

E1.7 Lowland to submontane, dry to mesic *Nardus* grassland

Summary

This kind of grassland, dominated by the tightly tussocky *Nardus stricta* is characteristic of nutrient-poor, acidic soils, sometimes seasonally wet, on siliceous substrates through the entire lowlands and sub-montane zone of temperate Europe, though optimally developed in the cooler and rainier climate of the Atlantic zone. Though *Nardus* is itself unrewarding for stock, the rather short swards are typically grazed by sheep and/or cattle and are part of wider pastoral landscapes of heathlands in the lowlands, and, at higher altitudes, other sub-montane habitats. Other grasses may share dominance but the associated flora is generally rather species-poor. Abandonment of grazing can permit invasion by sub-shrubs and eventually trees and smaller lowland fragments are more susceptible to enrichment through local agricultural improvement or atmospheric inputs. Afforestation is also sometimes a threat, also in the lowlands, improvement for arable cultivation, land-take for urbanisation and the invasion of non-native species.

Synthesis

The habitat is assigned to the category Vulnerable (VU), both in EU28 and EU28+, based on the application of Criterion A1, since it was affected by a remarkable quantitative decline, with a loss of around 38% of its former area during the last 50 years. Quantitative trends from the United Kingdom, accounting for 3/4 of the total known surface, were not available and therefore a large rate of the total area remains not evaluated. Due to a wide and scattered distribution, the application of Criterion B results in the category Least Concern (LC) both in EU28 and EU28+. Also evaluating the decline in quality (Criterion C/D1) leads to the conclusion Least Concern (LC). Nevertheless, a serious qualitative decline is evident, showing a degree of severity around 48% affecting 36% of the total habitat surface. These values are close to the threshold of Near Threatened, and it should be stressed that a dramatic process of qualitative degeneration clearly affected these grasslands during the last 50 years and will probably continue, a situation that calls for urgent conservation actions.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Vulnerable	A1	Vulnerable	A1

Sub-habitat types that may require further examination

No sub-habitats have been distinguished, but regional types with different species composition may be relevant and more threatened.

Habitat Type

Code and name

E1.7 Lowland to submontane, dry to mesic *Nardus* grassland



Arnica montana, a characteristic species in lowland to submontane *Nardus* grasslands. The Veluwe, The Netherlands (Photo: Rense Haveman).



Submontane *Nardus* grassland at Mt. Civitelle. Central Apennine, Italy (Photo: Daniela Gigante).

Habitat description

The grasslands characterized by *Nardus stricta* from the lowland areas up to the submontane belt of the mountains are separated from the *Nardus* communities in higher mountains (E4.3b), although Natura 2000 classifies them together in one type (H6230). This in spite of the naming of the habitat type in the EU Interpretation Manual: 'Species-rich *Nardus* grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)'. The habitat includes low-growing grasslands on nutrient-poor, acidic and moist to moderately dry soils. In most cases, the vegetation is grazed by sheep and/or cattle; occasionally, burning takes place. The species composition of the vegetation is closely related to the intensity and type of grazing. Generally, *Nardus stricta* is the dominant species, providing the vegetation with a densely tufted structure. Even from a distance, the pale wiry foliage of the species helps marking out the stands; later in the season the leaves turn to a bleached straw colour. Occasionally, other oligotrophic grasses (such as *Festuca filiformis*, *Agrostis capillaris* and *Deschampsia flexuosa*) may dominate, as well as – less frequent – rushes like *Juncus squarrosus*, the latter on relatively wet soils and in regions with a high precipitation. The habitat is widespread in the temperate zone of Europe, from Western to Central Europe. In Northern Europe, it reaches to Southern Norway, Southern Sweden and Latvia, in Southern Europe to Spain and Italy. The *Nardus* swards prefer a rainy and cool climate; in Great Britain, for instance, the habitat is rather rare in the warmer and drier lowlands, but very common and widespread in the cool and wet mountains in the north.

In the widespread 'sand landscape' of the lowland regions in North-western Europe (Belgium, Netherlands, Northern Germany and Southern Denmark), the *Nardus* grasslands are part of the traditional heathland systems, nowadays limited to nature reserves. Here, the communities are often restricted to small localities and highly endangered. Where the *Nardus* grasslands in Europe occupy larger areas, they tend to disappear due to abandoning at the one hand or nutrient enrichment on the other hand. In both cases, the sites are taken over by more competitive species.

Consequently to the abandonment of the traditional grazing activities, these grasslands are invaded by shrubs, such as *Calluna vulgaris*, *Vaccinium* sp. pl., *Juniperus communis*, or trees, e.g. *Betula pendula*, *Pinus sylvestris*, as well as *Picea* and *Larix* and, sometimes, *Pinus cembra* or *Populus tremula*.

Indicators of good quality:

- Low and rather dense vegetation structure;
- Absence of shrubs and trees.

Characteristic species:

Vascular plants: *Agrostis capillaris*, *Ajuga tenorei*, *Antennaria dioica*, *Arnica montana*, *Bellardiochloa*

variegata, *Brachypodium genuense*, *Campanula barbata*, *Carex ericetorum*, *Crepis conyzifolia*, *Crocus neapolitanus*, *Deschampsia flexuosa*, *Dianthus deltoides*, *Festuca circumediterranea*, *Festuca filiformis*, *Festuca ovina* (agg.), *Festuca nigrescens*, *Festuca paniculata*, *Galium saxatile*, *Gentiana pneumonanthe*, *Gentiana kochiana*, *Geum montanum*, *Gnaphalium sylvaticum*, *Homogyne alpina*, *Hypericum maculatum*, *Juncus squarrosus*, *Lathyrus linifolius* (= *L. montanus*), *Leontodon helveticus*, *Meum athamanticum*, *Nardus stricta*, *Nigritella rhellicani*, *Orchis spitzelii*, *Pedicularis sylvatica*, *Pilosella aurantiaca*, *Pilosella lactucella*, *Platanthera bifolia*, *Polygala serpyllifolia*, *Polygala vulgaris*, *Potentilla aurea*, *Potentilla erecta*, *Potentilla rigoana*, *Ranunculus pollinensis*, *Senecio scopolii*, *Tulipa sylvestris* subsp. *australis*, *Veronica officinalis*, *Viola calcarata* subsp. *cavillieri*, *Viola canina*.

Classification

This habitat may be equivalent to, or broader than, or narrower than the habitats or ecosystems in the following typologies.

EUNIS:

E1.7 Closed non-Mediterranean dry acid and neutral grassland

EuroVegChecklist alliances:

Violion caninae Schwickerath 1944

Nardo-Agrostion tenuis Sillinger 1933

Achilleo-Arnicion Horvat et Pawlowski in Horvat 1960

Campanulo herminii-Nardion Rivas-Mart. 1964

Nardo-Juncion squarrosi (Oberd. 1957) Passarge 1964

Ranunculo pollinensis-Nardion strictae Bonin 1972

Potentillo-Polygonion vivipari Nordhagen ex Dierssen 1992 (lower parts)

Annex 1:

6230* Species-rich *Nardus* grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)

Emerald:

E1.71 *Nardus stricta* swards

E1.722 Boreo-arctic *Agrostis-Festuca* grasslands

MAES-2:

Terrestrial Grassland

IUCN:

4.4 Temperate grassland

Does the habitat type present an outstanding example of typical characteristics of one or more biogeographic regions?

No

Justification

Although generally affected by reduction processes due to various pressures, this type of habitat has a scattered distribution involving several biogeographical regions: Boreal, Continental, Atlantic, Alpine and, for a limited range, Mediterranean.

Geographic occurrence and trends

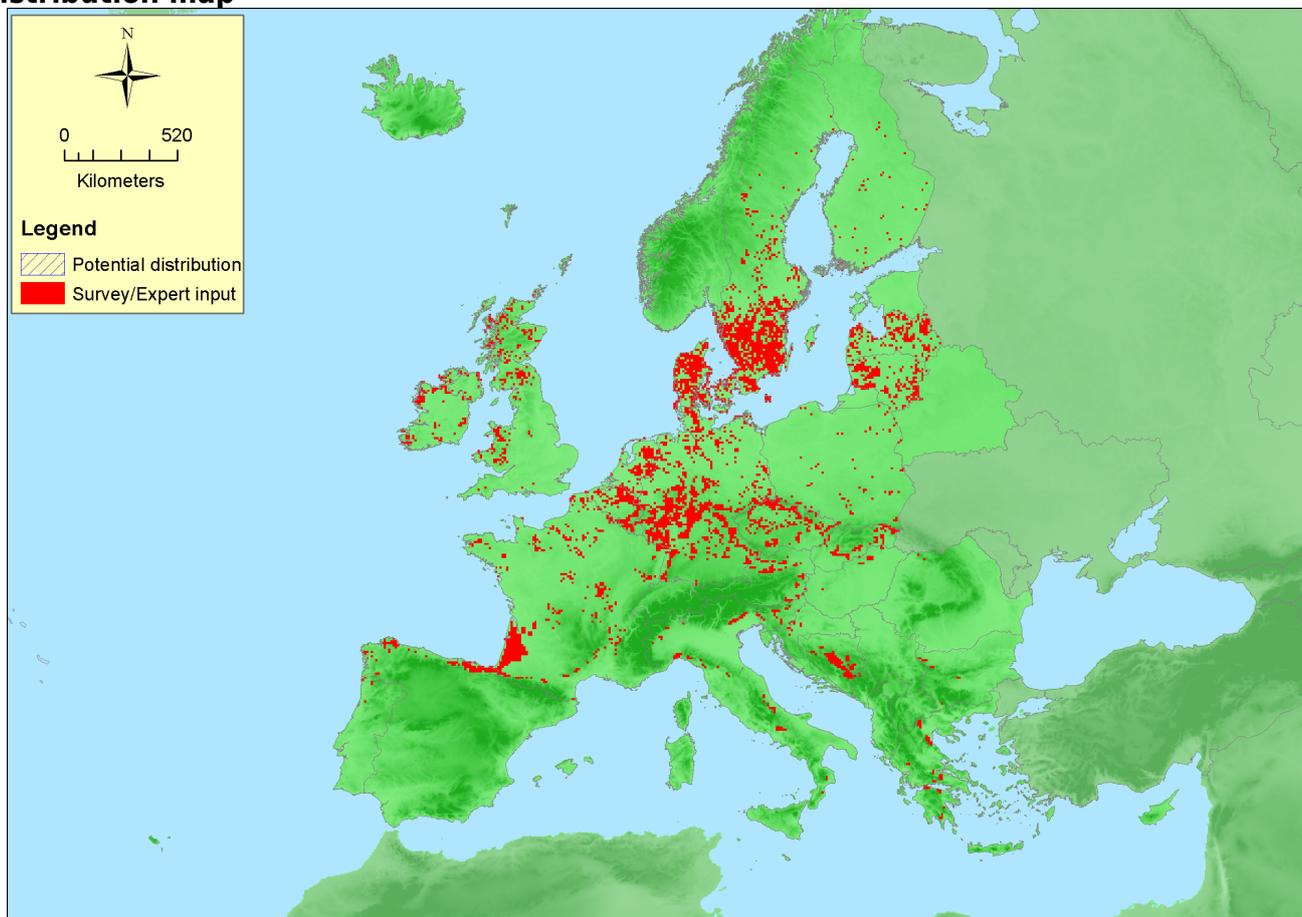
EU 28	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
<i>Austria</i>	Present	36 Km ²	Decreasing	Decreasing
<i>Belgium</i>	Present	10 Km ²	Decreasing	Decreasing
<i>Bulgaria</i>	Present	500 Km ²	Increasing	Decreasing
<i>Croatia</i>	Present	25 Km ²	Decreasing	Decreasing
<i>Czech Republic</i>	Present	91 Km ²	Decreasing	Decreasing
<i>Denmark</i>	Uncertain	Unknown Km ²	Unknown	Unknown
<i>Estonia</i>	Present	Unknown Km ²	Unknown	Decreasing
<i>Finland</i>	Aland Islands: Uncertain Finland mainland: Present	0.5 Km ²	Decreasing	Decreasing
<i>France</i>	France mainland: Present	750-1250 Km ²	Decreasing	Decreasing
<i>Germany</i>	Present	77 Km ²	Decreasing	Decreasing
<i>Hungary</i>	Present	1 Km ²	Decreasing	Decreasing
<i>Ireland</i>	Present	27-55 Km ²	Unknown	Decreasing
<i>Italy</i>	Italy mainland: Present	278-729 Km ²	Decreasing	Decreasing
<i>Latvia</i>	Present	5 Km ²	Decreasing	Decreasing
<i>Lithuania</i>	Present	2-2.5 Km ²	Decreasing	Decreasing
<i>Netherlands</i>	Present	8 Km ²	Decreasing	Decreasing
<i>Poland</i>	Present	125 Km ²	Decreasing	Decreasing
<i>Portugal</i>	Portugal mainland: Present	68 Km ²	Decreasing	Unknown
<i>Romania</i>	Present	2,000 Km ²	Stable	Decreasing
<i>Slovakia</i>	Present	199 Km ²	Decreasing	Decreasing
<i>Spain</i>	Spain mainland: Present	228 Km ²	Decreasing	Decreasing
<i>Sweden</i>	Uncertain	Unknown Km ²	Unknown	Unknown
<i>UK</i>	Gibraltar: Uncertain Northern Island: Uncertain United Kingdom: Present	15,000 Km ²	Unknown	Unknown

EU 28 +	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
<i>Bosnia and Herzegovina</i>	Present	10 Km ²	Decreasing	Decreasing
<i>Norway</i>	Norway Mainland: Uncertain	Unknown Km ²	Unknown	Unknown
<i>Switzerland</i>	Present	1-5 Km ²	Decreasing	Decreasing

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28	3,799,900 Km ²	2,356	19,432-20,412 Km ²	EOO+AOO to be corrected
EU 28+	3,809,450 Km ²	2,364	19,443-20,427 Km ²	EOO+AOO to be corrected

Distribution map



The map currently includes: Belgium, Estonia, Finland, France, Germany, Ireland, Latvia, Lithuania, Netherlands, Poland, Spain (probably largely underestimated), United Kingdom, Sweden and Denmark (the last 2 with no data). Austria, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Italy, Portugal, Romania, Slovakia, Switzerland and Norway should be added. EOO and AOO should be recalculated accordingly.

How much of the current distribution of the habitat type lies within the EU 28?

About 95% of the currently known distribution of this habitat type lies inside the EU28 territory. Only a very small amount is reported from Bosnia-Herzegovina and Switzerland. The presence in Norway has not been confirmed but it is highly probable.

Trends in quantity

In spite of very large values of EOO and AOO, this habitat type does not tend to cover very large surfaces locally, depending on the occurrence of very peculiar soil and substrata conditions. The quantitative trend from the last 50 years is strongly decreasing (between 32 and 38% on average, both in EU28 and EU28+). Hungary, Slovakia, Germany, Czech Republic, Latvia reported extremely high rates of decrease (between 80 and 90%). In Romania this habitat seems to be rather stable, while in Bulgaria it shows even a slight

increase (+10%). The United Kingdom, accounting for 3/4 of the total known surface, could not provide precise figures about quantitative decline; the experts indicated that in some places there was a loss of these grasslands due to forestry, agricultural improvement/reclamation, grazing reduction and invasion by heath; while in other places acid grassland has replaced previous heath (by grazing and burning) and woodland (after felling). The balance between these losses and gains is not known.

- Average current trend in quantity (extent)

EU 28: Decreasing

EU 28+: Decreasing

- Does the habitat type have a small natural range following regression?

No

Justification

The habitat type, although suffering for remarkable quantitative reduction, has a very large natural range.

- Does the habitat have a small natural range by reason of its intrinsically restricted area?

No

Justification

The habitat type has a very large natural range.

Trends in quality

The qualitative trend for this habitat type is remarkably declining, with a degree of severity that ranges around 48% on average and affects an extent of around 36% of the total surface, both in EU28 and in EU28+. It should be noted that no precise figures from the United Kingdom, accounting for 3/4 of the total known surface, are available; in this country, the experts reported that most (91%) of monitored Annex 1 6230 habitat within SSSI/SAC sites is in unfavourable condition.

- Average current trend in quality

EU 28: Decreasing

EU 28+: Decreasing

Pressures and threats

Among the most threatening pressures, the biocenotic evolution and the consequent succession of shrub and forest vegetation should be mentioned first. These grasslands are linked to a specific rural management with cattle, sheep or horses grazing. During the last decades, due to the abandonment of traditional land use and extensive pastoral systems, the area covered by this habitat type has been remarkably reduced and is expected to decline further in future, and its species richness as well. Overgrowing by shrubs, e.g. *Juniperus communis* or *Calluna vulgaris*, and development of forests are very frequent events all over the habitat range, with the vanishing of several characteristic and formerly widespread species. Other pressures are represented by changes in the land use (from transformation to arable land or forest planting on open ground, to development of urbanised areas and human habitation) and/or an intensification of its use (e.g. fertilisation, nitrogen input). Also overgrazing and intensive grazing can be a serious threat, especially in the uplands. Invasive non-native species can locally affect the floristic composition. Also climate change can play a role, with special reference to changes in the pluviometric regime.

List of pressures and threats

Agriculture

Modification of cultivation practices

Agricultural intensification

Abandonment / Lack of mowing

Grazing

Intensive grazing

Abandonment of pastoral systems, lack of grazing

Sylviculture, forestry

Forest planting on open ground

Pollution

Air pollution, air-borne pollutants

Nitrogen-input

Invasive, other problematic species and genes

Invasive non-native species

Natural biotic and abiotic processes (without catastrophes)

Biocenotic evolution, succession

Species composition change (succession)

Climate change

Changes in abiotic conditions

Conservation and management

The maintenance and promotion of traditional pastoral systems, with low intensity grazing, is an essential tool for the conservation of this habitat type and the related landscapes. At the same time, overgrazing should be carefully avoided, since it can provoke breaking of the sward continuity, soil transformation with enrichment in nitrogen and nutrients, ingress of ruderal species. The successional processes already ongoing should be halted by direct intervention, sometimes including mechanical eradication of shrub and tree species. Establishing protected areas and introducing (or reaffirming) the legal protection of habitats and species is necessary, because many times the traditional activities are not profitable in these areas and an economic support for their re-establishment is often needed.

List of conservation and management needs

Measures related to agriculture and open habitats

Maintaining grasslands and other open habitats

Measures related to spatial planning

Establish protected areas/sites

Legal protection of habitats and species

Manage landscape features

Conservation status

6230*: ALP U2, ATL U2, BOR U2, CON U2, MED XX

When severely damaged, does the habitat retain the capacity to recover its typical character and functionality?

This habitat is represented by semi-natural plant communities, depending on traditional, extensive land-use practices for their maintenance. The time needed for their recovery depends on the type of damage and the level of decline. In case of massive recolonization by the shrub-dominated vegetation, a drastic

removal of the wood vegetation is needed, followed by the re-introduction of not-intensive grazing. This process might give good results only on the medium-long term. In case of serious soil damage (with compaction, enrichment in nitrogen and nutrients, or breaking of the sward continuity) the needed time for restoration can be far longer. In any case, for the habitat recovery a direct human intervention is needed, otherwise the natural successional processes would fastly bring to the development of woody vegetation.

Effort required

20 years
Through intervention

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	-38 %	Unknown %	Unknown %	Unknown %
EU 28+	-38 %	Unknown %	Unknown %	Unknown %

Both in EU28 and EU28+, a range of average decline between 32 and 38% is recorded. The uncertainty derives from different scenarios from Austria, Hungary and Italy where a range of values about the past area and/or the rate of quantitative change has been provided. The quantitative decrease is highest in Hungary, Slovakia, Germany, Czech Republic, Latvia (between 80 and 90%). In Romania there is a stable trend, in Bulgaria a slight increase (+10%) has been reported by the territorial experts. No precise figures about quantitative decline are available for United Kingdom, accounting for 3/4 of the total known surface; the balance between losses and gains is not known. The assessment based on Criterion A results in the category Vulnerable.

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	EOO	a	b	c	AOO	a	b	c	
EU 28	3,799,900 Km ²	Yes	Yes	no	2,356	Yes	Yes	no	Unknown
EU 28+	3,809,450 Km ²	Yes	Yes	no	2,364	Yes	Yes	no	Unknown

The EOO and AOO are well above the thresholds for criterion B, although subcriteria a and b are satisfied, with reference to the abandonment of the traditional grazing activities, that caused a remarkable decline in the last 50 years and represents an ongoing threatening process likely to cause continuing decline within the next 20 years. The assessment based on Criterion B results in the category Least Concern.

Criterion C and D: Reduction in abiotic and/or biotic quality

Criteria C/D	C/D1		C/D2		C/D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	36 %	48 %	Unknown %	Unknown %	Unknown %	Unknown %
EU 28+	36 %	48 %	Unknown %	Unknown %	Unknown %	Unknown %

Criterion C	C1		C2		C3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	Unknown %	Unknown %	Unknown %	Unknown %	Unknown %	Unknown %

Criterion C	C1		C2		C3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28+	Unknown %	Unknown %	Unknown %	Unknown %	Unknown %	Unknown %

Criterion D	D1		D2		D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	Unknown %	Unknown%	Unknown %	Unknown%	Unknown %	Unknown%
EU 28+	Unknown %	Unknown%	Unknown %	Unknown%	Unknown %	Unknown%

The overall quality of this habitat type is remarkably declining, with a degree of severity of 48% on average affecting an extent of 36% of the total surface, both in EU28 and in EU28+. It should be noted that no precise figures from the United Kingdom, accounting for 3/4 of the total known surface, are available; however the local experts reported that most (91%) of monitored Annex 1 6230 habitat (representing a minimum fraction of the total surface) within SSSI/SAC sites is in unfavourable condition. Additionally, further 7 countries (Estonia, Ireland, Finland, Spain, Romania, Portugal, Switzerland) could not provide precise figures about the severity of the qualitative decline. Further detailed information is needed to proceed with a more complete qualitative assessment. On the ground of the available data, according to the Criterion C/D1, this habitat type doesn't meet the thresholds and can be assessed as Least Concern. However, it should be stressed that both extent and severity of decline show a clearly dramatic ongoing process of qualitative degeneration that, in spite of the fixed thresholds, calls for urgent conservation actions.

Criterion E: Quantitative analysis to evaluate risk of habitat collapse

Criterion E	Probability of collapse
EU 28	Unknown
EU 28+	Unknown

No data are available for the application of Criterion E.

Overall assessment "Balance sheet" for EU 28 and EU 28+

	A1	A2a	A2b	A3	B1	B2	B3	C/D1	C/D2	C/D3	C1	C2	C3	D1	D2	D3	E
EU28	VU	DD	DD	DD	LC	LC	DD	LC	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	VU	DD	DD	DD	LC	LC	DD	LC	DD	DD	DD	DD	DD	DD	DD	DD	DD

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Vulnerable	A1	Vulnerable	A1

Confidence in the assessment

Medium (evenly split between quantitative data/literature and uncertain data sources and assured expert knowledge)

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References

Biondi, E., Ballelli, S., Allegranza, M., Taffetani, F., Frattaroli, A. R., Guitian, J., and Zuccarello, V., 1999. La vegetazione di Campo Imperatore (Gran Sasso d'Italia). *Braun-Blanquetia* 16: 53-115.

Biondi, E., Blasi, C., Allegranza, M., Anzellotti, I., Azzella, M.M., Carli, E., Casavecchia, S., Copiz, R., Del Vico, E., Facioni, L., Galdenzi, D., Gasparri, R., Lasen, C., Pesaresi, S., Poldini, L., Sburlino, G., Taffetani, F., Vagge, I., Zitti, S. and Zivkovic, L. 2014. Plant communities of Italy: The Vegetation Prodrôme. *Plant Biosystems* 148(4): 728-814. doi: 10.1080/11263504.2014.948527

Biondi, E., Blasi, C., Burrascano, S., Casavecchia, S., Copiz, R., Del Vico, E., Galdenzi, D., Gigante, D., Lasen, C., Spampinato, G., Venanzoni, R. and Zivkovic, L. 2009. Manuale Italiano di interpretazione degli habitat della Direttiva 92/43/CEE. Società Botanica Italiana. Ministero dell'Ambiente e della tutela del territorio e del mare, D.P.N. <http://vnr.unipg.it/habitat/>

Biondi, E., Burrascano, S., Casavecchia, S., Copiz, R., Del Vico, E., Galdenzi, D., Gigante, D., Lasen, C., Spampinato, G., Venanzoni, R., Zivkovic, L. and Blasi, C. 2012. Diagnosis and syntaxonomic interpretation of Annex I Habitats (Dir. 92/43/ EEC) in Italy at the alliance level. *Plant Sociology*, 49(1): 5-37.

Blasi, C. (Ed.), 2010. La Vegetazione d'Italia. Palombi & Partner S.r.l. Roma. ISBN: 978-88-6060-290-9

Ciaschetti, G., Pirone, G., Frattaroli, A.R., and Corbetta, F. 2006. La vegetazione del Piano di Pezza (Parco Naturale Regionale "Sirente-Velino", Italia Centrale). *Fitosociologia* 43(1): 67-84.

Cortini Pedrotti, C., Orsomando, E., Pedrotti, F. and Sanesi, G. 1973. La vegetazione e i suoli del Pian Grande di Castelluccio di Norcia (Appennino centrale). *Atti Ist. Bot. Lab. Crittog.* Pavia 9: 155-249.

Di Pietro, R., De Santis, A., Fortini, P., and Blasi, C. 2005. Geobotanical investigation on acidophilous grasslands in the Abruzzo, Lazio and Molise National Park. *Lazaroa* 26: 115-137.

Genovesi, P., Angelini, P., Bianchi, E., Dupré, E., Ercole, S., Giacanelli, V., Ronchi, F. and Stoch, F. 2014. Specie e habitat di interesse comunitario in Italia: distribuzione, stato di conservazione e trend. MATTM, ISPRA. 194 pp.

ISPRA, 2009-2014. Progetto Carta della Natura alla scala 1:50.000.

<http://www.isprambiente.gov.it/it/servizi-per-lambiente/sistema-carta-della-natura/carta-della-naturaalla-scala-1-50.000>

- Poldini, L., and Oriolo, G. 1997. La vegetazione dei pascoli a *Nardus stricta* e delle praterie subalpine acidofile in Friuli (NE- Italia). *Fitosociologia* 34: 127-158.
- Pott, R., and Hüppe, J. 1991. Die Hudelandschaften Nordwestdeutschlands. Abhandlungen aus dem Landesmuseum für Naturkunde zu Münster in Westfalen 53: 1-313.
- Puppi Branzi, G., Zanotti, A.L., and Speranza, M. 1994. Phenological studies on *Vaccinium* and *Nardus* communities. *Fitosociologia*, 26: 63-79.
- Stieperaere, H. 1990. *De heischrale graslanden (Nardetea) van Atlantisch Europa*. Dissertatie Universiteit van Gent, 303 pp.
- Viciani, D. and Gabellini, A. 2000. Contributo alla conoscenza della vegetazione del Pratomagno (Toscana orientale): le praterie di crinale ed il complesso forestale regionale del versante casentino. *Webbia* 55(2): 297-316.