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A phytosociological analysis of abandoned olive-grove grasslands of Ausoni mountains (Tyrrhenian district of Central Italy)

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Abstract: Di Pietro, R. & Blasi, C. *A phytosociological analysis of abandoned olive-grove grasslands of Ausoni mountains (Tyrrhenian district of Central Italy). Lazaroa 23: 73-93 (2002).*

Over the last fifty years, about 80% of *Olea europea* L. cultivations in the submediterranean belt of Central Italy have been abandoned and they are now subjected to new colonizations from surrounding wild vegetation. A phytosociological study of the main types of grassland communities occurring in this «vanishing» typically mediterranean landscape is presented here. The Ausoni Mountains, a Tyrrhenian coastal chain of central Italy were selected as a study area. Distribution of secondary grassland communities is influenced by the combined action of many factors, such as bioclimatic parameters, soil characteristics, time since abandonment, land use pattern. In the warmest sites, the early successional stages are characterized by *Hyparrhenia hirta* open dry grasslands. This community is gradually replaced by dense steppe-like grasslands very poor in species, dominated by *Ampelodesmos mauritanicus* (*Psoraleo-Ampelodesmetum*) or less frequently by *Hyparrhenia hirta* again. Both the inland areas and the north facing slopes are characterized by *Festuco-Brometea* communities. Perennial grasses, in particular *Brachypodium rupestre* (*Galio-Brachypodietum*) dominate these environments, and annual species are confined to restricted areas, such as trampled sites or terrace boundaries (*Crucianello-Hypochoeridetum*). Two new associations (*Galio lucidi-Brachypodietum rupestris* and *Thymo vulgaris-Hyparrhenietum hirtae)* are presented in this paper.

Resumen: Di Pietro, R. & Blasi, C. *Estudio fitosociológico de los pastizales que aparecen en olivares abandonados de las montañas Ausoni (Distrito Tirrénico, Italia central). Lazaroa 23: 73-93 (2002).*

En el presente trabajo se presenta un estudio fitosociológico de los principales tipos de comunidades vegetales herbáceas que se encuentran en olivares abandonados. El área de estudio está localizada en los Montes Ausoni, cadena costera anti-apenínica cerca de la línea de costa del mar Tirreno. Los primeros estados sucesionales, sobre todo en las áreas mas térmicas del territorio, se caracterizan por la presencia de comunidades xerófilas de *Hyparrhenia hirta* (*Thymo vulgari-Hyparrhenietum hirtae).* Esta comunidad es gradualmente sustituida por pastizales graminoides de gran talla de *Ampelodesmos mauritanicus* (*Psoraleo-Ampelodesmetum*) muy pobres en especies y secundariamente de *Hyparrhenia hirta*. Las áreas internas y las laderas expuestas a norte y a mayor altitud se caracterizan por formaciones de *Brachypodium rupestre* (*Galio-Brachypodietum*). El contingente terofítico se reduce a áreas sujetas al pastoreo del ganado o cerca de los bordes de las terrazas (*Crucianello-Hypochoeridetum*). Se presentan en esta ocasión dos nuevas asociaciones vegetales *Galio lucidi-Brachypodietum rupestris* y *Thymo vulgaris-Hyparrhenietum hirtae*.

INTRODUCTION

Olive groves are one of the most typical landscape units of the Mediterranean region. In the Italian peninsula *Olea europaea* is to be found in a variety of forms that are difficult to survey because in each region particular types of *cultivar* have been selected to take into account not only productivity, but also the convergence of climatic and soil factors. Most of the olive fields are distributed along the coastal plain or the foothills. In 1980 a report of the Italian C.N.R. (National Council of Research) stated that over two million hectares of cultivated areas of the sub-Mediterranean belt of the Italian peninsula had been abandoned (GALANTE & *al*., 1980) and could henceforth be naturally recovered by wild vegetation. Nevertheless, to date, still too little data (ESCARRÉ & *al.,* 1983; ARRIGONI & *al*. 1985, VADOUR, 1991; TATONI & *al*., 1994; TATONI & ROCHE, 1994; BLASI & *al*., 1997; BLASI & *al*., 2000; DI PIETRO & FILIBECK, 2001) is available about the types of vegetation that have developed in these Mediterranean crops following their abandonment. Moreover a phytosociological approach to this problem is lacking.

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This study focuses on the grassland communities characterizing the first stages of abandonment of the terraced olive groves of Monti Ausoni, a Tyrrhenian coastal chain of central Italy. Olive cultivation in this area is distributed throughout different bioclimatic regions as well as throughout different altitudinal belts. The same, traditional methods of olive cultivation have been used, unchanged, over many centuries, and this, together with the location of the terraces (deeply «wedged» amongst the natural vegetation) has meant that a high degree of naturality has been maintained in the terrace environment. An important consequence of this is that detailed analysis of the community types that occur in the abandoned olive groves allows the potential vegetation types of the whole area to be hypothesized.

STUDY AREA

The Ausoni Mountains are a unit of the coastal chain of the Monti Volsci, a sub-coastal limestone range of central Italy (Figure 1). An overall physiographic soil survey of the study area revealed a predominance of shallow limestone soils, such as lithosoils and rendzinas whereas deep residual soils (which in literature they are often regarded as classical «terra rossa») occur on the footslopes (SEVINK & *al*., 1984). The macroclimate of the area is typically Mediterranean (Csa climate). Moving from the coastal plain to the montane zone, both mean annual Temperature (from 17°C. to 11°C.) and summer drought stress decreases sharply. On the other hand, rainfall increases, ranging from 950 mm./yr.

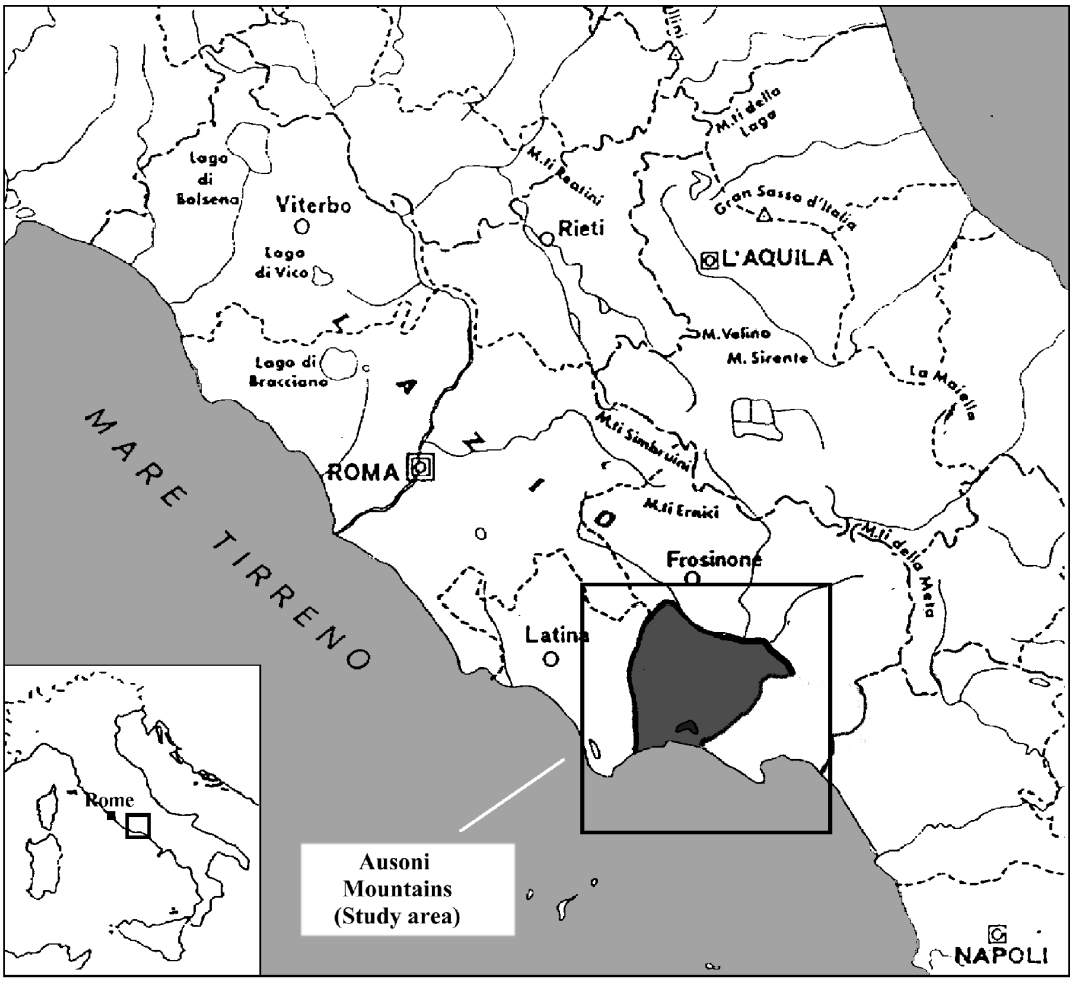

Figure 1.—Ausoni mountains geographical location.

of the coast to over 1600 mm./yr. of the inner hills (400 m.a.s.l.). Snow and frost (this latter was the main cause of the 1985' large scale death of olive trees in the inland regions of Central Italy), are not common phenomena during winter months. From a bioclimatic point of view (Figure 2), the Monti Ausoni area lies within the boundary between the Temperate and Mediterranean regions (BIONDI & BALDONI, 1994; BLASI, 1994; RIVAS-MARTÍNEZ, 1996), which runs roughly along the high ridge alignment. The termomediterranean thermotype (*sensu* RIVAS-MARTÍNEZ, 1995) occurs only sporadically, in areas such as promontories or limestone cliffs open to the sea. The majority of the olive groves are found in two subregions which have intermediate bioclimatic parameters, when compared with both the typical Mediterranean and Temperate ones (BLASI, 1994). The thermotypes ranges between lower mesomediterranean and upper hilly and ombrotypes between lower humid and lower hyperhumid.

DATA AND METHODS

The fieldwork was carried out during the period 1993-1996 using the Braun-Blanquet phytosociological approach (BRAUN-BLANQUET, 1964; WESTHOFF & VAN DER MAAREL, 1973). Fifty-one relevés were recorded in *the Olea europea* abandoned fields. The relevés were subjected to cluster analysis in order to define the vegetation types on an objective basis. The overall data were then classified and ordinated using the Syntax 5.2 computer package (PODANI, 1993; 1994). The clustering procedure adopts a sam-

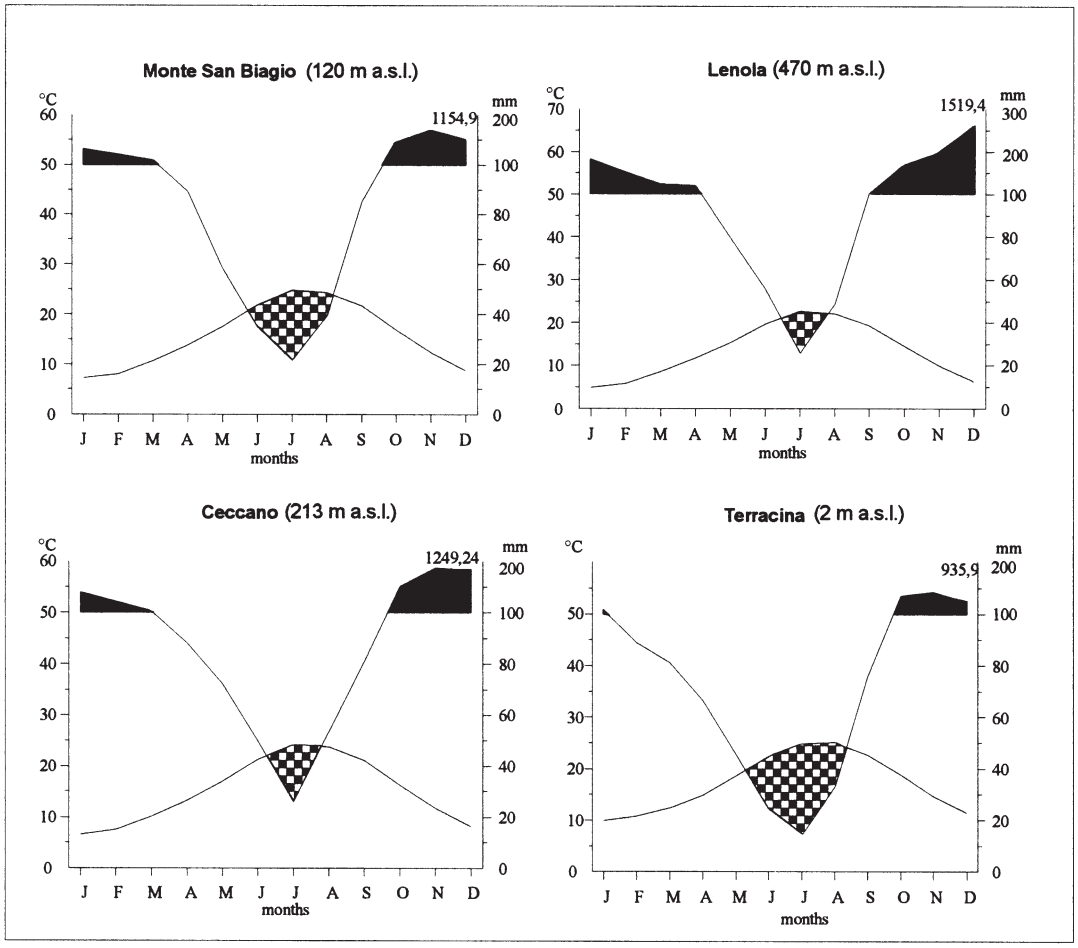

Figure 2.—Ombro-thermic diagrams of four thermo-pluviometric stations of the Ausoni mountains.

ple/species matrix, with a squares agglomeration based on chord distance. Average linkage clustering was adopted to produce the classification dendrograms. Nomenclature of the species, chorological elements and life forms were drawn from PIGNATTI (1982). Syntaxonomical nomenclature follows BARKMAN & *al*. (1986).

RESULTS

The dendrogram (Figure 3) shows different levels of clustering. The first division separates dry Mediterranean grasslands (A) from sub-mesophylous submediterranean ones which entirely corresponds to *Brachypodium rupestris* grassland (B). The other divisions concern only the «A» (dry grassland) group which is been further divided into four subclusters corresponding to the following community types: *Thymus vulgaris* and *Hyparrhenia hirta* grassland (A_{1-1}); *Brachypodium distachyon* and *Hypochoeris achyrophorous* annual grasslands (A_{1-2}); *Hyparrhenia hirta* close grasslands (A_2) and *Ampelodesmos mauritanicus* steppe-like grasslands (A_3).

In order to obtain more complete information about the various grassland communities, we analyzed for each association: whether or not specific life forms and chorotypes occurred (normal spectrum); the frequency of occurrence; and the degree of abundance through the I.R.S. (specific cover index, Table 1). Since the *Hyparrhenia hirta* pure grasslands are composed of two relevés only, they were not considered in this kind of analysis.

In the biological spectrum, two main groups are apparent. On the one hand *Thymus* and *Hyparrhenia* type and *Brachypodium* and *Hypochoeris* type, which show a H./T. < 1, and on the other hand *Ampelodesmos* steppe-like grasslands and *Brachypodium rupestris* ones, showing an opposite ratio. In this latter group *Brachypodium* community type is

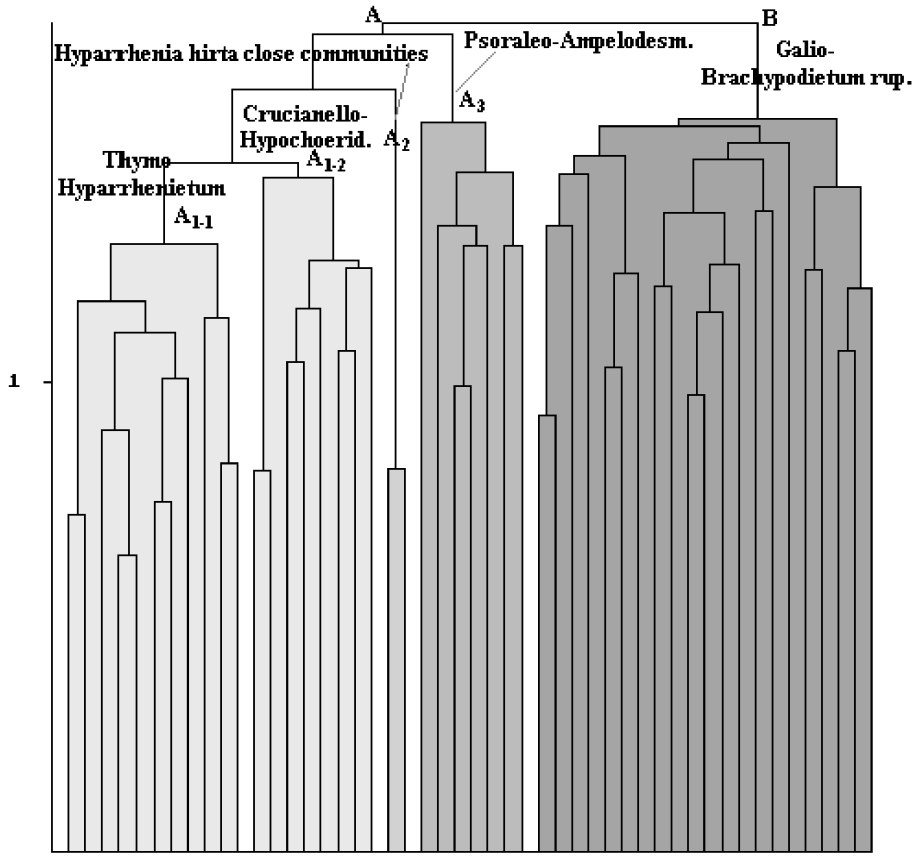

Figure 3.—Abandoned olive groves grasslands dendrogram.

clearly the one that most resembles a true grassland. In fact, in addition to dominance by hemicryptophytes, it is also characterized, by a relatively high percentage of therophytes, and a very low percentage of woody species. Instead, in the *Ampelodesmos mauritanicus* communities, the phanerophytic group component is constantly around 20% in all spectra.

As far as the chorological spectra (Table 2) are concerned, increasingly Mediterranean features are evident passing from *Brachypodium* community type (characterized by a high percentage of both Eurimediterranean and Eurasiatic chorotypes), to both *Thymus-Hyparrhenia* and *Ampelodesmos* stands (in which the stenomediterraneans dominate). An intermediate position is occupied by the *Brachypodium* and *Hypochoeris* type, in which, after the dominant eurimediterraneans (40%), stenomediterraneans and euroasiatics occur in equal proportion.

The few cosmopolitan species (less than 1%) must be considered as a sign of the maintenance of a high degree of naturality in olive grove environments both in the past and in the present.

Table 1
Life form table calculated on values of presence (nor.), frequency (frq.) and abundance (specific cover index, I.r.s) for each grassland community type. Ch: chamaephyte; G: geophyte; H: hemicryptophyte; P: phanerophyte; T: therophyte

Crucianello-Hypochoeridetum				**Galio-Brachipodietum**			
	nor.	*frq.*	*I.r.s.*		*nor.*	*frq.*	*I.r.s.*
Ch	6,1	4,7	4,9	**Ch**	5,5	2,8	1,6
G	7,9	5,6	4,2	**G**	7,2	6,5	4,9
H	33,3	35,9	33,7	**H**	41,4	51,7	70,6
P	8,5	4,7	1,5	**P**	13,8	11,7	5,3
T	44,2	49,1	55,8	**T**	32	27,3	17,6
Thymo-Hyparrhenietum				**Psoraleo-Ampelodesmetum**			
	nor.	*frq.*	*I.r.s.*		*nor.*	*frq.*	*I.r.s.*
Ch	6,4	7	15,3	**Ch**	9,4	7,4	3,7
G	8	4,4	1,7	**G**	5,8	4,6	0,7
H	21,2	23,1	23,4	**H**	38,8	43,6	70,8
P	11,5	7,2	1,4	**P**	20	22,1	18,2
T	52,9	58,3	58,2	**T**	25,8	22,1	6,4

Table 2
Chorological table calculated on values of presence (nor.), frequency (frq.) and abundance (I.r.s) for each grassland community type

	Thymo-Hyparr.			**Cruc.-Hypoch.**			**Psoral.-Amp.**			**Galio-Brachip.**		
	nor.	*frq.*	*I.r.s.*	*nor.*	*frq.*	*I.r.s.*	*nor.*	*frq.*	*I.r.s.*	*nor.*	*frq.*	*I.r.s.*
Boreal	1,6	0,7	0,1	2,4	0,9	0,8	1,2	0,7	0,1	4,4	5,1	3,2
Endemic	0	0	0	3,0	2,6	3,3	3,5	2,1	0,6	3,3	4,4	4,5
Eurasiat.	9,8	8,1	9,2	16,4	18,4	22,2	19,8	16,7	6,8	25,5	30,7	33,3
SE-Eur.	1,6	0,7	0,1	4,8	3,5	1,6	8,7	6,7	3,0	8,9	8,4	4,6
Eurimed.	35,8	39,4	35,8	38,8	41,6	38,8	27,3	27,5	15,4	31,3	32,4	37,7
Stenomed.	46,3	45,1	45,5	24,8	25,1	23,8	32,6	40,9	61,4	18,3	12,7	5,6
Med.-Mont.	0,8	0,2	0,0	3,0	2,4	3,1	2,3	1,3	0,2	3,3	2,0	2,4
Subatlantic	1,6	1,0	0,5	2,4	2,2	1,9	1,2	0,7	1,4	0,6	1,2	6,1
Subcosm.	0	0	0	1,8	0,9	0,8	0	0	0	2,2	1,2	1,0
Subtrop.	2,4	4,7	8,7	2,4	2,6	3,5	3,5	3,4	10,7	2,2	1,8	1,4

DISCUSSION

Thymo vulgaris-Hyparrhenietum hirtae (*ass. nova hoc loco*)

Holosyntypus: Table 3, rel. 2

Synecology

The main factors influencing the distribution of annual grassland communities in the study area are slope orientation and distance from the sea. Moving inland from the flat coastal plain (Pontina plain and Fondi basin), the abandoned terraces found on the line of hills tend to be covered by a pseudogariga characterized by the dominance of both *Thymus vulgaris* and *Hyparrhenia hirta*. This grassland type, which is particularly common close to the sea, is completely absent from the rest of the Monti Ausoni massif. Although scattered individuals of *Thymus vulgaris* and *Hyparrhenia hirta* are responsible for the physiognomy of this community, a detailed analysis of the flora reveals the presence of a large number of typical Mediterranean therophytes, such as *Trifolium scabrum*, *Trifolium lappaceum, Trifolium angustifolium, Lotus ornitopodioides, Scorpiurus moricatus, Coronilla scorpioides*, *Hypochoeris achyrophorus, Brachypodium distachyum, Catapodium rigidum, Bupleurum baldense* and so on. This community type is typical of the first stages of abandonment prior to the arrival of the long grass and woody species of the *Pistacio-Rhamnetalia* communities. The dynamical evolution of this early grassland successional stage is mainly due to any human activity there may have been in the terrace following its abandonment. When there are few disturbances (grazing, firing, cutting), a rapid decrease in the therophytic component occurs. In fact, the relatively deep soil of terraces permits the development of the more evolved hemicryptophytic and nanophanerophytic communities. The abundance and permanence of *Thymus vulgaris* in the community, on the other hand, seems to be closely linked to long periods of heavy grazing following terrace abandonment.

Thymus vulgaris and *Hyparrhenia hirta* are probably the vegetational aspects that most closely approach the typical thermo-Mediterranean garigue. Within the abandoned groves of the study area, however, this community occurs only as secondary vegetation type. In fact, in addition to typical Mediterranean climatic features (e.g. high values of both mean annual temperature and highest temperature of the warmest month), Monti Ausoni also has high annual rainfall (almost always exceeding 1000 mm.) and a relatively short summer drought stress period (two or three months) and this prevents the development of atural primary Mediterranean chamephytic vegetation types.

Syntaxonomy

The name *Thymo vulgaris-Hyparrhenietum hirtae* gives importance to the physiognomic aspect of the community, even if from a sociological point of view the major role in the floral composition is still played by the therophytic component.

As far as the attribution of the higher-level syntaxa the situation is rather intricate. Different alliances with a different syn-chorological amplitude, have been used in the past to refer western Mediterranean *Hyparrhenia hirta* grasslands. Following a chronological order these can be listed as follows: *Hyparrhenion hirtae* (western part of the Iberian Peninsula); *Dauco-Hyparrhenion hirtae* (extreme south-western part of the Iberian Peninsula); *Saturejo-Hyparrhenion hirtae* (Catalonia, Provence and Sicily); *Aristido-Hyparrhenion hirtae* (strictly Southern Mediterranean-central Macaronesic distribution) A recent syntaxonomical revision (DÍEZ-GARRETAS & ASENSI, 1999) proposed the reunion of these four alliances into a single syntaxa to which the first proposed name was applied (*Hyparrhenion hirtae*). For the eastern Adriatic district, HORVATÌC (1957) proposed the *Cymbopogo-Brachypodion retusi* an alliance which embraced all the steppe like grasslands (especially those rich in therophytes) previously included in the south-eastern European class *Brachypodio-Chrysopogonetea*, and later HORVATÌC (1975) placed in the *Thero-Brachypodietalia*.

In order to hold the same biogeographical and syntaxonomical identity for all the Mediterranean *Hyparrhenia hirta* grasslands we have considered the association *Thymo-Hyparrhenietum* as included in *Hyparrhenion* alliance. However it is worth noting that this alliance, together with the *Hyparrenietalia* order, find their coenological and chorological optimum in the driest territories of the Mediterranean basin, where usually rainfalls does not exceed 600-700 mm. p.a. On the contrary, the coastal areas of the Tyrrhenian district of central Italy exhibits a bioclimate in which high temperatu-

Table 3
Thymo vulgaris-Hyparrhenietum hirtae ass. nova
(Hyparrhenion hirtae, Hyparrhenietalia hirtae, Thero-Brachypodietea ramosi)

Altitude (m a.s.l.)			150	160	160	190	200	190	55	65	65	
Exposure			SW	SW	SE	SE	S	S	S	S	S	
Área (m^2)			10	16	7	5	40	9	10	6	10	
Grass layer cover (%)			80	80	85	70	85	85	85	85	85	
Number of species			47	42	44	29	35	37	42	21	25	
Releve n.º			1	2	3	4	5	6	7	8	9	
Assoc. characteristic species:												
Ch suffr	w-stenomed.	*Thymus vulgaris*	3	4	2	1	2	3	2	2	2	V
Ch suffr	stenomed.	*Micromeria graeca*	+	+	+	+	.	1	.	.	.	III
Ch suffr	stenomed.	*Fumana laevipes*	2	2	.	.	.	.	.	.	.	II
Alliance and Order characteristic species:												
H caesp	paleotrop.	*Hyparrhenia hirta*	3	3	1	1	3	1	2	1	3	V
H scap	eurimed.	*Psoralea bituminosa*	.	+	2	2	1	+	3	+	1	V
H caesp	stenomed.	*Dactylis hispanica*	1	.	1	.	.	.	1	.	1	III
H caesp	w-stenomed.	*Brachypodium ramosum*	1	+	.	.	.	.	+	.	+	III
G bulb	stenomed.	*Allium subhirsutum*	1	1	.	.	.	+	.	+	.	III
P caesp	s-stenomed.	*Andropogon distachyus*	.	.	.	.	.	.	1	.	.	I
T scap	stenomed.	*Anthyllis tetraphylla*	.	.	.	.	.	.	1	.	.	1
Class characteristic species:												
H scap	stenomed.	*Reichardia picroides*	1	2	+	+	1	1	+	.	.	IV
T scap	eurimed.	*Avena barbata*	+	1	+	.	.	1	1	1	1	IV
T scap	subtrop.	*Briza maxima*	1	1	.	.	1	1	1	.	1	IV
H bienn	paleotemp.	*Centaurium erythraea*	+	+	1	+	.	.	+	.	+	III
H scap	eurimed.	*Urospermum dalechampii*	1	.	.	+	+	.	+	.	.	III
T scap	s-stenomed	*Melilotus sulcata*	.	+	1	2	.	+	.	.	.	III
H scap	eurimed.	*Convolvulus cantabrica*	.	+	.	.	.	.	+	1	+	III
T scap	eurimed.	*Trifolium lappaceum*	.	.	+	1	1	1	.	.	.	III
T scap	stenomed.	*Sideritis romana*	.	+	.	.	.	.	1	+	.	II
T scap	n-stenomed.	*Trifonella corniculata*	.	.	1	.	2	2	.	.	.	II
H scap	stenomed.	*Carlina corymbosa*	.	+	1	.	.	.	.	.	.	II
T scap	eurimed.	*Bellardia trixago*	+	.	.	.	.	.	.	.	.	I
H scap	s-eurimed.	*Foeniculum vulgare subsp. piperitum*	.	+	.	.	.	.	.	.	.	I
H scand	s-stenomed.	*Convolvulus elegantissimus*	.	1	.	.	.	.	.	.	.	I
T scap	stenomed.	*Anthyllis vulneraria subspr. maura*	.	.	1	.	.	.	.	.	.	I
H Scand	stenomed	*Convolvulus althaeoides*	.	.	+	.	.	.	.	.	.	I
Companion species:												
H caesp	sw-stenomed.	*Ampelodesmos mauritanicus*	2	1	2	+	1	1	+	1	1	V
T scap	stenomed.	*Brachypodium distachyum*	2	2	1	1	3	3	3	3	2	V
T scap	stenomed.	*Hypochoeris achyrophorus*	1	+	2	2	2	2	1	1	1	V
T scap	stenomed.	*Linum strictum*	1	1	+	1	.	+	1	1	1	V
T scap	paleotemp.	*Trifolium campestre*	2	2	2	2	1	1	1	1	.	V
T scap	eurimed.	*Medicago minima*	1	1	2	3	2	1	1	.	.	V
H. bienn	stenomed.	*Galactites tomentosa*	+	+	+	.	1	1	1	+	.	IV
T repts	eurimed.	*Anagallis arvensis*	+	+	+	.	+	+	+	+	.	IV
T scap	eurimed.	*Coronilla scorpioides*	.	2	2	2	1	2	.	1	+	IV
T scap	eurimed.	*Catapodium rigidum*	.	+	.	1	1	1	1	1	+	IV
T scap	eurimed.	*Scorpiurus muricatus*	.	.	1	2	+	.	1	1	1	IV
T rept	eurimed.	*Trifolium scabrum*	+	1	1	2	.	.	1	.	.	IV
T scap	eurimed.	*Trifolium stellatum*	1	1	.	.	1	.	+	.	.	III
T scap	eurimed	*Blackstonia perfoliata*	2	2	.	1	+	1	+	.	.	IV
NP	stenomed.	*Asparagus acutifolius*	+	.	+	+	+	+	+	.	.	III
T scap	stenomed.	*Sonchus tenerrimus*	+	.	.	.	+	+	+	.	+	III

T scap	eurimed.	*Lathyrus setifolius*	+	+	1	.	+	.	.	.	.	III
T scap	eurimed.-turan.	*Vicia sativa*	+	.	+	.	.	1	+	.	.	III
T scap	eurimed.	*Urospermum picroides*	+	.	.	.	+	.	1	1	.	III
T scap	stenomed.	*Campanula erinus*	.	.	.	.	+	+	+	2	.	III
T scap	stenomed.	*Tordylium apulum*	+	+	.	.	1	.	.	.	.	II
P caesp	stenomed.	*Olea europaea subsp. oleaster*	1	+	.	.	.	.	.	.	+	II
P caesp	s-stenomed.	*Pistacia lentiscus*	+	.	+	.	.	+	.	.	.	II
T scap	eurimed.	*Trifolium angustifolium*	.	1	2	1	.	.	.	.	.	II
T scap	eurimed.	*Vicia tenuissima*	.	.	1	+	+	.	.	.	.	II
T scap	eurimed.	*Linum tryginum*	.	.	+	+	.	.	1	.	.	II
T scap	stenomed.	*Lotus edulis*	.	.	+	.	.	.	1	.	+	II
T scap	eurimed.	*Sherardia arvensis*	.	.	.	+	+	.	+	.	.	III
T scap	stenmed.-atl	*Gastridium ventricosum*	.	.	.	1	.	1	.	.	1	II
NP	stenomed.	*Euphorbia dendroides*	.	.	.	.	+	+	.	.	+	II
G bulb	eurimed.	*Serapias vomeracea*	+	+	.	.	.	.	.	.	.	II
H scap	paleotemp.	*Hypericum perforatum*	+	+	.	.	.	.	.	.	.	II
H bienne	eurimed.	*Verbascum sinuatum*	+	+	.	.	.	.	.	.	.	II
T scap	eurimed.	*Bupleurum baldense*	1	.	.	.	.	2	.	.	.	II
T scap	eurimed.	*Medicago orbicularis*	.	.	1	1	.	.	.	.	.	II
T scap	eurimed.	*Hippocrepis unisiliquosa*	.	.	.	2	.	.	.	.	+	II
T scap	stenomed.	*Malva cretica*	.	.	.	.	1	+	.	.	.	II
T scap	eurimed.	*Nigella damascena*	.	.	.	.	+	+	.	.	.	II
T scap	paleotemp.	*Mercurialis annua*	.	.	.	.	+	+	.	.	.	II
G bulb	stenomed.	*Allium tenuiflorum*	.	.	.	.	.	.	+	+	.	II
G rhiz	stenomed.	*Asphodelus microcarpus*	.	.	.	.	.	.	1	.	1	II
T scap	eurimed.	*Avena sterilis*	.	.	.	.	.	.	1	.	+	II

Other species: Companion species: *Althaea hirsuta, Sedum hispanicum, Bellardia trixago, Cerastium ligusticum, Daucus carota, Erica multiflora, Geranium columbinum, Leopoldia comosa, Myrtus communis, Parentucellia viscosa, Prassium majus* and *Sanguisorba minor* + in 1; *Petrorhagia saxifraga* 1, *Allium roseum, Cistus salvifolius, Foeniculum vulgare, Serapias lingua, Smilax aspera* + in 2; *Medicago lupulina* and *M. rigidula* 2, *Ononis breviflora* 1, *Colvolvulus althaeoides, Daphne gnidium, Galium corrudifolium, Ranunculus bulbosus, Thamnus alaternus, Scabiosa columbaria and Silene pendula* + in 3; *Bromus madritensis* 1, *Brachypodium rupestre* + in 5; *Elaeoselinum asclepium, Euphorbia peplus* and *Misopates calycinum* + in 6; *Lotus ornitopodioides* 1, *Lathyrus aphaca* + in 5; *Anthyllis tetraphylla* and *Dasyprum villosum* 1, *Clematis flammula, Plantago lagopus* and *Tragopogon pratensis* + in 7; *Calicotome vilosa* + in 8; *Allium vineale* + in 9.

Localities: 1, 2: Monte Sterpano, Terracina (LT), 30.05.1996; 3-6: Monte Croce, Terracina (LT), 31.05.1996; 7-9: Colle Leano, Terracina (LT), 05.06.1996.

re is followed by very high rainfalls (usually exceeding 1100 mm/year). Also, the main potential woodland vegetation types of the driest zones of the Ausoni Mountains are *Viburno-Quercetum ilicis* and *Orno-Quercetum ilicis,* and the same seems to happen in the northeastern Adriatic coastal district regions. It is hypotizable, therefore, that *Cymbopogo-Brachypodion* (obviously with a syntaxonomical rank lower than the alliance) might be considered as the eastern fringe of a higher syntaxa such as *Hyparrhenion hirtae*, which is extended throughout the entire Mediterranean basin.

In Palestine and Crete island is described the *Hyparrhenio-Coridothymetum capitati* (cf. ZOHARY & ORSHAN, 1966; HORVAT & *al*., 1974; BRULLO & *al*., 1997), which, although very different in its floristic, bioclimatical and syndynamical features, should be very similar in physiognomic and structural terms to *Thymo-Hyparrhenietum* of Latium.

Crucianello latifoliae-Hypochoeridetum achyrophori Filesi, Blasi & Di Marzio 1996 (Table 4)

Synecology

A mixture of therophytic and (in less percentage) perennial grasses characterizes the *Crucianello latifoliae-Hypochoeridetum achyrophori* and shows relatively high floral diversity in which there is no single dominant species. The most common elements are *Trifolium campestris*, *T. scabrum*, *Brachypodion distachyon*, *Hypochoeris achyrophorus, Me-*

dicago minima and *Dactylis glomerata*, *Sanguisorba minor*. This community usually forms small patches occurring within wider communities of tall grass (e.g. *Brachypodium rupestre* or *Ampelodesmos mauritanicus)*. These patches are mainly found along narrow paths trampled by animals crossing the terraces for grazing. This community develops at higher altitudes than *Thymo-Hyparrhenietum* and mainly on north-facing slopes. Consequently, even though this community type is composed largely of Mediterranean annual grasses, it is frequently surrounded by *Festuco-Brometea* grassland types which are in syndynamical relationship with *Quercetalia pubescenti-petraeae,* rather than with *Quercetalia ilicis*.

When a period of light grazing occurs on a terrace hosting *Crucianello-Hypochoeridetum* stands, a rapid decrease in the annual component of the community is observable and invasion by competitive hemicryptophytes occurs. However, even in the latter case, the community does not disappear completely from the terrace, but survives on its edge, on a thin layer of soil deposited on the dry-stone border wall.

Syntaxonomy

The flora of this grassland community type shows strong similarity with both *Trifolio scabri-Hypochoeretum achyrophori* (LAPRAZ, 1982 *nom.inv*. art.) described in the Maritime Alps and later identified also in Central Italy (BLASI & *al*., 1990; BIONDI & *al*., 1997) and *Crucianello-Hypochoeridetum* described within Circeo National Park. In its original description (LAPRAZ, *op. cit*.) *Trifolio-Hypochoeridetum* is defined as a xerophylous grassland characterized not only by the abundance of, but also by the dominance of *Brachypodium ramosum*. The Monti Ausoni communities, in addition to lacking the local characteristics of *Trifolio-Hypochoeretum*, show a rather marginal role for *Brachypodium ramosum*. On the other hand, a possible reference to the *Trifolio-Hypochoeridetum* (*sensu* BIONDI & *al*., 1997) should be excluded since this association is, at least in part, overlappable with the *Crucianello-Hypochoeridetum* (FILESI & *al*., 1996). As the alliance as well, the latter association, which belongs to the *Trachynion* alliance, *Trachynetalia* order and *Helianthemetea* class, finds, its best environmental conditions on limestone substrate (cfr. Rivas-Martínez, 1977). In an environment so particular, such as the terrace, which is characterized by both relatively high soil availability and a rather variable degree of human disturbance, *Crucianello-Hypochoeridetum* appears enriched in perennial and lightly nitrophilous Mediterranean species if compared to the typical form.

Andropogonetum hirto-pubescentis A. & O. Bolòs & Br.-Bl. in A. & O. Bolòs 1950

Synecology

Perennial steppe-like communities represent the successional stage which replaces therophytic grasslands. These community types are characterized by the dominance of *Ampelodesmos mauritanicus* or *Hyparrhenia hirta*, two tall grasses which tend to cover the space at their disposal very densely, but which are very rarely found together in co-dominance. *Ampelodesmos mauritanicus* needs relatively deep soils, and tends to avoid unstable debris. *Hyparrhenia hirta*, to the contrary, finds its best environmental conditions in precisely such shallow and fine textured soil. In some cases, large abandoned olive groves that have not been affected either by frequent fires or by heavy grazing, may be characterized by dense grasslands of *Hyparrhenia hirta* (cluster A_2). This community type, which is characterized by a very poor floristic composition, in which, in addition to *Hyparrhenia hirta* (by far the dominant species) just few tall grasses occur (e.g. *Andropogon distachyon, Bothriochloa ischaemon, Foeniculum vulgare* subsp. *piperitum)*, seems to be strictly limited to the coastal terraces, where a particular mixture of carbonate and siliceous substrates occurs. Undisturbed successional stages then, lead to a rapid invasion of *Pistacia lentiscus*, *Myrtus communis* and other evergreen woody species. When, instead, there is a sustained human impact, it frequently causes a regression towards *Thymo-Hyparrhenietum* open communities.

Syntaxonomy

The extremely sporadicity of this community type within the study area (testified by the occurrence of two relevés only), does not allow to provide a precise syntaxonomical reference in terms of association. Just as a first provisorial scheme, the

Table 4
Crucianello latifoliae-Hypochoeridetum achyrophori Filesi, Blasi & Di Marzio 1996
(Trachynion distachyae, Trachynetalia distachyae, Helianthemetea)

Altitude (m a.s.l.)			355	30	400	405	450	535	555	335	420	
Exposure			W	WSW	NNE	W	NE	NNE	NNE	WSW	W	
Área (m^2)			15	8	15	9	8	12	20	30	8	
Grass layer cover (%)			90	60	95	80	80	80	80	90	70	
Number of species			39	22	59	40	35	45	21	43	42	
Releve n.º			1	2	3	4	5	6	7	8	9	
Assoc. characteristic species:												
T scap	eurimed	*Catapodium rigidum*	+	1	+	+	+	+	+	.	+	IV
T scap	eurined.	*Coronilla scorpioides*	.	2	+	1	.	+	.	.	+	III
T scap	eurimed.	*Scorpiurus muricatus*	1	.	1	.	1	.	.	2	1	III
T scap	stenomed.	*Hypochoeris achyrophorus*	.	.	.	2	1	1	.	1	+	III
T scap	stenomed.	*Lotus ornitopodioides*	+	1	.	.	.	.	.	1	+	III
T scap	eurimed.	*Crucianella latifolia*	.	.	.	.	.	.	.	.	I	I
Alliance and Order characteristic species:												
T scap	eurimed.	*Bupleurum baldense*	1	.	1	+	.	+	.	.	+	II
T scap	e-medit.-turan.	*Ononis reclinata*	.	.	1	+	.	.	.	.	.	II
Order characteristic species:												
T scap	stenomed.	*Brachypodium distachuyum*	2	.	.	.	.	3	.	2	1	III
T scap	stenomed.	*Linum strictum*	1	+	.	.	.	.	.	.	+	III
T scap	stenomed.	*Sideritis romana*	+	.	1	.	.	.	.	.	+	III
T scap	eurimed.	*Linum strictum* subsp. *spicatum*	.	.	1	1	.	.	.	.	.	II
Class characteristic species:												
T scap	paleotemp.	*Trifolium campestre*	1	2	2	1	2	2	2	2	2	V
T scap	eurimed.	*Medicago minima*	+	.	1	.	+	1	2	1	.	IV
T rept	eurimed.	*Trifoliumn scabrum*	3	.	.	.	2	1	3	1	1	IV
T scap	eurimed.	*Trifolium stellatum*	+	.	.	.	1	+	4	+	2	IV
T scap	stenomed.-atl	*Gastridium ventricosum*	.	.	1	.	.	1	+	+	+	III
T scap	eurimed.	*Trifolium angustifolium*	.	.	2	.	1	.	.	1	+	III
T caesp	eurimed.	*Vulpia myrus*	+	.	1	.	.	.	1	.	.	II
T scap	eurimed.	*Bromus madritensis*	.	.	.	.	+	.	1	.	.	II
T scap	paleotemp.	*Trifolium arvense*	.	.	.	.	+	.	.	.	.	I
T scap	eurime	*Medicago rigidula*	.	.	.	.	.	.	.	1	.	I
T scap	SE-sudsib.	*Crupina vulgaris*	.	.	.	.	.	.	.	.	+	I
Companion species:												
T scap	eurimed.	*Blackstonia perfoliata*	+	.	2	1	1	+	.	1	+	IV
H scap	paleotemp.	*Hypericum perforatum*	+	.	+	+	+	+	.	.	+	IV
H scap	stenomed.	*Reichardia picroides*	.	.	1	1	1	+	1	1	2	IV
H scap	paleotemop.	*Sanguisorba minor*	.	.	+	+	2	+	.	1	2	IV
T scap	ne-eurimed.	*Crepis neglecta*	.	+	1	2	1	1	2	.	+	IV
T scap	subtrop.	*Briza maxima*	+	1	1	.	.	.	+	1	1	IV
H scap	stenomed.	*Galium corrudifolium*	.	.	+	2	1	+	1	+	.	IV
T scap	eurimed.	*Acinos arvensis*	+	.	2	1	1	.	.	1	1	IV
H caesp	paleotemp.	*Dactylis glomerata*	+	.	.	1	1	1	+	2	.	IV
H scap	eurimed.	*Urospermum dalechampii*	+	.	+	.	1	+	.	+	1	IV
T scap	eurasiat.	*Scabiosa columbaria*	+	.	.	1	2	1	1	1	.	IV
H caesp	sw-stenomed.	*Ampelodesmos mauritanicus*	.	1	2	+	.	.	.	1	2	III
H scap	eurimed.	*Convolvulus cantabrica*	1	2	1	.	1	+	.	.	.	III
H bien	paleotemp.	*Centaurium erythraea*	+	.	2	1	1	+	.	.	.	III
T scap	eurimed.	*Cynosurus echinatus*	1	+	.	.	+	+	.	.	.	III
H scap	stenomed.	*Carlina corymbosa*	+	.	.	.	+	+	.	.	+	III
T scap	stenomed.	*Tordylium apulum*	+	.	.	.	1	+	+	.	.	III

T scap	eurimed.	*Medicago orbicularis*	+	.	.	.	1	.	.	+	+	II
G bulb	stenomed.	*Allium subhirsutum*	.	+	1	1	+	.	.	.	.	III
H bien	paleotemp.	*Campanula rapunculus*	.	.	+	1	+	.	.	.	+	III
T scap	eurimed.	*Sherardia arvensis*	.	.	+	.	1	.	+	.	+	III
Ch rept	eurimed	*Thymus longicaulis*	.	.	.	.	1	1	2	2	.	III
H caesp	subatlant.	*Brachypodium rupestre*	.	.	.	.	1	1	+	1	.	III
T scap	paleotemp.	*Medicago lupulina*	.	.	.	.	1	1	.	1	2	III
T scap	eurimed.	*Avena barbata*	.	.	.	.	1	.	+	1	1	III
Ch suffr	stenomed.	*Micromeria graeca*	1	1	.	.	.	1	.	.	.	II
T scap	stenomed.	*Anthemis arvensis*	2	.	+	.	+	.	.	.	.	II
H scap	stenomed.	*Anthyllis vulneraria* subsp. *maura*	1	.	+	.	.	.	.	1	.	II
H scap	se-europ.-pontica	*Eryngium amethystinum*	+	.	+	.	.	.	.	.	+	II
G rhiz	endem.	*Phleum amgiguum*	2	.	2	.	.	.	.	.	1	II
H caesp	s-europ.-sudsib.	*Melica transsylvanica*	+	.	.	.	.	+	.	1	.	II
H scap	eurimed.	*Mentha suaveolens*	+	.	.	.	.	1	.	1	.	II
H bien	stenomed.	*Galactites tomentosa*	.	+	.	.	.	+	.	.	+	II
T scap	stenomed.	*Elaeoselinum asclepium*	.	.	1	+	.	.	.	+	.	II
G bulb	eurimed	*Anacamptis pyramidalis*	.	.	+	1	.	.	.	.	1	II
H scap	endem.	*Linaria purpurea*	.	.	+	+	.	.	.	.	+	II
H scap	eurimed.	*Prunella laciniata*	.	.	+	.	2	1	.	.	.	II
H ros	eurasiat.	*Plantago lanceolata*	.	.	1	.	.	+	.	1	.	II
Ch suffr	eurimed.	*Teucrium chamaedrys*	.	.	.	.	+	1	+	.	.	II
T scap	eurimed.	*Hippocrepis unisiliquosa*	.	.	.	.	+	.	.	1	1	II
H caesp	paleotemp.	*Bromus erectus*	2	.	.	.	1	.	.	.	.	II
T scap	stenomed.-turan.	*Aegilops geniculata*	2	.	.	.	.	1	.	.	.	II
T scap	eurimed.	*Nigella damascena*	.	1	.	.	.	.	.	.	+	II
T scap	stenomed.	*Phleum subulatum*	.	1	.	2	.	.	.	.	.	II
T scap	stenomed.	*Sonchus tenerrimus*	.	1	.	.	.	.	.	.	+	II
T rept	eurimed.	*Trifolium subterraeum*	.	.	+	+	.	.	.	.	.	II
T rept	eurimed.	*Anagallis arvensis*	.	.	+	+	.	.	.	.	.	II
T scap	stenomed.	*Orlaya kochii*	.	.	+	1	.	.	.	.	.	II
T scap	stenomed.	*Plantago psyllium*	.	.	+	+	.	.	.	.	.	II
T scap	stenomed.	*Trifolium bocconei*	.	.	2	1	.	.	.	.	.	II
H caesp	medit.-mont.	*Koeleria splendens*	.	.+	2	.	.	.	.	.	.	II
H scap	s-europ.-sudsib.	*Globularia punctata*	.	.	+	+	.	.	.	.	.	II
T scap	n-stenomed.	*Iberis umbellata*	.	.	1	+	.	.	.	.	.	II
Ch suffr	orof. s-europ.	*Teucrium montanum*	.	.	+	+	.	.	.	.	.	II
H scap	europ.-caucas.	*Hieracium piloselloides*	.	.	+	1	.	.	.	.	.	II
G rhiz	europ.	*Carex flacca* subsp. *serrulata*	.	.	+	.	+	.	.	.	.	II
T scap	eurimed.	*Trifolium lappaceum*	.	.	1	.	1	.	.	.	.	II
H caesp	w-stenomed.	*Brachypodium ramosum*	.	.	1	.	1	.	.	.	.	II
H scap	paleotemp.	*Silene vulgaris*	.	.	+	.	+	.	.	.	.	II
H caesp	eurimed.	*Petrorhagia saxifraga*	.	.	+	.	.	+	.	.	.	II
Np	endem.	*Euphorbia characias*	.	.	+	.	.	.	.	+	.	II
Ch Succ	w-e c-europ.	*Sedum rupestre*	.	.	.	+	.	.	.	.	1	II
H scap	w-medit.-mont.	*Knautia purpura*	.	.	.	1	1	.	.	.	.	II
H bien	w-europ. (atl.)	*Carduus nutans*	.	.	.	+	+	.	.	.	.	II
Ch suffr	europ.-caicas.	*Helinthemum nummularium* subsp. *obscurum*	.	.	.	.	+	+	.	.	.	II
Ch suffr	n-eurimed.	*Helichrysum italicum*	.	.	.	.	.	3	.	+	.	II
H scap	eurimed.	*Salvia pratensis*	.	.	.	.	.	.	.	+	+	II

Other species: Companion species: *Malva cretica* 2, *Bromus hordeaceous, Daucus gingidium, Ononis breviflora, Ruta angustifolia* and *Sedum stellatum* + in 1; *Bromus sterilis* 2, *Althaea hirsuta, Anemone hortensis, Asparagus acutifolius, Asphodelus microcarpus, Lonicera implexa,* Orlaya grandiflora, *Parentucellia viscosa* in 2; *Arabis sagittata, Aira tenorei* and *Vincetoxicum hirundinaria* + in 3; *Dorycnium penthaphyllum* 2, *Euphorbia exigua, Filago germanica, Muscari atlanticum, Ornitoghalum brevistylum, Rosa seppervirens, Serratula tinctoria* and *Trifolium pratense* + in 4; *Pteridium aquilinum* 2; *Crataegus monogyna, Echium vulgare, Pallenis spinosa, salvia verbenaca, Sedum sexangulare* + in 5; *Aira caryophyllea* and *Urospermum picroides* + in 6; *Anacyclus radiatus* 1, *Agrimonia eupathoria, Allium ampeloprasum,* Carex distachya, *Foeniculum vulgare, Hordeum leporium, Picris hieracioides* and *Spartium junceum* + in 7; *Dianthus sylvestris* 1 in 8; *Centaurea deusta* 3, *Poa bulbosa, Allium vineale* and *Verbascum densiflorum* + in 9.

Localities: 1: Vado di Regno, Castro dei Volsci (FR), 14.06.1996; 2: Frasso, Sonnino (LT), 07.06.1996; 3, 4: M. La Foresta, Sonnino (LT), 07.06.1996; 5: M, Romano, Sonnino (LT), 12.06.1996; 6, 7: Valle Vettia, Amaseno (FR), 13.06.1996; 8: Il Pantano, Lenola (LT), 14.06.1996; 9: Aquaro, Vallecorsa (FR), 14.06.1996.

Table 5
Psoraleo bituminosae-Ampelodesmetum mauritanici Arrigoni & Di Tommaso 1997
(Hyparrhenion hirtae, Hyparrrhenietalia hirtae, Thero-Brachypodietea ramosi)

Altitude (m a.s.l.)			70	80	160	190	355	330	330	30	415	225	
Exposure			SSW	SSW	E	SE	WSW	WSW	WSW	WSW	WNW	SW	
Área (m^2)			30	20	10	5	15	20	10	8	8	16	
Shrubs layer cover (%)			.	.	10	10	30	.	30	45	30	25	
Grass layer cover (%)			100	100	90	90	80	100	70	90	80	100	
Number of species			21	11	16	12	12	11	24	16	25	27	
Releve n.º			1	2	3	4	5	6	7	8	9	10	
Assoc. characteristic species:													
H Caesp	esw-stenomed.	*Catapodium rigidum*	+	.	5	5	4	5	4	4	5	4	V
H Scap	eurimed.	*Psoralea bituminosa*	.	.	.	.	.	.	1	.	.	.	II
H Scap	eurimed.	*Galium lucidum*	.	.	.	.	.	.	1	.	.	.	I
Andropogonetum hirto-pubescentis charac. sp. s.l.													
H Caesp	paleotrop.	*Hyparrhenia hirta*	3	5	.	.	.	.	.	.	.	.	I
Order and Alliance cgaracteristic species:													
H Scap	eurimed.	*Convolvulus cantabrica*	2	1	.	.	.	.	+	+	.	+	III
H Caesp	w-stenomed.	*Brachypodium ramosum*	.	.	.	2	.	.	2	1	2	.	III
H Scap	s-eurimed.	*Foeniculum vulgare* subsp. *piperitum*	1	1	.	.	+	.	.	.	.	.	II
P Caesp	s-stenomed.	*Andropogon distachyus*	2	1	.	.	.	.	.	.	.	.	I
G Bulb	stenomed.	*Urginea maritima*	+	.	.	.	.	.	.	+	.	.	I
T Scap	eurimed.-turan.	*Vicia sativa*	.	+	.	.	.	.	.	.	.	+	I
G Bulb	stenomed.	*Allium subhirsutum*	.	.	.	.	.	.	.	+	+	.	I
H Caesp	subcosmop.	*Bothriochloa ischaemon*	2	.	.	.	.	.	.	.	.	.	I
T Scap	stenomed.	*Anthyllis tetraphylla*	+	.	.	.	.	.	.	.	.	.	I
H Scap	s-eurimed.	*Ferula communis*	.	.	.	.	.	+	.	.	.	.	I
T Scap	subtrop.	*Briza maxima*	.	.	.	.	.	.	.	.	1	.	I
Class characteristic species:													
T Scap	eurimed.	*Avena barbata*	2	2	.	.	.	.	1	.	+	.	III
H Scap	stenomed.	*Carlina corymbosa*	.	.	.	+	1	+	+	+	.	.	III
H Caesp	stenomed.	*Dactylis hispanica*	1	1	1	+	.	.	.	.	.	.	III
HScap	stenomed.	*Reichardia picroides*	1	.	.	.	.	.	.	.	.	.	I
H Scap	eurimed.	*Urospermum dalechampii*	1	.	.	.	.	.	.	.	.	.	I
Companion species:													
Np	stenomed.	*Asparagus acutifolius*	.	1	.	.	+	+	1	.	+	.	III
P Caesp	s-stenomed.	*Pistacia lentiscus*	.	.	1	+	+	+	.	2	.	.	III
Ch Suffr	stenomed.	*Micromeria graeca*	.	.	+	.	.	+	1	+	.	.	II
T Scap	eurimed.	*Blackstonia perfoliata*	1	.	.	.	+	+	.	.	.	+	II
P Lian	eurimed.	*Clematis flammula*	.	.	.	.	.	.	1	1	1	+	II
T Scap	stenomed.	*Lotus ornitopodioides*	+	.	.	+	.	.	1	.	.	.	II
T Scap	stenomed.	*Linum strictum*	+	.	.	..	.	.	+	.	.	+	II
H Scap	paleotemp.	*Sanguisorba minor*	+	.	.	.	.	.	.	.	+	+	II
P Caesp	eurimed.	*Spartium junceum*	.	.	.	1	2	.	.	.	1	.	II
H Caesp	paleotemp	*Dactylis glomerata*	.	.	.	.	2	.	2	.	.	1	II
H Bienne	stenomed.	*Galactites tomentosa*	2	1	.	.	.	.	.	.	.	.	II
H Caesp	s-europ.-sudsib.	*Melica transsylvanica*	=	+	.	.	.	.	.	.	.	.	I
T Scap	stenomed.	*Sonchus tenerrimus*	+	.	.	.	.	.	.	.	+	.	I
H Scap	eurasiat.	*Ranunculus bulbosus*	.	.	+	.	+	.	.	.	.	.	I
H Scap	orof. s-europ.	*Calamintha nepeta*	.	.	+	.	.	.	2	.	.	.	I
H Ros	eurasiat.	*Plantago lanceolata*	.	.	+	.	.	.	+	.	.	.	I
T Scap	paleotemp.	*Medicago lupulina*	.	.	+	.	.	.	.	.	.	1	I

P Lian	stenomed.	*Rubia peregrina*	.	.	.	+	.	.	.	.	.	+	I
H Bienne	paleotemp.	*Daucus carota*	.	.	.	.	+	.	.	.	+	.	I
Ch Suffr	europ.-caucas	*Helianthenum nummulariu* subsp. *obscurum*	.	.	.	.	1	.	.	.	.	2	I
P Caesp	se-europ.	*Quercus pubescens*	.	.	.	.	2	.	.	.	.	1	I
Ch. Suffr	n-stenomed.	*Euphorbia spinosa*	.	.	.	.	.	+	+	.	.	.	I
H Scap	endem.	*Linaria purpurea*	.	.	.	.	.	.	+	.	+	.	I
T Scap	paleotemp.	*Trifolium campestre*	.	.	.	.	.	.	1	.	+	.	II
P Caesp	stenomed.	*Myrtus communis*	.	.	.	.	.	.	.	2	+	.	I
T Scap	eurimed.	*Geranium purpureum*	.	.	.	.	.	.	.	.	+	+	I
H Scap	paleotemp.	*Hypericum perforatum*	.	.	.	.	.	.	.	.	+	+	I

Other species: Companion species: *Phleum bertolinii* 1 and *Pimpinella peregrina* + in 1; *Lavatera punctata* + in 2; *Anemone hortensis, Campanula rapunculus* and *Geranium columbinum* +, *Tamus communis* 1 in 3; *Anagallis arvensis* and *Thymus vulgaris* + in 4; *Eryngium amethystinum, Helichrysum italicum* and *Silene paradoxa* + in 6; *Anacyclus radiatus* and *Ruta graveolens* +, *Phleum ambiguum* and *Rubus ulmifolius* 2, *Stipa bromoides* 3 in 7; *Erysimum pseudorhaeticum* 1 in 8; *Orlaya kochii, Picris hieracioides* and *Sedum rupestre*+, *Phleum subulatum* and *Viola alba* subsp. *dehnharddtii*1 in 9; *Asperula laevigata, Centaurium erythraea, Inula conyza, Lathyrus sylvestris, Mentha suaveolens, Ornitoghalum brevistylum, Ostrya carpinifolia, Prunus spinosa* and *Scabiosa columbaria* +, *Fraxinus ornus* 1, *Brachypodium rupestre, Dorycnium hirsutum* and *Rubus canescens* 2 in 10.

Localities: 1, 2: M. Passignano, Fondi (LT), 14.06.1996; 3: Monte Pannozzo, Terracina (LT), 30.05.1996; 4: Monte Croce, Terracina (LT), 31.05.1996; 5: Il Pantano, Lenola (LT), 14.06.1996; 6, 7: Cimitero, Pastena (FR), 06.07.1996; 8: Frasso, Sonnino (LT), 07.06.1006; 9: M. La Foresta, Sonnino (LT), 07.06.1996; 14: Camposarianni, Lenola (LT), 14.06.1996.

Ausoni mountains relevés could be assigned, in form of impoverished variant, to *Andropogonetum hirto-pubescentis*, a community type firstly described in the northern Mediterranean coastal district of Catalonia (A. & O. de Bolòs, 1950), with which they share a similar floristic composition, and a comparable bioclimatic situation. On the other hand it would be inappropriate the reference to associations such as *Aristido-Hyparrhenietum* or *Heteropogono-Hyparrhenietum*, which are developed in the driest areas of Calabria and Sicily, and which exhibit a floristic composition characterized by several southern-Mediterranean and northern-African species which are completely lacking in central Italy (cf. BRULLO & *al*., 1997).

Psoraleo bituminosae-Ampelodesmetum mauritanici Arrigoni & Di Tommaso 1997 (Table 5)

Synecology

Given *A. Mauritanicus* high degree of post-fire resprouting and seed germination (MAZZOLENI, 1989) traditional land use patterns, such as firing macchia or gariga areas in order to create new pastures, have certainly favored its abundance. The ecological plasticity of *Ampelodesmos mauritanicus* allows it to maintain a dominant role for long periods before being completely replaced by communities of later successional stages. In areas where there is no, or minimal, human disturbance, *A. mauritanicus* populations tend to form quite dense communities, in which very few other species are able to grow below the thick canopy formed by its long bladed leaves. Instead, where extensive grazing prevails, patches of annual communities, mostly developing along animals paths, are intermixed with *A. mauritanicus* stands. In the abandoned olive groves of southern Latium *A. mauritanicus* is accompanied by a poor flora in which it is possible to recognize *Brachypodium ramosum Clematis flammula, Psoralea bituminosa, Allium subhirsutum*, *Carlina corymbosa*, but few others.

Syntaxonomy

Phytosociological references concerning *Ampelodesmos mauritanicus* communities in the Italian territory have mainly dealt with aspects of maquis or garigue vegetation types (PIGNATTI & *al*., 1961; BIONDI, 1986; BIONDI & MOSSA, 1992; FILESI & *al*., 1996). MINISSALE (1995), defines for Sicily the new *Hyparrhenietalia* alliance *Avenulo-Ampelodesmion mauritanici,* while ARRIGONI & DI TOMMASO (1997) describe two associations named *Ampelodesmo-Ericetum multiflorae* and *Psoraleo-Ampelodesmetum* and included respectively in the *Cisto-Ericion* and *Thero-Brachypodietea*.

The hypotesis of a *Micromerietum-Brachypodietum* (PIGNATTI & *al*., 1961) embracing also the *Am-*

pelodesmos communities, is, in our opinion to be excluded given the marked differences between *Ampelodesmos mauritanicus* and *Brachypodium phoenicoides* in their ecology. Also *B. phoenicoides* results as completely lacking in the *Ampelodesmos* stands and its real occurrence within the Ausoni mountains range is still not confirmed (LUCCHESE & LATTANZI, 2000).

The almost complete lacking of both *Cisto-Ericion* and *Avenulo-Ampelodesmion* species led us to include Ausoni mountains *Ampelodesmos* stands in the *Psoraleo-Ampelodesmetum* which behaves as an early stages of colonization in which woody species occurs only in the undergrowth. In accordance to how proposed in its original syntaxonomical diagnosys (ARRIGONI & DI TOMMASO, 1997), the *Psoraleo-Ampelodesmetum* has been included in *Thero-Brachypodietea* class. In fact, although it seems to be a common opinion that *A. mauritanicus* should be considered a *Oleo-Ceratonion* characteristic species (cf. BOLÒS & MOLINIER, 1958; RIVAS-MARTÍNEZ, 1975; RIVAS MARTINEZ & *al*., 1984; QUEZEL & *al*., 1992; DÍEZ-GARRETAS & ASENSI, 1999; RIVAS-MARTÍNEZ & *al*., 1999), in this case it forms an essentially hemicryptophytic community type in which phanerophytes tend to occur in the undergrowth only. Anyway, both the scarce role of the therophytic component and the typically steppic physiognomy of this community type had brought us to shift the *Psoraleo-Ampelodesmetum* from *Thero-Brachypodietalia* (original proposal of the Authors) to *Hyparrhenietalia*.

Galio lucidi-Brachypodietum rupestris (*ass. nova hoc loco*)

Holosyntypus: Table 6, rel. 5

Synecology

While typical mediterranean xerophylous grasslands are mainly distributed near the sea, *Brachypodium rupestre* grasslands are found further inland, or on the north-facing terraced slopes of intramontane basins. This type of grassland is characterized by a dense and continuous dominant layer, where *Brachypodium rupestre*, is by far the major species. The floristic composition of *B. rupestre* communities is highly variable and is a function of the precise location of the terrace on the slopes. In terraces located on footslopes, where there is a higher degree of moisture, an increase in the number of mesophylous meadows species such as *Festuca arundinacea, Poa pratensis, Poa trivialis, Lathyrus sylvestris, Tragopogon pratensis, Phalaris bulbosa, Trifolium pratense* is evident. Instead, in drier areas such as tops of hills or steep south facing slopes, *Phleo-Bromion* sub-xerophylous species become more abundant. Where extensive grazing peridically occurs, the role of some *Thero-Brachypodietea* species is significantly increased, though they never reach very high degrees of cover. Terraces in which there is a more or less uninterrupted passage of animals show scattered small patches of *Thero-Brachypodietalia* communities within a *Brachypodium rupestre* matrix. The species most frequently associated with *Brachypodium rupestre* are *Dactylis glomerata,* (which shows an about 100% frequence in the community), *Sanguisorba minor, Galium lucidum, Bromus erectus, Phleum ambiguum, Ornithogalum brevistylum, Trifolium ochroleucum, Lathyrus sylvestris*, *Cephalaria leucantha, Scabiosa columbaria*. Because of the tendency of *Brachypodium rupestre* to gain advantage from woodland clearances (LUCCHESE, 1990), it is rarely mentioned as a grasslands guide species. Yet in the Monti Ausoni area, *B. rupestre* is abundant in open *Quercus pubescens*, *Ostrya carpinifolia* and *Carpinus orientalis* woods (BLASI & DI PIETRO, 1998; DI PIETRO & BLASI, 1998; BLASI & *al*., 2001). However, abandoned olive groves terraces would also seem to provide sites which are well-suited to *Brachypodium rupestre,* because the species is undoubtedly more abundant in these environments than in the surrounding open areas, where it is always subordinate to *Bromus erectus*. *Brachypodium rupestre* dominance is mainly due to the greater depths of soil and clay percentage inside terraces than outside. The lines of stone walls across the slopes prevent soil removal during storms and allow a higher degree of moisture to be conserved during the warm, dry summer months. The presence of xerophytic *Bromus erectus* communities immediately around the terraces, on ground on which *B. rupestre* never dominates, seems to support this hypothesis.

Syntaxonomy

For *Brachypodium rupestre* communities a new association named *Galio lucidi-Brachypodietum rupestris*, is here proposed. Among all the communities analyzed in this study, this association is probably the one which most closely depends upon the particular conditions created by terraces. The diffe-

rential species of *Galio -Brachypodietum* are*, Galium lucidum, Trifolium ochroleucum, Lathyrus sylvestris*, *Sanguisorba minor,* and *Scabiosa columbaria*. This association can be considered a low-altitude and termophilous variant of both *Polygalo flavescentis-Brachypodietum rupestris* described in the submontane and low-montane belt of Latium and Umbria regions (LUCCHESE & *al*., 1995) and *Dorycnio-Brachypodietum* described for for the marl-arenaceous substrates of northern Appennine (UBALDI, 1988, ZANOTTI & *al.,* 1995).

The *Galio-Brachypodietum* also shares common elements with the *Briza media* and *Brachypodium rupestre* variant of the *Pseudolysimachio-Brometum*, which is derived from firing and cutting of woods, in the Monte Rufeno reserve in northern Latium (SCOPPOLA & PELOSI, 1995). However, compared with the Monti Ausoni *Brachypodium rupestre* communities, the M.Rufeno ones occur on soils which have a markedly higher clay component (this is attested to by the occurrence of species such as *Aster linosyris, Plantago maritima, Agrostis stolonifera*).

Although the Monti Ausoni olive groves experienced long periods of human influence prior to abandonment, there is little evidence to support any affinity between *Galio-Brachypodietum* and *Agropyretalia-repentis* or *Brachypodietalia phoenicoidis*. The high degree of naturalness in the olive groves, even during active periods, suggests we should retain a *Festuco-Brometea* syntaxonomical context, and more precisely, in the moister fringe of *Phleo-Bromion erecti* alliance at the contact with *Bromion erecti* communities. On the basis of the description of the communities which belong to this last alliance (BRAUN-BLANQUET & MOOR, 1938; BARBERO & LOISEL, 1971; ROYER, 1978; 1991; BIONDI & *al*., 1995) the high rate of stenomediterranean species occurring in the Ausoni mountains *Brachypodium* community, does not allow to include them in *Bromion*.

SYNDYNAMICAL CONSIDERATIONS

If we exclude just a few restricted areas within the limestone cliffs facing the sea, where the shrubby communities of *Pistacio-Rhamnetalia alaternii* are to be considered the final stage of the dynamical succession (BLASI & *al*., 2000), the whole study area exhibits a strong dynamic tendency for woodlands (see Figure 4; BLASI & DI PIETRO, 1998; DI PIETRO & BLASI, 1998; BLASI & *al*., 2001). The potential vegetation type of the steeper parts of south facing slopes is the evergreen *Quercus ilex* wood (*Viburno-Quercetum ilicis* and *Orno-Quercetum ilicis*), whereas on the foothills it tends to be the deciduous *Quercus pubescens* wood (*Roso sempervirentis-Quercetum pubescentis*). North facing slopes on the parts of the mountain chain nearest to the sea are characterized by mixed woods of *Quercus ilex* and deciduous termophylous trees such as *Fraxinus ornus* and *Carpinus orientalis* (*Orno-Quercetum ilicis* and *Lonicero-Carpinetum orientalis*). Around the intramontane basins, olive grove areas tend syndynamically towards *Ostrya carpinifolia* and *Quercus pubescens* woods on steep and gentle slopes respectively (*Melitto-Ostryetum* and *Roso-Quercetum pubescentis*). Regarding shrubland intermediate successional stages (BLASI & *al*., 2000), *Thymo-Hyparrhenietum* and *Psoraleo-Ampelodesmetum* are linked to *Myrto-Lentiscetum* or *Rhamno-Euphorbietum*, whereas *Galio-Brachypodietum* is chiefly linked to *Roso-Rubetum ulmifolii*. As far as *Crucianello-Hypochoeridetum* is concerned, it can be involved in the regressive dynamics of both evergreen and deciduous potential vegetation types.

CONCLUSIONS

Considering the strong trend towards abandonment of traditional terraced olive cultivation in the Italian peninsula, it is becoming important to investigate the pattern of plant communities through which the natural recovery of wild vegetation is being expressed.

In the relatively small area of the Monti Ausoni (about 500 Km^2), a rather diversified response of vegetation to different environmental conditions has been observed for abandoned olive grove grasslands. Some species (e.g. *Ampelodesmos mauritanicus* or *Brachypodium rupestre*) have gained advantage in increasing their role as dominants because of the presence of an artificial structure such as the terrace. However, at the community level, only *Galio-Brachypodietum* is apparently to be found exclusively in the terrace environment.

A syntaxonomical outcome of our study is the proposal for two new grassland associations. Furthermore, this paper gives a contribution to the interpretation (at least in terms of syntaxonomical dis-

Table 6
Galio lucidi-Brachypodietum rupestris ass. nova
(Phleo-Bromion erecti, Brometalia erecti, Festuco vallesiacae-Brometea eecti)

Altitude (m a.s.l.)			135	135	420	400	540	540	370	390	510	505	505	505	515	300	130	290	420	340	360	
Exposure			E	E	W	N	NNE	ENE	ENE	W	WN W	WN W	WN W	WN W	WN W	NN W	NE	WN W	W	WS W	W	
Área (m^2)			10	12	8	15	16	15	30	30	15	25	12	10	20	10	8	50	8	15	8	
Shrubs layer cover (%)			30	10	.	.	.	.	30	20	5	.	10	20	15	10	.	.	.	.	.	
Grass layer cover (%)			100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	90	90	
Number of species			47	23	14	44	45	18	24	29	35	24	14	28	34	14	30	42	23	28	25	
Relevé n.º			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Assoc. characteristics species:																						
H Caesp	subatlant.	*Brachypodium rupestre*	2	5	3	3	3	4	4	4	3	4	4	4	4	5	3	4	1	3	4	V
H scap	euromed.	*Galium lucidum*	.	.	1	1	1	+	1	.	1	.	+	1	.	+	.	.	2	1	2	III
G bulb	endemica	*Ornitoghalum brevistylum*	1	+	.	1	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.	III
H scand	europ.-caucas.	*Lathyrus sylvestris*	+	.	1	.	+	1	2	.	.	.	.	.	.	.	.	.	1	.	1	II
T scap	eurasiat	*Scabiosa columbaria*	.	.	.	.	1	.	.	.	2	.	.	1	1	.	1	2	1	.	.	II
H caesp	s-europ.-sudsib.	*Trifolium ochroleucum*	.	.	.	.	2	1	.	.	1	+	.	.	+	.	.	1	.	.	.	II
Alliance characteristic species:																						
G rhiz	endem.	*Phleum ambiguum*	.	1	.	.	.	.	.	2	1	1	1	.	.	.	.	1	4	2	2	III
Ch suffr	euromed.	*Teucrium chamaedrys*	2	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	2	I
H scap	SE-europ.	*Eryngium amethystinum*	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+	.	I
H scap	w-medit.-mont.	*Knautia purpurea*	1	1	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	I
H scap	paleotemp.	*Cerastium arvense*	.	.	+	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	I
Ch suffr	europ.-caucas.	*Helianthemum nummularium* subsp. *obscurum*	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	I
H caesp	endem.	*Bromus caprinus*	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	I
H bienn	endem.	*Centaurea deusta*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	2	I
H scap	w-euromed.	*Pontentilla hirta*	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H scap	medir.-mont.	*Dianthus sylvestris*	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	I
H scap	s- e c-europ.	*Dianthus carthusianorum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	I
H scap	endem.	*Erysimum pseudorhaeticum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	I
T scap	paleotemp.	*Medicago lupulina*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Order and Class characteristic species (s.l.):																						
H caesp	paleotemp.	*Dactylis glomerata*	1	2	2	3	2	2	1	4	2	1	1	.	2	2	2	2	2	3	3	V
H scap	eurasiat.	*Ranunculus bulbosus*	+	.	.	.	1	1	.	.	+	+	.	.	+	.	.	+	.	.	.	II
H caesp	eurosib.	*Trifolium pratense*	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	+	.	.	.	II
H caesp	paleotemp.	*Bromus erectus*	.	.	.	3	.	.	3	.	1	.	.	.	1	.	2	.	3	.	.	II
H scap	eurosib.	*Tragopogon pratensis*	.	.	.	.	.	.	+	.	+	+	+	1	.	.	.	.	.	.	.	II
H scap	paleotemp.	*Lotus corniculatus*	2	.	.	.	2	2	.	.	.	.	.	.	+	.	.	.	.	.	.	I
H scap	s-europ.-sudsib.	*Dorycnium pentaphyllum*	.	.	.	.	1	2	2	.	.	.	.	.	.	.	.	+	.	.	.	I
T scap	subcosmop.	*Bromus hordeaceous*	+	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H scap	SE-sudsib.	*Potentilla recta*	+	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	I
H caesp	circumbor.	*Poa pratensis*	.	.	1	.	+	.	.	2	.	.	.	.	.	.	.	.	.	.	.	I
Ch suffr	euromed.	*Ononis spinosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	I
G bulb	euromed.	*Leopoldia comosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Companion species:																						
H scap	paleotemp.	*Sanguisorba minor*	1	1	.	1	+	.	+	.	1	.	+	1	.	.	1	1	+	1	.	IV
H bienn	paleotemp.	*Daucus carota*	.	.	.	1	1	+	.	.	+	+	.	+	.	1	2	1	.	+	2	III
P scap	SE-sudsib.	*Fraxinus ornus*	+	.	.	+	+	1	1	1	+	.	.	+	.	.	.	.	.	.	.	III
T scap	euromed.-turan.	*Vicia sativa*	.	1	1	1	+	.	.	.	.	+	.	+	1	.	.	+	.	.	.	III
H bienn	paleotemp.	*Campanula rapunculus*	.	+	.	2	+	.	+	.	+	1	.	.	.	.	.	+	+	.	.	II
H scap	stenomed.	*Carlina corymbosa*	.	.	.	+	.	.	+	1	.	.	.	.	.	.	+	1	1	+	1	II
T scap	euromed.	*Acinos arvensis*	.	.	.	.	+	.	+	1	+	.	.	.	+	.	.	+	+	1	.	II
T sacap	euromed.	*Avena barbata*	1	2	+	.	+	.	.	.	.	.	.	.	.	.	1	.	.	2	1	II
H scap	paleotemp.	*Hypericum perforatum*	+	.	.	+	+	.	+	+	.	+	.	.	+	.	.	.	.	.	.	II
T scap	euromed.	*Blackstonia perfoliata*	+	.	.	1	.	.	+	.	+	.	.	.	+	.	.	+	.	+	.	II
T scap	paleotemp.	*Trifolium campestre*	4	.	.	.	+	.	.	2	.	.	.	+	.	.	1	.	.	1	2	II
H caesp	SE-sudsib.	*Melica transsylvanica*	+	.	.	.	.	.	.	.	+	.	.	.	.	+	+	.	+	+	2	II
T scap	subtrop.	*Briza maxima*	.	.	+	.	.	.	.	1	1	.	.	+	1	+	.	.	.	.	.	II
H scap	euromed.	*Mentha suaveolens*	2	1	.	.	.	.	.	1	.	.	.	.	.	.	2	1	.	.	.	II
H bienn	paleotemp.	*Centaurium erythraea*	.	+	.	1	.	.	.	.	+	+	.	.	.	.	.	.	+	.	.	II
H scap	stenomed.	*Reichardia picroides*	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+	1	.	II
P caesp	euromed.	*Spartium iunceum L.*	.	.	.	+	.	+	.	.	+	+	.	.	.	.	.	.	+	.	.	II
H ros	eurasiat.	*Plantago lanceolata L.*	.	.	.	.	1	.	.	+	+	.	.	.	+	.	2	.	.	.	.	II
P scap	euromed.	*Securigera securidaca*	.	.	.	.	.	.	.	1	.	.	.	+	1	1	.	2	.	.	.	II
H scap	eurosib.	*Picris hieracioides L.*	.	.	.	.	.	.	.	.	1	+	1	.	1	.	.	1	.	.	.	II
T scap	euromed.	*Avena sterilis L.*	.	.	.	.	.	.	.	.	2	1	.	1	2	.	.	2	.	.	.	II
H scap	euromed.	*Urospermum dalechampii*	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	I
H caesp	euromed.	*Poa sylvicola*	.	.	1	.	+	2	.	.	.	.	.	.	.	.	1	.	.	.	.	I
H caesp	paleotemp.	*Festuca arundinacea*	.	.	3	.	2	2	.	.	.	.	.	.	.	.	.	.	1	.	.	I
T scap	euromed.	*Trifolium stellatum*	.	.	.	1	+	.	.	.	.	.	.	+	.	.	.	+	.	.	.	I

Hscap	euromed.	*Prunella laciniata*	.	.	.	1	1	.	.	.	.	.	.	.	.	.	1	1	.	.	.	I
T scap	euromed.	*Cynosurus echinatus*	.	.	.	1	.	.	.	.	+	+	.	2	.	.	.	.	.	.	.	1
H caesp	circumbor.	*Lolium perenne*	.	.	.	.	2	.	.	1	.	+	..	.	.	.	1	.	.	.	.	I
P caesp	paleotemp.	*Crataegus monogyna*	.	.	.	.	.	.	+	+	.	.	1	+	.	.	.	.	.	.	.	I
T scap	euromed.	*Medicago minima*	.	.	.	.	.	.	.	1	.	.	.	.	.	.	2	+	.	1	.	I
T scap	stenomed.	*Elaeoselinum asclepium*	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	I
H caesp	eurasiat.	*Poa trivialis*	.	.	.	.	1	.	.	.	.	.	.	1	+	.	.	1	.	.	.	I
Np	euromed.	*Rubus ulmifolius*	2	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
T scap	ne-euromed.	*Crepis neglecta*	1	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
T scap	euromed.	*Medicago rigidula*	1	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
P scap	stenomed.	*Quercus ilex*	1	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	I
T scap	euromed.	*Gaudinia fragilis*	1	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	I
Np	subtrop.	*Smilax aspera*	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
G rhiz	europ.	*Carex flacca* subsp. *serrulata*	1	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	I
H caesp	stenomed.	*Phalaris bulbosa*	+	.	.	.	.	.	.	1	.	.	.	.	.	2	.	.	.	.	.	I
H bienn	stenomed.	*Galactites tomentosa*	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	I
P caesp	europ.-caucas.	*Prunus spinosa*	.	+	.	.	.	.	.	.	.	+	.	.	1	.	.	.	.	.	.	I
T scap	stenomed.	*Hypochoeris achyrophorus*	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	I
G bulb	euromed.	*Gladiolus italicus*	.	.	.	.	+	.	+	.	.	.	.	.	.	1	.	.	.	.	.	I
H caesp	se-europ.	*Sesleria autumnalis*	.	.	.	.	.	.	1	.	1	.	.	1	.	.	.	.	.	.	.	I
Np	paleotemp.	*Rosa canina*	.	.	.	.	.	.	1	.	.	.	.	1	+	.	.	.	.	.	.	I
H scap	orof. s-europ.	*Cephalaria leucantha*	.	.	.	.	.	.	.	.	2	+	3	.	.	.	.	.	.	.	.	I
H scap	endem.	*Linaria purpurea*	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	1	I
Np	stenomed	*Rosa sempervirens*	.	.	.	.	.	.	.	.	+	.	1	.	1	.	.	.	.	.	.	I
H scap	s-euromed.	*Foeniculum vulgare*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	I
P Lian	euromed.	*Clematis flammula*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+	.	I
H caesp	sw-stenomed.	*Ampelodesmos mauritanicus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	2	I
T scap	euromed.	*Bromus sterilis*	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
T scap	stenomed.	*Lotus ornitopodioides*	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
T scap	stenomed.	*Anthemis arvensis*	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H cap	circumbor.	*Prunella vulgaris*	2	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	I
T scap	euromed.	*Bromus madritensis*	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
T scap	euromed.-turan.	*Torilis nodosa*	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	I
T scap	stenomed.	*Brachypodium distachyum*	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.I
P caesp	se-europ.	*Quercus pubescens*	.	+	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	I
H caesp	paleotemp.	*Poa bulbosa*	.	.	.	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H ros	euromed.	*Viola alba* subsp. *dehnhardtii*	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	I
G rhiz	stenomed.	*Asphodelus microcarpus*	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	I
T scap	stenomed.	*Plantago psyllium*	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	I
T scap	stenomed.-atl.	*Gastridium ventricosum*	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	I
H rept	paleotemp.	*Trifolium repens*	.	.	.	.	2	.	.	.	.	.	.	.	.	.	1	.	.	.	.	I
H scap	subcosmop.	*Agrimonia eupathoria*	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	+	.	.	.	I
P Lian	euromed.	*Lonicera etrusca*	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	I
T scap	stenomed.-turan.	*Aegilops geniculata*	.	.	.	.	.	.	.	1	.	.	.	+	.	.	.	.	.	.	.	I
T scap	euromed.	*Medicago orbicularis*	.	.	.	.	.	.	.	1	.	.	.	.	+	.	.	.	.	.	.	I
T scap	stenomed.	*Orlaya kochii*	.	.	.	.	.	.	.	.	2	.	.	+	.	.	.	.	.	.	.	I
Ch Succ	w- e c-europ.	*Sedum rupestre*	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	I
P caesp	europ.-caucas.	*Ulmus minor*	.	.	.	.	.	.	.	.	.	+	.	2	.	.	.	.	.	.	.	I
Np	europ.-caucas	*Ligustrum vulgare*	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	I
H scap	euromed.	*Galium mollugo*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.	.	I
H scap	euromed.	*Nigella damascena*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	I
G bulb	stenomed.	*Allium tenuiflorum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	I
H scap	euromed.	*Convolvulus cantabrica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	I
T scap	stenomed.	*Anacyclus radiatus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	+	.	.	I
H scap	paleotemp.	*Silene vulgaris*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	I

Other species: Companion species: *Allium subhirsutum, Buglossoides purpurocaerulea, Cruciata laevipes, Galium corrudifolium, Lolium multiflorum, Melica arrecta* and *Urospermum picroides* +, *Hedera helix* and *Sonchus oleraceus* 1, *Vicia villosa s.str.* 2 in 1; *Bunium bulbocastanum* and *Sherardia arvensis* + in 2; *Ranunculus lanuginosum* + in 3; *Aira tenorei, Brachypodium ramosum, Bupleurum baldense, Crupina crupinastrum, Geranium sanguineum, Lapsana communis, Lathyrus ochrus, Phleum subulatum, Tamus communis* and *Veronica serpyllifolia* +, *Cerastium ligusticum, Ranunculus millefoliatus* and *Tordylium apulum* 1, *Orlaya grandiflora* 2 in 4; *Acer monspessulanum, Aira caryophyllea, Holcus lanatus* and *Rosa canina* var. *andegavense* +, *Cynosurus cristatus, Sedum tenuifolium, Vulpia myuros* 1, *Brachypodium sylvaticum* 2 in 5; *Castanea sativa, Genista tinctoria* and *Geranium purpureum* +, *Oenanthe pimpinelloides* 2 in 6; *Allium vineale* +, *Cytisus scoparius* 1, *Teucrium siculum* 2 in 7; *Coronilla emeroides, Sorbus domestica* and *Trifolium lappaceum* + in 8; *Carpinus orientalis* and *Catapodium rigidum* 1 in 8; *Lathyrus aphaca* 1 in 10; *Linum strictum* + in 12; *Linum trygunum, Mycelis muralis, Phleum pratense, Plantago altissima* and *Scorpiurus muricatus* +, *Asperula laevigata* and *Trifolium striatum* 1 in 13; *Olea europaea* +, *Asparagus acutifolius* 1 in 14; *Rumex obtusifolium* and *Salvia verbenaca* +, *Hordeum bulbosum* 1 in 15; *Convolvulus arvensis, Petrorhagia prolifera, Rubus canescens* and *Torilis arvensis* +, *Dasypyrum villosum, Pallenis spinosa* and *Stachys salvifolia* 1, *Medicago sativa* subsp. *sativa* 2 in 16; *Anacamptis pyramidalis* and *Lilium croceum* + in 17; *Micromeria graeca* 2, *Sonchus tenerrimus* + in 18; *Carduus pycnocephalus, Chrysopogon grillus* and *Lavatera punctata* 1 in 19.

Localities: 1, 2: Topanti - M. S. Biagio (LT), 06.06.1996; 3: Aquaro, Vallecorsa (FR), 14.06.1996; 4: M. La Foresta, Sonnino (LT), 07.06.1996; 5, 6: Valle Vettia, Amaseno (FR), 13.06.1996; 7: S. Sosio, Castro dei Volsci (FR), 11.06.1996; 8: Vado di Regno, Castro dei Volsci (FR), 14.06.1996; 9-13: M. S. Angelo - Castro dee Volsci (FR), 27.06.1996; 14: M. Cimate, Pastena (FR), 12.07.1996; 15: Colle Giustici, Amaseno (FR), 13.06.1996; 16: Taverna, Campodimele (LT), 27.06.1996; 17: Aquaro, Vallecorsa (FR), 14.06.1996; 18: Cimitero, Pastena (FR), 06.07.1996; 19: Vado di Regno, Castro dei Volsci (FR), 14.06.1996.

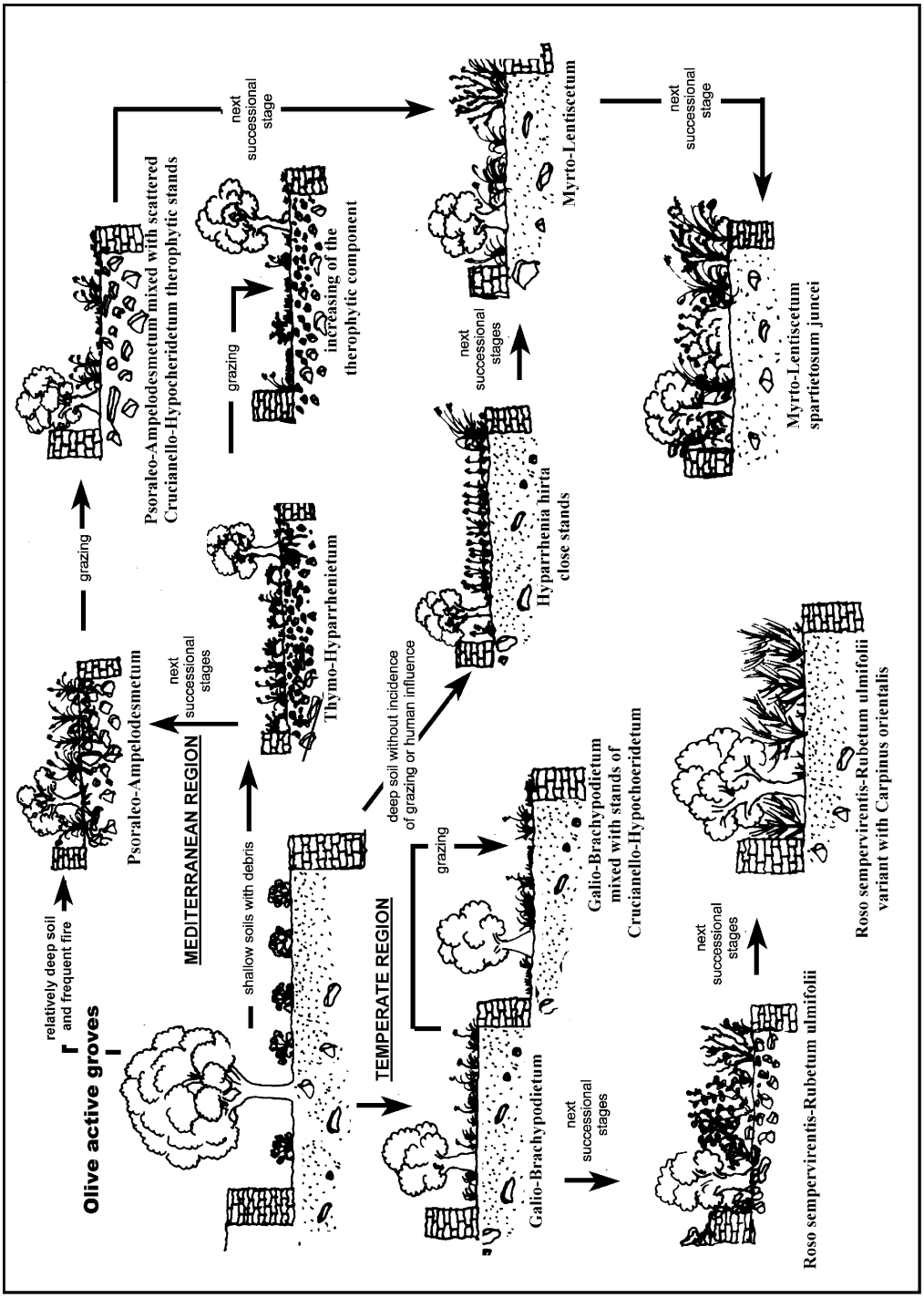

Figure 4.—Syndynamical evolution of Ausoni mountains abandoned olive groves grasslands.

cussion) of the Italian peninsula dry grasslands in which are involved alliances such as *Cymbopogo-Brachypodion* or *Bromion erecti* which previously was never used for central Italy.

However, we believe that the most significant result of this paper lies in the information and quantitative data it provides about the vegetation of this mediterranean «vanishing landscape». Nevertheless, given the relatively small area studied, the results should be read and analysed in the context of the situation throughout the mediterranean basin, where the abandonment of traditional olive groves is becoming a generalized phenomenon.

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SYNTAXONOMICAL SCHEME

FESTUCO VALESIACAE-BROMETEA ERECTI Br.-Bl. & Tx. *ex* Br.-Bl 1949
- *Brometalia erecti* Br.-Bl. 1936
  - *Phleo-Bromion erecti* Biondi & Blasi *ex* Biondi, Ballelli, Allegrezza & Zuccarello 1995
    - *Galio lucidi-Brachypodietum rupestris* ass.nova

THERO-BRACHYPODIETEA RAMOSI Br.-Bl. *ex* A. & O. Bolòs 1950
- *Hyparrhenietalia hirtae* Rivas-Martinez 1978
  - *Hyparrhenion hirtae* Br.-Bl., P. Silva & Rozeira 1956
    - *Thymo vulgaris-Hyparrhenietum hirtae* ass. nova
    - *Andropogonetum hirto-pubescentis* A. & O. Bolòs & Br.-Bl. in A. & O. Bolòs 1950.
    - *Psoraleo bituminosae-Ampelodesmetum mauritanici* Arrigoni & Di Tommaso 1997

HELIANTHEMETEA (Br.-Bl. *in* Br.-Bl., Roussine & Négre, 1952) Riv.-God. & Riv.-Mart. 1963 em. Riv.-Mart. 1978
- *Trachynetalia distachyae* Rivas-Martínez 1978
  - *Trachynion distachyae* Rivas-Martínez 1978
    - *Crucianello latifoliae-Hypochoeridetum achyrophori* Filesi, Blasi & Di Marzio 1996

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Ampelodesmo mauritanici-Ericetum multiflorae Arrigoni & Di Tommaso 1997
Aristido-Hyparrhenion hirtae Brullo, Spampinato & Minissale 1997
Avenulo-Ampelodesmion mauritanici Minissale 1995
Brachypodietalia phoenicoidis Br.-Bl. ex Molinier 1934
Brachypodio-Chrysopogonetea Horvatic 1958
Bromion erecti Koch 1926
Cisto-Ericion Horvatic 1958
Cisto incani-Ampelodesmetum mauritanici Biondi & Mossa 1992
Cymbopogo-Brachypodion ramosi Horvatic (1956) 1958
Dauco-Hyparrhenion hirtae Br.-Bl. & *al.* 1956 em. Bolòs 1962
Dorycnio pentaphylli-Brachypodietum rupestris Ubaldi 1988
Elaeoselino asclepii-Ampelodesmetum mauritanici Filesi, Blasi & Di Marzio 1996
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Hyparrhenietalia hirtae Rivas-Martínez 1978
Hyparrhenio-Coridothymetum capitati Eig 1939
Lonicero etruscae-Carpinetum orientalis Blasi, Di Pietro, Filesi & Fortini 2001
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Melitto-Ostryetum Avena, Blasi, Scoppola, Veri 1980
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Orno-Quercetum ilicis Horvatìc (1956) 1958
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Teucrio siculi-Quercion cerridis Ubaldi 1988 em. Scoppola & Filesi 1995
Thero-Brachypodion ramosi Br.-Bl. 1925
Saturejo-Hyparrhenion hirtae O. Bolòs 1961
Trifolio scabri-Hypochoeridetum achirophori Lapraz ex Biondi, Izco, Ballelli & Formica 1997
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