*, *Melica uniflora* and *Viola odorata*. The richness of organic matter in the soil is demonstrated by the presence of nitrophilous species, such as: *Chaerophyllum hirsutum*, *Lamium maculatum*, and *Urtica dioica*, etc..

From the syntaxonomical perspective, the

Tab. 5 - *Acer pseudoplatanus* and *Allium ursinum* community

		Rel. n.	1
		Exposure	NO
Life form	Chorotype	Slope (°)	5
		Coverage arboreus layer (%)	80
		Coverage herbaceous layer (%)	100
		Area (m ²)	400
		height (m)	25
P scap	EUROP.-CAUC.	<i>Acer pseudoplatanus</i> L.	4.5
P scap	EUROP.-CAUC.	<i>Acer campestre</i> L.	2.2
G bulb	EURASIAT.	<i>Allium ursinum</i> L.	5.5
		Charact. and diff. species of the <i>Pulmonario-Carpinion</i> suball. and the <i>Erythronio-Carpinion</i> all.	
H scap	ENDEM.	<i>Pulmonaria apennina</i> Cristof. & Puppi	2.3
H scap	EUROP.-CAUC.	<i>Ranunculus lanuginosus</i> L.	1.1
G rhiz	CIRCUMBOR.	<i>Milium effusum</i> L.	1.2
H scap	EUROP.	<i>Lunaria rediviva</i> L.	+
		Charact. species of the <i>Fagetalia sylvaticae</i> ord. and the <i>Quercu-Fagetea</i> class	
P caesp	EUROP.-CAUC.	<i>Corylus avellana</i> L.	2.2
P scap	PONTICO	<i>Prunus avium</i> L.	+
P lian	EURIMEDIT.	<i>Hedera helix</i> L.	2.3
H caesp	PALEOTEMP.	<i>Brachypodium sylvaticum</i> (Hudson) Beauv.	1.2
H caesp	PALEOTEMP.	<i>Melica uniflora</i> Retz.	1.2
H ros	EURIMEDIT.	<i>Viola odorata</i> L.	1.2
T scap	SUBCOSMOP.	<i>Geranium robertianum</i> L.	+2
Ch suffr	EUROP.-CAUC.	<i>Euphorbia amygdaloides</i> L.	+
		Other species	
H scap	EUROP.-CAUCAS.	<i>Chaerophyllum hirsutum</i> L.	2.3
G rhiz	EURIMEDIT.	<i>Ruscus aculeatus</i> L.	+2
P scap	AVV.	<i>Juglans regia</i> L. pl.	+
H scap	EURASIAT.	<i>Lamium maculatum</i> L.	1.2
H scap	SUBCOSMOP.	<i>Urtica dioica</i> L.	2.2
H scap	CIRCUMBOR.	<i>Geum urbanum</i> L.	+
H scap	EURASIAT.	<i>Chelidonium majus</i> L.	+
P caesp	EURASIAT.	<i>Euonymus europaeus</i> L.	1.1
Ch suffr	SUBATL.	<i>Helleborus foetidus</i> L.	+
T scap	EURASIAT.	<i>Galium aparine</i> L.	+
P caesp	EUROP.-CAUC.	<i>Prunus spinosa</i> L.	+

community of *Acer pseudoplatanus* revealed is included in the alliance *Erythronio-Carpinion betuli* and the endemic suballiance *Pulmonario apenninae-Carpinion betuli*.

TEROPHYTIC VEGETATION OF THE MARGINS AND THE FOREST CLEARINGS

Geranium lucidum community

At the margin of the maple woods of *Acer pseudoplatanus* and along the paths that cross the plain and run through the clearings of the forest vegetation, there is a terophytic community that is dense, nitrophilous and sciaphilous, with a dominance of *Geranium lucidum* (Tab. 6) that can be considered an impoverished aspect of the vegetation included in the alliance *Cardaminion graecae* described for the limestone formations of the Umbria–Marche Apennines (Biondi *et al.* 2004).

The vegetational succession

Figure 11 shows the distribution of vegetation typologies that are found along a transect across Pian delle Melette. At the edge of the plain, there is a wood with long-trunked trees of *Acer pseudoplatanus* and *Allium ursinum* that connects with the herbaceous, terophytic, sciaphilous and nitrophilous community of *Geranium lucidum*.

In the central area of the plain that is covered by the hay meadows there are the *Arrhenatherum elatius*

Syntaxonomical scheme

GERANIO PURPUREI-CARDAMINETEA HIRSUTAE (Rivas-Martínez, Fernández-González & Loidi 1999) Rivas-Martínez *et al.* 2001

+*Geranio purpurei-Cardaminetalia hirsutae* Brullo in Brullo & Marcenò 1985

**Cardaminion graecae* Biondi, Pinzi & Gubellini 2004

Geranium lucidum community

ARTEMISIETEA VULGARIS Lohmeyer, Preising & Tüxen ex von Rochow 1951

+*Agropyretalia repentis* Oberdorfer, Müller & Görs in Oberdorfer, Görs, Korneck, Lohmeyer, Müller, Philippi & Seibert 1967

**Convolvulo-Agropyron repentis* Görs 1966

Agropyro-Dactyletum Ubaldi 1976

MOLINIO-ARRHENATHERETEA Tüxen 1937

+*Arrhenatheretalia* Tüxen 1931

**Ranunculo neapolitani-Arrhenatherion elatioris* Allegrezza & Biondi 2011

Ranunculo neapolitani-Arrhenatheretum elatioris Allegrezza & Biondi 2011

ranunculetosum velutini Allegrezza & Biondi 2011

Centaureo neapolitanae-Ranunculetum velutini ass. nova hoc loco

QUERCO-FAGETEA Br.-Bl. & Vlieger in Vlieger 1937

+*Fagetalia sylvaticae* Pawlowski in Pawlowski, Sokolowski & Wallisch 1928

**Erythronio dentis-canis-Carpinion betuli* (Horvat 1958) Marinček in Wallnöfer, Mucina & Grass 1993

***Pulmonario apenninae-Carpinion betuli* Biondi, Casavecchia, Pinzi, Allegrezza & Baldoni 2002

Acer pseudoplatanus and *Allium ursinum* community

Tab. 6 - *Geranium lucidum* community

Life form	Chorotype	Rel. n. Slope (°) Coverage (%) Area (m ²)	5 - 90 5	8 - 100 10	P r e s
T scap	EURIMEDIT.	<i>Geranium lucidum</i> L.	5.5	4.5	2
T scap	EURASIAT.	<i>Geranium dissectum</i> L.	+	.	1
T scap	SUBCOSMOP.	<i>Geranium robertianum</i> L.	.	3.3	1
Other species					
G rhiz	S-EUROP.-SUDESIB.	<i>Lathyrus venetus</i> (Miller) Wohlf.	+	+	2
T scap	EURASIAT.	<i>Galium aparine</i> L.	1.2	+	2
H bienn	PALEOTEMP.	<i>Alliaria petiolata</i> (Bieb.) Cavara et Grande	+2	+2	2
T scap	EURIMEDIT.	<i>Bromus gussonei</i> Parl.	1.2	1.1	2
H scap	EURASIAT.	<i>Lamium maculatum</i> L.	1.2	1.1	2
H ros		<i>Viola alba</i> Besser ssp. <i>dehnhardtii</i> (Ten.) W. Becker	+	.	1
T scap	PALEOTEMP.	<i>Medicago lupulina</i> L.	+	.	1
T scap	CIRCUMBOR.	<i>Fallopia convolvulus</i> (L.) Holub	+	.	1
G bulb	EURASIAT.	<i>Ranunculus ficaria</i> L.	+	.	1
H scap	CIRCUMBOR.	<i>Geum urbanum</i> L.	+	.	1
H bienn	S-EUROP.-SUDESIB.	<i>Arabis turrita</i> L.	.	1.1	1
H ros	EURIMEDIT.	<i>Silene italica</i> (L.) Pers.	.	+2	1
Ch suffr	SUBATL.	<i>Helleborus foetidus</i> L.	.	+	1
H caesp	EURASIAT.	<i>Poa trivialis</i> L.	.	+	1
H scap	EURASIAT.	<i>Cruciata glabra</i> (L.) Ehrend.	.	+	1
H scap	EURASIAT.	<i>Chelidonium majus</i> L.	.	+	1

grasslands (*Ranunculo neapolitani-Arrhenatheretum elatioris* subass. *ranunculetosum velutini*) at the slightly greater altitudes, and therefore characterised by a shorter period of water stagnation than the areas occupied by phytocoenoses of *Ranunculus velutinus* (*Centaureo neapolitanae* - *Ranunculetum velutini*), which are found in the most depressed areas (1-2 m) Finally, there are the *Agropyron* grasslands of *Agropyron repens* (*Agropyro-Dactyletum*) that occupy the areas where the soil is drier, perhaps because of the accumulation of material due to erosion of the slopes, especially from those affected by agricultural activities. The plain therefore shows three typologies of grassland phytocoenoses that are interlinked by chain relationships (microgeosigmetum *sensu* Biondi *et al.*, 2004) based on the micromorphology of the flat area that determines the differences in the annual water gradients.

Conclusions

Pian delle Melette is included in SICIT5210066 “Media Val Casana (Monti Coscerno-Civitella)” (Fig. 12), for which there have at present been recognised the Habitats of Community Interest (SCIs) that are listed below (www.biodiversita.regione.umbria.it):

5130 “*Juniperus communis* formation of heaths or calcareous grassland”;

6210 “Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites);

8130 “western Mediterranean and thermophilous scree”;

8210 “calcareous rocky slopes with casmophytic vegetation;

8310 “Caves not open to the public”;

9340 “*Quercus ilex* and *Quercus rotundifolia*

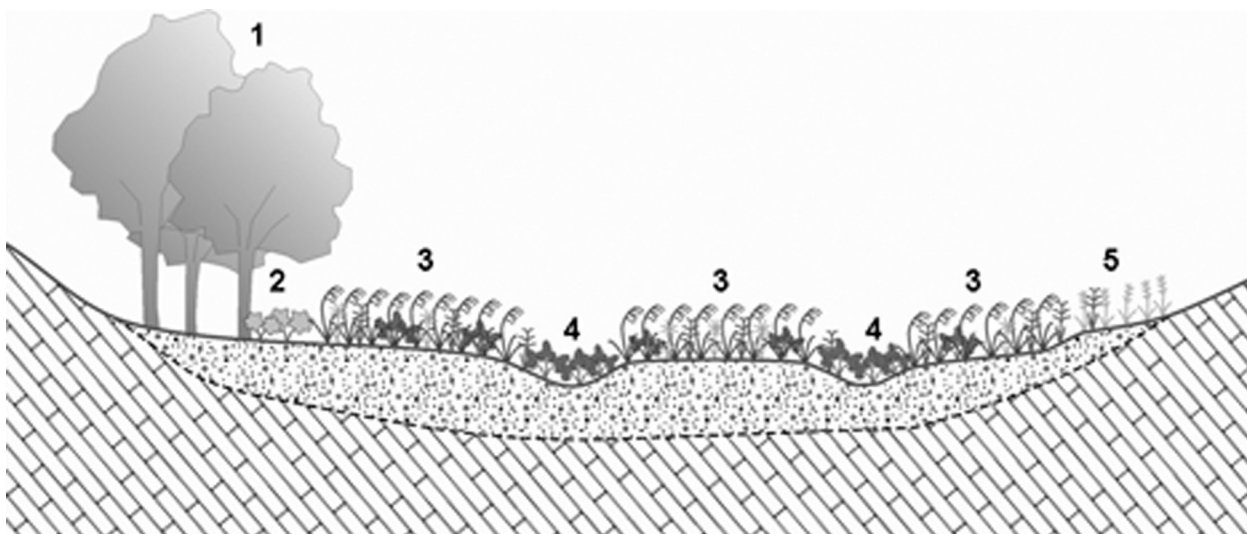


Fig. 11 - Vegetation succession (microgeosigmetum) along a transect across Pian delle Melette: 1) *Acer pseudoplatanus* and *Allium ursinum* community; 2) *Geranium lucidum* community; 3) *Ranunculo neapolitani-Arrhenatheretum elatioris* subass. *ranunculetosum velutini*; 4) *Centaureo neapolitanae-Ranunculetum velutini*; 5) *Agropyro-Dactyletum*.

forests”;

*9210 “Apennine beech forests with *Taxus* and *Ilex*.”

The phytosociological survey carried out shows the high level of diversity that distinguishes Pian delle Melette, and it has allowed us to improve our knowledge of this SCI. In the study area, two other habitats have been identified that are described below. This is habitat 6510 “hay meadows at low altitude (*Alopecurus pratensis*, *Sanguisorba officinalis*” in which, according to the Italian manual of interpretation (Biondi & Blasi, 2009; Biondi, 2011) there are also the *Arrhenatherum elatius* grasslands and the other hay meadows of wet and flooded environments. This habitat has not been specified for the SCI, even though the grassland typology, which is also without a precise phytosociological indication, should have been revealed previously in reports on the vegetation of Umbria (Francalancia & Orsomando, 1981 e Orsomando *et al.*, 1998).

The other habitat identified that had not been reported previously is 91LO “Illyrian oak-hornbeam forests (*Erythronio-Carpinion*)”, represented by *Acer pseudoplatanus* and *Allium ursinum* community. This is of particular interest for the area in that it refers to a forest phytocoenosis that is extremely localised and very rare, and therefore needs to be carefully protected.

The analyses carried out are of fundamental importance, as they identify the dynamic and chain relationships between the various communities that are fundamental elements for the conservation phase of the habitats of the entire system through their knowledgeable management. Moreover, these

analyses provide information as to the progress of the communities in the study area. It is on this basis that it is necessary to organise the conservational management of the habitats of the entire landscape that these define.

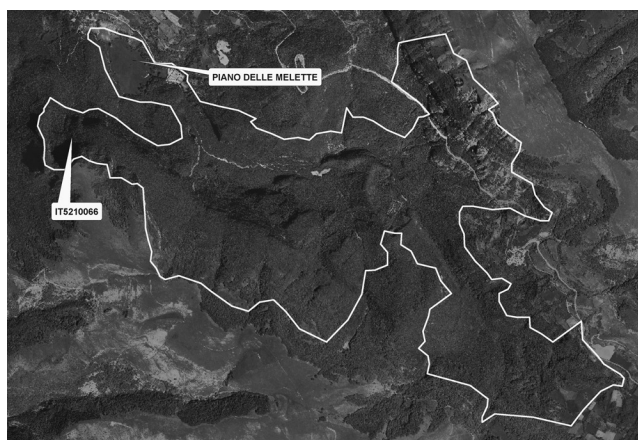


Fig. 12 - Territorial margins of the SCI SICIT5210066 “Media Val Casana (Monti Coscerno-Civitella)”

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Quoted in the text

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