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MANAGEMENT of Natura 2000 habitats

* Pseudo-steppe with grasses and annuals (*Thero-Brachypodietea*)

6220

Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

EUROPEAN COMMISSION

environment

The European Commission (DG ENV B2) commissioned the Management of Natura 2000 habitats. 6220 *Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*

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Xerophile pseudo-steppic grassland on calcareous soil. Murcia (SE Spain). Photo: Alfonso San Miguel-Ayanz

62 Semi-natural dry grasslands and scrubland facies

EUNIS Classification:

E1.3 Mediterranean xeric grassland

* Priority habitat

Summary

Pseudo-steppe with grasses and annuals includes a variety of xeric, termophilic and mostly open Mediterranean perennial and annual grasslands growing on usually eutrophic, but also oligotrophic, soils. Three major sub-types should be considered: one of perennial basophile rather hard short-grass communities, included in *Lygeo-Stipetalia*; another one of very dense and short but highly productive perennial summer drying swards, created by intense and continuous livestock activity, included in *Poetalia bulbosae;* and a last one of pioneer and ephemeral basophilous annual grasslands, included in *Brachypodietalia (Trachynietalia) distachyae*. The diversity of plant, invertebrate and vertebrate communities is usually high.

Pseudo-steppe with grasses and annuals has a typical Mediterranean distribution, with a significant area located in the Iberian Peninsula (mostly in Spain), followed by Italy, France, Greece, Cyprus and Malta. The habitat has been favoured by traditional management schemes and contributes to the so-called cultural landscapes. It usually occurs in a mosaic pattern with a wide variety of related habitats, many of them also included in the 92/43 EEC Directive. As a consequence, a high number of animal species protected by that Directive depend, to a higher or lesser degree, on this habitat type. That is why a holistic perspective is needed when considering conservation management models.

Too low a grazing intensity will result in scrub encroachment, a reduction in biodiversity and an increased risk of wild fires. For *Poetalia bulbosae* communities, experience shows that this will lead to their disappearance due to rapid changes in floristic composition. Therefore, grazing (particularly sheep grazing) is essential for the long-term maintenance of this habitat. Regular scrub clearing on small to medium-size irregular plots and silvicultural treatments on related forests and coppices are advisable as complementary measures, as well as the conservation or restoration of traditional infrastructures (water points, hedges, stone walls) and nearby small agricultural plots. A light phosphoric fertilization is recommended for *Poetalia bulbosae* communities; however, fertilization with other nutrients or on other 6220 habitat type communities should be banned.

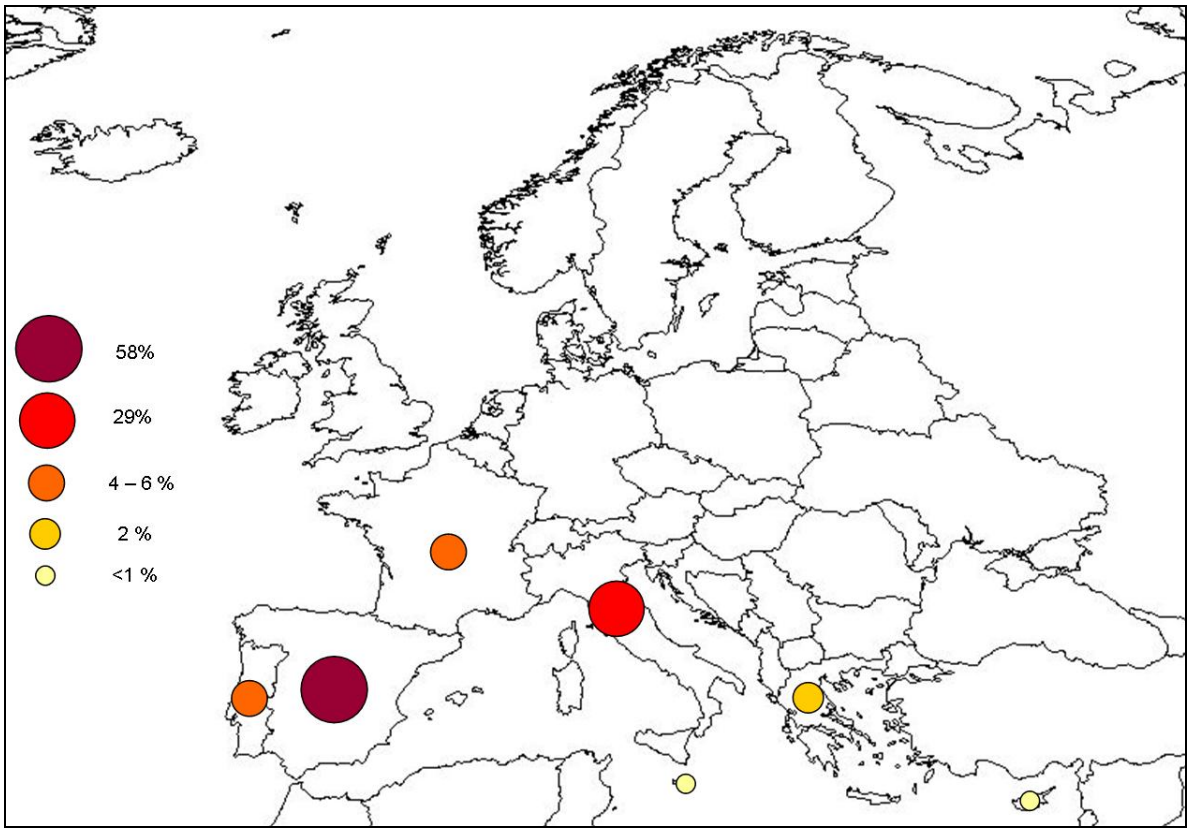
Restoration of 6220 habitat type communities from overgrown sites will require scrub clearing and intense grazing for many years. Other relevant measures are reducing or banning the use of pesticides and herbicides, protecting the habitat from urbanization processes, control of tourism activity when necessary, promoting livestock quality labels, improving living conditions for shepherds and implementing new land management strategies.

1. Description of habitat and related species

The 6220 habitat type is not a homogeneous one. The broad description given in the Interpretation Manual of European Union habitats EUR27 (EC 2007) concentrates on some basic and distinctive features, such as the dominance of short grasses, Mediterraneity, xerophility and thermophility. The habitat therefore includes xeric, termophilic and mostly open Mediterranean perennial and annual grasslands growing on usually eutrophic, but also oligotrophic, soils.

Distribution

Due to its dependence on Mediterranean climate, the habitat occurs only in the Mediterranean states of the European Union: Portugal, Spain, France, Italy, Greece, Cyprus and Malta. Here, it occurs from sea level up to medium altitude mountains (usually under 1,700-1,800 m above sea level); in the thermo- to supra Mediterranean climatic belts.



Percentage distribution of the total surface of pseudo-steppes with grasses and annuals of the Thero-Brachypodietea in Natura 2000

Pseudo-steppes with grasses and annuals *of the Thero-Brachypodietea* in Natura 2000 sites

The following data have been extracted from the Natura 2000 Network database, elaborated by the European Commission with data updated on December 2006. The surface was estimated on the basis of the habitat cover indicated for each protected site and should be considered only as indicative of the habitat surface included in Natura 2000.

Biogeographical region	Nº of sites	Estimated surface in Natura 2000 (ha)	% of total surface in Natura 2000
Mediterranean	977	693,747	98.25
Atlantic	40	7,714	1.09
Continental	71	2,741	0.39
Alpine	5	1,925	0.27
Countries	**Nº of sites**	**Estimated surface in Natura 2000 (ha)**	**% of total surface in Natura 2000**
Spain	428	408,023	57.78
Italy	508	206,756	29.28
Portugal	23	41,757	5.91
France	77	34,684	4.91
Greece	33	13,496	1.91
Cyprus	20	1,400	0.20
Malta	4	10	0.01
TOTAL	**1,093**	**706,127**	**100**

Main habitat features, ecology and variability

As a consequence of the looseness of its definition, at least three broad subtypes should be considered within the 6220 habitat type, each of which are described below in terms of their habitat features, ecological requirements and variability.

Subtype 1: *Lygeo-Stipetalia*

Mediterranean perennial basophile rather hard short-grass communities dominated by *Brachypodium retusum* (= *B, ramosum. B. bosissieri* included). This subtype is included in Order *Lygeo-Stipetalia* Br.-Bl. & O. Bolós 1958 (= *Thero-Brachypodietalia*); Class *Lygeo-Stipetea* (= *Thero-Brachypodietea*). The most widespread and important alliance within this subtype is *Thero-Brachypodion retusi (ramosi)* though other, such as *Triseto-Brachypodion boissieri* and *Stipion parvifoliae,* should also be considered.

Its ecological requirements are a thermo- to supra-Mediterranean thermo-climate and a semiarid (potential vegetation: shrubland) to subhumid (potential vegetation: semi-deciduous forests) ombro-climate. It is usually found in areas of long summer drought period. Under semiarid conditions, the grass community usually "hides" under shrub cover. The habitat is found mostly on eutrophic and less frequently neutral siliceous soils, often stony and degraded by erosion. It ranges from sea level up to 1600-1700 m in south-eastern Spain (700-800 m in southern France).

When this habitat subtype is in good ecological and management conditions, ground cover is often high, sometimes complete. Since it is considered to be the last substitution stage of sclerophyllous forests (*Quercus rotundifolia*), Mediterranean pine forests (mostly *Pinus halepensis*) or Mediterranean shrublands (*Quercus coccifera*, garrigue or *Rosmarinus-Salvia-Thymus* associations), it usually occurs associated with those woody communities, both in small to medium-size gaps or clearings and under their often light canopies. Its presence is usually linked with extensive grazing (sheep and goat) and frequent fires.

Thero - Brachypodion retusi community (Phlomido lychnitis – Brachypodietum retusi). Murcia (eastern Spain). Photo: Alfonso San Miguel-Ayanz

The most characteristic species include *Brachypodium retusum, Phlomis lychnitis, Avenula bromoides, Dactylis glomerata hispanica, Narcissus dubius, Ophris tenthredinifera.*

The variability of the habitat is usually low in terms of physiognomy, structure and function. The floristic differences between associations often depend upon geographic distribution (phytogeography) and ecological conditions.

Subtype 2: *Poetalia bulbosae*

Very dense and short, but highly productive, Mediterranean perennial swards dominated by *Poa bulbosa,* and also including many annual species. They are created and maintained by intense and persistent livestock (usually sheep) activity on both oligotrophic and eutrophic soils. Grazing and selection of species on the one hand, and fertilization and nutrient cycle acceleration through faeces on the other result in the optimum Mediterranean sward type for livestock grazing. It has been described as a `cultural´ pastoral climax (Montserrat & Fillat 1999). This subtype is included in Order *Poetalia bulbosae* Rivas Goday & Rivas Martínez in Rivas Goday & Ladero 1970; Class *Poetea bulbosae*.

The ecological requirements of this subtype are a thermo- to supra-Mediterranean thermo-climate; a dry (potential vegetation: sclerophyllous perennial forests) to subhumid (potential vegetation: semi-deciduous hardwood or Mediterranean mountain pine forests) ombro-climate and a summer drought period of greater than 2 months, at least in the upper soil horizon, where most grass roots concentrate. It is found on oligotrophic or eutrophic soils, but the upper soil horizon is always rich in organic matter and nutrients as a result of intense and persistent livestock activity. It ranges in altitude from sea level up to 1,800-1,900 m in central and southern Spain.

When this habitat subtype is in good ecological and management conditions, ground cover is complete, woody vegetation is usually absent or scarce (due to intensive browsing in times of green grass shortage in summer and winter), and legumes are abundant.

Another essential feature is the high level of activity of soil meso- and microfauna: e.g. worms, ants, bacteria, etc.

The most characteristic species of this sub-type are: *Poa bulbosa, Bellis annua*, *Parentucellia latifolia*, *Trifolium subterraneum* (oligotrophic soils), *Trifolium scabrum*, *Plantago albicans*, annual medics: *Medicago* sp. (eutrophic soils), *Plantago serraria* (clay soils).

Thermophile Poetalia clay soil community: Plantaginion serrariae (Trifolio subterranei – Plantaginetum serrariae). Browsed shrub-like wild olive trees (Olea europaea subsp. silvestris) are scattered over the sward. Cadiz (southern Spain). Photo: Alfonso San Miguel-Ayanz.

Three alliances have been described: one for acidic soils (*Periballio-Trifolion subterranei*), another one for basic soils (*Astragalo-Poion bulbosae*) and a third one for clay soils (*Plantaginion serrariae*). Since oligotrophic substrates are less favourable for agriculture and more for livestock grazing, *Periballio-Trifolion* is, by far, the alliance with the largest area. This alliance is also closely linked with the dehesa system: 6310 Natura 2000 habitat.

Subtype 3: *Brachypodietalia distachyi*

Pioneer and ephemeral basophilous annual grasslands, usually growing on lithosols. This subtype is included in Order *Brachypodietalia distachyi* Rivas-Martínez 1978 (syn. *Trachynietalia distachyae*).

This sub-type needs thermo- to supra-Mediterranean temperatures; a semiarid (potential vegetation: shrubland) to subhumid (potential vegetation: semideciduous hardwood or Mediterranean mountain pine forests) ombro-climate and a long summer dry period, at least in the upper soil horizon. It is found on eutrophic soils, but usually degraded or showing a low level of development (lithosols) and from sea level up to 1,800-1,900 m in central and southern Spain. Its presence is usually related to frequent fires end extensive grazing (sheep and goat), though its pastoral interest is low.

This habitat subtype is considered to be the last substitution stage of xeric Mediterranean forests and shrub communities. Since woody plants are stronger competitors than herbs under Mediterranean climate, this subtype usually occurs in the clearings of woody chamaephyte communities, forming a mosaic-like pattern in which the area occupied by its communities is usually small: a few square metres. Indeed, these patches get even smaller as climatic humidity increases.

The most characteristic species in this sub-type are: *Brachypodium distachyon* (syn. *Trachynia distachya*), *Bombycilaena erecta, Echinaria capitata, Polygala mospelliaca, Scabiosa stellata, Stipa capensis*.

Thermophile Brachypodietalia distachyi community growing on a limestone lithosol. Valencia (eastern Spain). Photo: Alfonso San Miguel-Ayanz

Four alliances have been described: *Stipion capensis*, the one covering the largest individual area, occurs under thermo-Mediterranean and semiarid climates; *Sedo-Ctenopsion gypsophilae* grows on gypsic soils; *Omphalodion commutatae*, grows on dolomite, serpentine or mafic soils and *Brachypodion distachyi* occurs under thermo- to supra-Mediterranean or thermo-to meso-temperate climates.

In spite of the description of those three major subtypes, which are in strict conformity to the Manual of European Union habitats EUR27, some more Mediterranean dry grass communities might also be included in the 6220 habitat type. That is the case of other *Lygeo-Sipetalia* communities (*Stipion tenacissimae, Agropyro-Lygeion sparti*); annual salty soil communities (*Saginetea maritimae*); perennial succulent *Crasulaceae* and other dwarf chamaephyte, geophophic medium-height perennial grass communities (*Brachypodietalia phoenicoidis* or *Stipo giganteae-Agrostietea castellanae*). Some of them have been considered for use as management models in France (Muller 2002).

Species that depend on the habitat

Many animal species included in Annex II or IV of the 92/43/EEC "Habitats" Directive or in the 79/499/EEC "Birds" Directive depend, to a higher or lesser degree but, as far as we know, not exclusively, on the 6220 habitat type. This is the case for *Cervus elaphus corsicanus* (Sardinian red deer), *Ovis ammon musimon (O gemelini)* (European mouflon), *Testudo hermanii* (Hermann´s tortoise), *Testudo graeca* (spur-thighed tortoise), *Podarcis pytiusensis* (Ibiza wall lizard), the rare *Apteromantis aptera* (Iberian mantis) (Annex II and IV), *Erinaceus algirus* (Algerian hedgehog) and *Algyroides marchi* (Spanish algyroides) (Annex IV).

Lynx pardina, the most endangered feline species, *Aquila adalberti* (Iberian imperial eagle), *Hieraaetus fasciatus* (Bonelli´s eagle) and even *Aegypius monachus* (black vulture) also depend to a certain degree on *Poetalia bulbosae* swards, since they are very positively selected by their most important prey, the European rabbit (*Oryctolagus cuniculus*), and also provide a high protein forage which allows rabbit females to get pregnant (Villafuerte *et al*. 1997). Therefore, much effort is being done to increase the area of *Poetalia* communities in the habitat of those endangered species (Gonzalez & San Miguel 2004; San Miguel 2007).

Falco naumannii (lesser kestrel) and *Falco biarmicus* (Lanner falcon) seem to depend on the 6220 habitat type for their usual invertebrate prey. It is a similar story with some steppe birds, such as *Otis tarda* (great bustard), *Tetrax tetrax* (little bustard), *Alectoris graeca* (rock partridge), *Pterocles orientalis* (black bellied sandgrouse), *Pterocles alchata* (pin-tailed sandgrouse), *Burhinus oecdinemus* (stone curlew), *Pyrrhocorax pyrrhocorax* (reb-billed chough), *Chersophilus duponti* (Dupont´s lark), *Melanocorypha calandra* (Calandra lark), lesser short-toed lark (*Calandrella rufescens*) and other *Alaudidae* .

The actual relationships between other animal species cited in LIFE-Nature Projects as being related to the 6220 habitat type and that habitat seem to be very loose.

No plant species included in Annex II or IV of the 92/43/EEC "Habitats" Directive has been described as characteristic of any community included in the 6220 habitat type. However, some of them, such as *Aster sorrentini*, show a certain relationship with that habitat type, and many orchid species may be found in *Thero-Brachypodion retusii* communities. Other endangered species related with this habitat type are *Bellevalia hackellii, Verbascum fontqueri, Silene diclinis, Koeleria dasyphylla, Echium valentinum* and *Cistus heterophyllus* sbsp. *carthaginensis*.

Related habitats

As a consequence of the large variety of communities included in the 6220 habitat type, and given the large area they occupy, there are many other types of habitats that are associated or in contact with it. Since they all share the same landscapes, their ecological requirements and management needs are also rather similar. Therefore, we will describe only those included in the 92/43/EU Habitats Directive, and we will do this for each 6220 habitat subtype.

- 1340: Inland salt meadows. Contact with 6220 habitat type (*Lygeo-Stipetalia* and *Brachypodietalia distachyi*).
- 1510: Mediterranean salt steppes (*Limonietalia*). Contact with 6220 habitat type (*Lygeo-Stipetalia* and *Brachypodietalia distachyi*).
- 1520 Mediterranean gypsum steppes (*Gypsophiletalia*). Contact with 6220 habitat type (*Lygeo-Stipetalia* and *Brachypodietalia distachyi*).
- 2240: *Brachypodietalia* dune grasslands with annuals. Overlaps with 6620 habitat type: dunal formations of 6220 pseudo-steppe with grasses and annuals of the *Thero-Brachypodietalia* (EUR27).
- 4090: Endemic oro-Mediterranean heaths with gorse. Contact with 6220 habitat type (*Lygeo-Stipetalia* and *Poetalia bulbosae*).
- 5110: Stable xerothermophilous formations with *Buxus sempervirens* on rock slopes (*Berberidion* p.p.). Contact with 6220 habitat type (usually *Lygeo-Stipetalia*).
- 5220: Arborescent matorral with *Zizyphus*. Contact with 6220 habitat type (*Lygeo-Stipetalia* and *Brachypodietalia distachyi*). They complement each other for fauna and flora conservation purposes: the first one provides shelter for both flora and fauna and the second one, food for wildlife.
- 5320: Low formations of *Euphorbia* close to cliffs. Contact with 6220 habitat type (*Lygeo-Stipetalia* and *Brachypodietalia distachyi*). They share ecological and management requirements.
- 5330: Thermo-Mediterranean and pre-desert scrub. Contact with 6220 habitat type (*Lygeo-Stipetalia* and *Brachypodietalia distachyi*). They complement each other for fauna and flora conservation purposes: the first one provides shelter for both flora and fauna – facilitation - and the second one, food for wildlife.
- 5410, 5420, 5430: Phryganas. Contact with 6220 habitat type (*Lygeo-Stipetalia* and *Brachypodietalia distachyi*). They share ecological and management requirements.
- 6110: Rupicolous calcareous or basophilic grasslands of the *Alysso-Sedion albi*. Contact with 6220 habitat type (*Lygeo-Stipetalia* and *Brachypodietalia distachyi*).
- 6210: Seminatural dry grassland and scrubland facies on calcareous substrates (*Festuco-Brometalia*)(important orchid sites). Contact with 6220 habitat type (*Lygeo-Stipetalia, Poetalia bulbosae* and *Brachypodietalia distachyi*) in its most xeric subtypes (*Xero-Bromion*).
- 6310 Dehesas with evergreen *Quercus* spp. Closely related with *Poetalia bulbosae* communities, which is the best sward type of the dehesa system - a cultural landscape used for extensive livestock rearing. Their management needs therefore coincide to a great extent.
- 9240: *Quercus faginea* and *Quercus canariensis* Iberian woods. 6220 habitat type is often their last vegetation substitution stage.
- 9320: *Olea* and *Ceratonia* forests. 6220 habitat type is often their last vegetation substitution stage.
- 9340: *Quercus ilex* and *Quercus rotundifolia* forests. 6220 habitat type is their last vegetation substitution stage on base-rich soils.
- 93A0: Woodlands with *Quercus infectoria* (*Anagyro phoetidae-Quercetum infectoriae*). 6220 habitat type is often their last vegetation substitution stage.
- 9530: (Sub-)Mediterranean pine forests with endemic black pines. 6220 habitat type (*Lygeo-Stipetalia*) is often their last vegetation substitution stage.

- 9540: Mediterranean pine forests with endemic Mesogean pines. 6220 habitat type (*Lygeo-Stipetalia, Brachypodietalia distachyi*) is often their last vegetation substitution stage on base-rich soils.
- 9550: Canarian endemic pine forests. 6220 habitat type (*Lygeo-Stipetalia, Brachypodietalia distachyi*) is often their last vegetation substitution stage.
- 9560: Endemic forests with *Juniperus* spp. 6220 habitat type (*Lygeo-Stipetalia, Brachypodietalia distachyi*) is sometimes their last vegetation substitution stage.
- 9570. *Tetraclinis articulata* forests. Contact with 6220 habitat type *(Lygeo-Stipetalia* and *Brachypodietalia distachyi*).

Ecological services and benefits of the habitat

The environmental and social services provided by pseudo-steppes include:

- Soil protection in ecosystems endangered by erosion and desertification.
- Soil restoration after forest fires. These grasslands are pioneer communities.
- Prevention of wild fires. Open xeric grasslands play a major role in preventing wildfires and facilitating their control.
- Rare or endangered plant species. However most rare or endangered species are not characteristic species of 6220 habitat communities but of related habitats.
- Landscape diversity. Mosaic-like pattern composed of grasslands, shrub communities, woodlands, forests and agricultural plots. The grasslands and agricultural plots both provide food for both livestock and wildlife. Extensive grazing is closely linked to landscape and biodiversity conservation as well as with sustainable rural development (as also are peasant agriculture and traditional breeds) – see below.
- High levels of insect biodiversity (grasshoppers, beetles, butterflies, bees and many other).
- Biological activity within the soil: micro-invertebrates, earthworms, ants, bacteria, fungi and many other biological forms. Acceleration of nutrient cycles and, therefore, reduction of problems imposed by limiting nutrients, such as phosphorous (Gonzalez & San Miguel 2004, Dutoit *et al*. 2005). That is particularly important in Poetalia bulbosae communities.
- Xerophile grasslands provide forage, but also invertebrate prey and nesting sites for birds, for example. Invertebrates are essential for feeding fledglings of most birds, and in particular endangered species such as *Otis tarda* (great bustard)*, Tetrax tetrax* (little bustard) *Alectoris graeca* (rock partridge)*, Pterocles orientalis* (black bellied sandgrouse)*, Pterocles alchata* (pin-tailed sandgrouse), *Burhinus oecdinemus* (stone curlew)*, Falco naumannii* (lesser kestrel), *Pyrrhocorax pyrrhocorax* (red-billed chough), *Chersophilus duponti* (Dupont´s lark), and other *Alaudidae*, as well as for game species, such as *Alectoris rufa* (red-legged partridge) (Baldock 1994, González & San Miguel 2004).
- Extensive livestock using the 6220 habitat type as forage also provide food for endangered scavengers or predators, such as *Aegypius monachus* (black vulture), *Gyps fulvus* (griffon vulture), *Gypaetus barbatus* (bearded vulture), *Neophron pernocpterus* (Egyptian vulture), *Aquila adalberti* (Spanish imperial eagle), *Hieraaetus fasciatus* (Bonelli´s eagle), *Canis lupus* (wolf) and many other.

Trends

6620 habitat type communities are semi-natural habitats. They are natural, since they are constituted by spontaneous plant species. However, they are not completely natural, since they substitute, or precede, woody plant communities in natural vegetation series and are, hence, the result of disturbing processes, usually associated with human activities: fire, livestock grazing, the growing of crops and silviculture.

Therefore, they are closely linked with traditional extensive management systems which have resulted in so-called "European cultural landscapes", usually belonging to a mosaic-like pattern (Baldock 1994, Bunce *et al.* 2001, Watkinson & Ormerod 2001, Marriot *et al.* 2004, Dutoit *et al.* 2005, Hodgson *et al.* 2005). As a consequence, the conservation of these habitats requires a certain degree of human or livestock activity: both the abandonment of those activities and their intensification constitute serious threats for their future.

Traditional extensive management regimes have changed dramatically over the last decades, with very significant impacts on cultural and high nature value landscapes. The usual trend is negative - their surface is decreasing both as a consequence of abandonment (which results in the encroachment of woody vegetation, loss of biodiversity and increase of fire risk) and of intensification or transformation into purely agricultural landscapes or urban areas.

Threats

Most regional studies and LIFE Nature Projects (see Projects in Chapter 3) describe similar threats for the 6220 habitat type. They are all associated with dramatic changes of traditional management practices in Mediterranean ecosystems over the last decades:

Abandonment of traditional activities

Type 6220 Natura 2000 communities rely on traditional management activities and are integrated into so-called cultural landscapes, never constituting the potential vegetation of their area. The abandonment of those activities thus triggers the reactivation of natural succession and therefore the substitution of those communities by others.

An almost immediate consequence for *Poetalia* swards (subtype 2), which strictly depend on intense livestock grazing, is their substitution by former grasslands: usually pioneer communities dominated by annual or xerophytic perennial species. Those communities, with *Poa bulbosa* (the indicator species) almost or completely absent usually constitute the last stage of substitution of Mediterranean forest and shrub communities. They have lower biodiversity levels and dramatically fewer legumes and livestock-selected plant ecotypes, and lower forage quality and pastoral value. When grazing disappears from *Thero-Brachypodion retusii* communities, the first effect is an increase in the cover of *Brachypodium retusum* and a parallel decrease in biological diversity.

Another consequence is the encroachment of woody vegetation as a result of the re-activation of natural succession. This process is faster in *Lygeo-Stipetalia* (subtype 1) and *Brachypodietalia distachyi* (subtype 3) than in *Poetalia bulbosae* (subtype 2) communities. This situation results in both a reduction in biodiversity and a dramatic increase in the risk of wild fire (Troumbis *et al.* 2001, Muller 2002). Livestock is therefore being increasingly used for creating and maintaining fire-breaks in many Mediterranean countries (Etienne 1996, González-Rebollar *et al.* 1999, Varela *et al.* 2007, Generalitat Valenciana 2008, Dopazo pers. comm.).

Finally, the abandonment of traditional activities usually results in the disappearance of traditional infrastructures which might be important for wildlife (e.g. water points, stone walls or hedges) or from a cultural point of view.

Overgrazing

Overgrazing is not as big a threat for the 6220 habitat type as it is for temperate grasslands. It is less common in Mediterranean ecosystems, due to their lower productivity and the seasonality of their forage supply. Besides, there are evidences that most Mediterranean pastures are able to sustain high livestock stocking rates without a reduction in their biodiversity; they are highly resilient as a result of their long history of human and livestock influence (Sternberg *et al.* 2000, Pardini *et al.* 2004, Alrababah *et al.* 2007).

The effect of over-grazing on *Poetalia bulbosae* is not particularly harmful, since those swards were created and maintained by livestock grazing and are therefore dependent on it. However, overgrazing does strongly affect woody vegetation, and especially its regeneration or recruitment, posing a big threat to dehesa systems (6310 Natura 2000 habitat type). The consequence for *Lygeo-Stipetalia* communities is different, due to the chamaephyte character of their dominant species (e.g. *Brachypodium retusum*), whose abundance decreases with increasing stocking rates, sometimes resulting in higher levels of annual species biodiversity (Colas *et al.* 2002, Muller 2002). The effect of overgrazing on *Brachypodietalia distachyi* communities is usually negative, since they are made up mainly of therophytes.

As a general rule, both the intensification of agricultural or pastoral activities on Mediterranean grasslands and their abandonment usually reduce biodiversity levels (Hodgson *et al.* 2005).

Fire

The effect of livestock grazing on fire prevention and control has been referred to above. The effect of fire on grasslands may be negative or positive, depending on season, size, temperature, wind and fuel biomass. Fire usually benefits herbaceous communities and therefore has been traditionally used for that purpose; indeed, pastoral activities are frequently linked with forest fires. However, it usually results in erosion and soil degradation and in a reduction of biodiversity. That is why many regional governments (e.g. Castilla and León, Andalucía, Valencia and Cantabria, in Spain) are currently working with stakeholders with the aim of properly using grazing, fire and mechanical treatments to reduce the risk of wild fires.

Transformation into agricultural land

Transformation of 6220 habitat type communities into arable land results in an instantaneous disappearance of biodiversity whose recovery might require decades (San Miguel 2001, Dutoit *et al.* 2005, Römermann *et al.* 2005). However if agriculture is carried out on ancient croplands and does not affect large areas, it may be compatible with a mosaic-like landscape pattern, where *Brachypodietalia distachyi* communities may play a key ecological role. Indeed the presence of small patches of agricultural crops, which has been a traditional feature of cultural landscapes, is considered to be beneficial for many wildlife species, since it provides them with seasonal high quality food and sometimes shelter (Suarez-Seoane *et al.* 2002, Gonzalez & San Miguel 2004, San Miguel 2007)

Utilization of pesticides, herbicides and fertilizers

Pesticides may increase grassland yields. However, quality and seasonal availability are usually much more important than quantity in Mediterranean grasslands. Besides, pesticides and phytocides may also produce a high negative impact on the biodiversity of invertebrates and weeds. These may not only be important in themselves but may also be essential not only as food for many other animal species (e.g. birds) but even for the very stability of the ecosystem (e.g. bees, dung-beetles).

Mineral fertilization obviously affects 6220 habitat type communities. Due to limitations imposed by the normal growth period (summer drought and winter cold), it is usually aimed at increasing spontaneous legume species (and therefore forage protein content) and is carried out only there where such treatment is profitable. As a consequence mineral fertilization usually affects only *Poetalia bulbosae* communities and consists in the distribution of small quantities of phosphorus (20-60 kg of P_2O_5/ha) on the sward every few years. It does not increase or reduce the number of plant species but only their relative abundance. Mineral fertilization treatment might therefore be considered as positive, if it is carried out with phosphoric rock material (Ferrera *et al.* 2007, Olea & San Miguel 2006). Phosphoric fertilization has been successfully used to improve natural pastures and thus increase wild rabbit population in several LIFE Nature Projects aimed at the conservation of Iberian lynx, Iberian imperial eagle and black vulture (see list below). Fertilization with nitrogen or potassium on 6220 habitat type communities should be banned.

Urbanization and tourism

Transformation of 6220 habitat type communities into urban areas is an important threat, especially in coastal regions. It means the complete and permanent disappearance of the natural biodiversity. Tourism also seems to constitute a dangerous threat for some 6220 habitat type communities in coastal regions, especially in some Mediterranean islands. On the other hand, grazing has been to demonstrated to increase the touristic value of Mediterranean landscapes (Pardini *et al*. 2004).

Invasive alien species

This is not a significant threat. However, some invasive alien species, such as *Carpobrotus* sp. *Opuntia ficus-indica, Opuntia subulata, Sporobolus indicus, Paspalum vaginatum* or *Arctotheca calendula*, have been cited on territories related with the 6220 habitat type.

Climate change effects

6220 habitat type communities might benefit from climate change, if it results in a slight temperature increase and maybe also a lengthening of the summer drought period (Mannetje 2006). Many of their characteristic species have not been negatively affected by ozone or CO_2 increment in the atmosphere (Gimeno *et al*. 2004).

2. Conservation management

General recommendations

Due to the pioneer or semi-pioneer character of every community included in the 6220 habitat type, it is obvious that management, especially grazing, is required to perpetuate them. However, management intensification is also negative both for their persistence and for conserving high biodiversity levels at many scales: landscape and structure (γ diversity), ecotones (β diversity), species (α diversity) and genetics (e.g. plant ecotypes selected by livestock grazing through millennia). Therefore, as a general rule, traditional extensive management schemes should be considered as the desired conservation management model. Obviously, the economic and social changes of the last decades may impose changes in the scope or intensity at which they can be applied, or even introduce new management requirements.

From a more detailed point of view, it is evident that conservation management treatments may vary between subtypes. Hence, a general recommendation for the whole 6220 habitat is given here when possible, but differences between subtypes are also mentioned where necessary.

Active management

Advisable positive ongoing management and recovery management actions for the 6220 habitat type are described below. Technical prescriptions, techniques, examples and constraints for many of those management actions have been described for Mediterranean Spain by Guil *et al.* (2007).

Grazing

Grazing is essential for creating and maintaining grasslands where forests or shrub communities constitute the potential vegetation, in otherwords, everywhere in European Mediterranean countries. Therefore, maintaining extensive grazing or restoring it there where it is no longer present, is necessary for preserving 6220 habitat type communities. This is especially true for *Poetalia bulbosae* communities, a true cultural pastoral climax sward which is strictly dependent on livestock grazing. Since grazing requirements are different for the three subtypes described for 6220 habitat type communities, they are described separately.

Subtype 1 (*Lygeo-Stipetalia*)

- Livestock species: sheep or goat. Sheep are better for improving grass swards and where minimal impact on woody vegetation is desired. Goats are used where browsing is desired for controlling the growth of scrub biomass (e.g. conservation or enlargement of swards or fire prevention). Cattle are seldom used. Flock sizes are usually around 500 (up to 1,000) individuals for sheep and 250 (up to 400) for goats, which are more difficult to manage.
- Stocking rates: carrying capacity of between 0.2 – 0.4 livestock units (500 kg) $ha^{-1}yr^{-1}$. Higher stocking rates, up to 1 livestock units $ha^{-1}yr^{-1}$ are advisable for short periods of time where control of woody vegetation is desired.
- Grazing periods: usually spring, and sometimes autumn when possible. Browse from shrub or forest formations and agricultural by-products (e.g. stubble) are complementary sources of food for livestock.
- Grazing system: continuous.
- Artificial feeding: usually low, with the exception of dairy herds.

Subtype 2 (*Poetalia bulbosae*)

- Livestock species: sheep or cattle; sometimes goat where nearby browsable biomass is abundant. Horses are less frequently used due to the lower market demand. Sheep are much better for

improving grass swards, due both to its ability to graze short swards and for its better dunging characteristics. In addition, its need for supplementary feeding is much lower and its impact on tree regeneration is minimal, an essential characteristic for the dehesa (= montado) system (6310 Natura 2000 habitat type). It is by far the most advisable species, maybe the only one, for the conservation of *Poetalia bulbosae* communities. However, sheep numbers are decreasing due to the shortage of shepherds. In spite of their poorer adaptation to the sward type, their higher supplementary feeding requirement and its severe impact on woody vegetation (shrubs and young trees), cattle are widely used since they do not require shepherds and there is a higher market demand for their products. Promoting sheep grazing at the expense of cattle is a very advisable management action for *Poetalia bulbosae* communities and for dehesas and montados. Flock size usually around 500 (up to 1,000) individuals. Cattle herds are highly variable.

- Stocking rates: sward carrying capacity: around 1 livestock unit $ha^{-1}yr^{-1}$ for the duration of the grazing period. However, much lower stocking rates (around 0.2 – 0.3 livestock units $ha^{-1}yr^{-1}$) are advisable for the dehesa ecosystems, where other sward types are also present and where regeneration of the tree layer is absolutely necessary.
- Grazing period: from mid autumn until early summer (period of forage availability).
- Grazing system: continuous.
- Supplementary feeding: usually low for sheep; high (sometimes too high as a result of the scarcity of information provided to livestock owners) for cattle.

Subtype 3 (*Brachypodietalia distachyae*)

- Livestock species: sheep or goat. Sheep are better for improving grass swards and where a minimum impact of livestock on woody vegetation is desired. The use of goats are used where browsing is desired for controlling the growth of scrub biomass (e.g. conservation or enlargement of swards or fire prevention). Flock sizes are usually around 500 (up to 1000) individuals for sheep and 250 (up to 400) for goat (which are more difficult to manage).
- Stocking rates: the carrying capacity is around 0.1 livestock units $ha^{-1}yr^{-1}$. Higher stocking rates, of up to 0.5 livestock units $ha^{-1}yr^{-1}$, might be advisable for short periods of time there where control of woody vegetation is desired.
- Grazing periods: usually spring and sometimes autumn, depending on the time of onset of the autumn rain. Browse from shrub or forest formations and agricultural sub-products (e.g. stubble) are complementary sources of food for livestock.
- Grazing system: continuous.
- Supplementary feeding: usually low, with the exception of dairy goat herds.

Management units vary, usually according to herd size and stocking rates, but are around 500 ha in Spain and smaller in other European countries.

Short or long herd movements are necessary due to the seasonality of green fodder supply. They are also closely related to movement of plant material (seeds), biological connectivity and high biodiversity. Short movements may be to use agricultural sub-products (stubble, fallow land) or crops or to nearby mountain pastures (transterminance). Long movements are usually to distant mountain pastures (transhumance). Traditional herd movements should be preserved as far as possible (Bunce *et al.* 2004) with the aim both of preserving biodiversity and of achieving a certain degree of productive efficiency.

The lack or scarcity of shepherds is becoming a big problem. Their partial substitution by fences is common, but is not an advisable solution for high nature value ecosystems.

As a general rule, supplementary feeding should be adjusted so as to provide the minimum required. Providing updated information on the topic and relevant and accessible examples to livestock owners is essential in order for that objective to be achieved.

Fertilization

Mineral fertilization is an advisable treatment only for *Poetea bulbosae* communities. It should be carried out with small quantities of phosphoric rock (20-60 kg of P_2O_5/ha) distributed on the sward every few (3-6) years. Fertilization with other nutrients or on other 6220 habitat type communities is neither necessary nor advisable and hence should be banned.

The above mentioned treatment is advisable not only in order to benefit livestock (and therefore livestock owners and rural development), but also to enable farmers to reduce supplementary feeding, as well as to favour many wild herbivores. It has been successfully used in LIFE-Nature projects aimed at the conservation of Iberian imperial eagle, Iberian lynx and black vulture (LIFE02/NAT/E/8617, LIFE03NAT/E/0050) through the resulting increase in wild rabbit populations (Gonzalez & San Miguel 2004, San Miguel 2007).

Infrastructure: water points, traditional hedges, stone walls

Traditional infrastructures present in landscapes with 6220 habitat type communities are usually of a high value for wildlife, even those with endangered plant species. In addition, they sometimes have a high cultural value. However they are disappearing as traditional management regimes are being abandoned. Their conservation or restoration is therefore an advisable measure for this habitat type.

Watering points (rivers, streams, wells, reservoirs, drinking troughs) are essential within Mediterranean ecosystems. Many LIFE-Nature projects have therefore used European funds to recreate and restore traditional water points. Results have been very positive, not only for extensive livestock but also for many other wildlife species, such as black stork, rabbit (and hence Iberian lynx, Iberian imperial eagle, Bonelli´s eagle and black vulture), lesser kestrel, steppe birds, many amphibians and reptiles and even invertebrates. The location, size and depth of the water points to be created depend on the species designed to benefit. However, the creation of new water points must never mean the destruction or degradation of natural springs or valuable humid vegetation. That is why it might be advisable to protect them (e.g. by fences) and take their water to concrete drinking troughs when livestock or wild ungulate concentrations are very high and might result in the degradation of those water points (González & San Miguel 2004).

The conservation of traditional hedges and stone fences preserves structural diversity and cultural heritage and provides shelter for many wildlife and plant species.

Agriculture: occasional cropping on small plots of land with deeper and richer soils

One of the most outstanding features of Mediterranean ecosystems is their long history of human influence, especially on basic, fertile soils. Over centuries many small family units have been scattered all over Mediterranean ecosystems, along with their diverse cropped plots. Many wildlife species have found food and shelter, and hence depend to a certain degree, on those agricultural plots.

However, changes in traditional management regimes have resulted in a dramatic reduction of those traditional, diverse cropped plots. That situation has proved to be very negative for many wildlife species: rabbit (and hence most predators cited above), partridges (red legged, rock partridge), wood pigeon, turtle dove, steppe birds, crane, red deer, roe deer, wild boar and many other. Besides, those agricultural plots might provide a very valuable seasonal food for non-transhumant extensive livestock.

Consequently, the preservation of those agricultural plots, and even permanent artificial pastures, has proved to be highly beneficial both for extensive livestock and wildlife and is therefore a very advisable conservation management measure (González and San Miguel 2004, Guil *et al.* 2007). However, those agricultural crops or permanent artificial pastures must not be established instead of 6220 communities, but on agricultural land, because the recovery of some natural or semi-natural steppe pastures after ploughing might take a very long time (Dutoit *et al.* 2005, Römermann *et al.* 2005).

Beetle-banks or evenly distributed patches of unploughed land

One of the main problems for endangered animal species (and game species) in large purely agricultural areas is the lack or scarcity of shelter (at least seasonally) and suitable places for feeding or for finding safe breeding sites (e.g. nests, burrows). Therefore, simple and cheap treatments, such as beetle banks (González & San Miguel 2004, Guil *et al.* 2007) or evenly distributed patches of unploughed land usually produce very satisfactory results.

Control of woody vegetation (scrub) encroachment

The abandonment of many traditional human activities on Mediterranean ecosystems usually results in the encroachment of woody vegetation. Some consequences of that process are a decrease in biodiversity (structures, ecotones, species) and a dramatic increase in wildfire risk. That is why the control of woody vegetation is frequently a very advisable conservation management measure.

Prescribed burning might be and advisable treatment if it is carried out following all the technical prescriptions about season, temperature, humidity, wind, slope, plot size and other safety measures. However, it is a somewhat dangerous treatment and there is a danger of giving apparent approval to a technique which in the absence of appropriate technical knowledge can be very damaging indeed. That is why mechanical treatments are usually the most advisable treatment, despite the necessity for them to be repeated all too frequently (usually every 3-5 yr). They should be carried out in small, irregular plots, with the aim of both increasing structural diversity without negative impacts on landscapes and of making it possible to use livestock as a living tool to delay woody vegetation encroachment. That is why phosphate fertilisation or artificial livestock feeding might be suitable complementary treatments on those plots.

Silvicultural treatments, especially in dense conifer plantations

Most traditional silvicultural treatments have been aimed at producing natural resources: fuelwood, timber, forest fruits and so on. However dramatic economic, social and political changes have reduced the demand for those resources, especially in the Mediterranean region, and as a consequence many traditional silvicultural treatments are no longer profitable (without taking into account other services provided by forest systems).

Trees have been planted all over the Mediterranean basin with the main aim of reducing erosion processes. Their initial densities were usually very high, necessitating frequent silvicultural treatments to reduce the stem density as tree age increases while maintaining appropriate canopy cover and basal area stocking rates.

However, those treatments are usually expensive and as a consequence they are seldom carried out with the desired frequency and intensity. This results in problems of stand stability (especially in plantations and coppices, Gonzalez & San Miguel 2004), increase of wildfire risk and reduction of biodiversity. Both the shrub and the herb layers fade and sometimes disappear as the tree layer becomes overstocked and many wildlife species are negatively affected. Therefore, the undertaking of suitable silvicultural treatments on those stands is a very advisable conservation measure not only for the forest stands themselves but also for the 6220 habitat type communities which may constitute their herb layer (e.g. *Brachypodium retusum* communities) and their related plant and wildlife species. Such management has also proved to be very positive for some wildlife species with high conservation and hunting interest (see above González and San Miguel 2004, Guil *et al.* 2007).

Regarding the dehesa system, where *Poetalia bulbosae* communities are widespread, there is a dramatic lack of regeneration of the tree layer that is closely link with browsing by extensive livestock and the sudden death of a large number of trees. As a consequence tree planting and protection (beating up) is another advisable management conservation measure for that system. Beating up should be aimed at securing a minimum of over 200, preferably uneven-aged, young trees per ha.

Restoration

The restoration of 6220 habitat type communities on scrub or forest communities can be carried out through mechanical treatment of scrub cover or the silvicultural treatment of forested lands, always with followed by years of subsequent grazing.

The restoration of 6220 habitat type communities on bare land is not easy, since the seeds of most of the characteristic species are not available for purchase, although they are usually present in the soil seed

bank. It is usually therefore just a matter of time, natural succession and extensive grazing. However, the restoration of *Poetea bulbosae* communities also requires intense and continuous grazing for many years. In any case, the restoration of traditional high biodiversity levels may well require decades of suitable management (Dutoit *et al.* 2005, Römermann *et al.* 2005).

The restoration of *Poetea bulbosae* communities may be achieved also through intense and continuous grazing on high quality (usually legume rich) permanent sown pastures. Obviously, those sown pastures should include only native species.

Other relevant measures

Reducing or banning the use of pesticides or herbicides

Many wildlife species related to the 6220 habitat type depend, to a higher or lesser degree, on its invertebrate populations or on weeds from nearby agricultural lands. In addition, some of those species play an essential role in the pollination and seed dispersion processes of plant species characteristics of the 6220 habitat type. Consequently, the utilisation of pesticides and herbicides is not advisable for those systems. Reasonable control of pests and weeds could be achieved through integrated or biological means and/or crop rotation.

Protection from urbanisation processes

Urbanisation processes obviously result in the complete substitution of natural habitats by urban structures. It affects 6220 habitat type communities, especially in coastal areas. That is why protection from urbanisation must be guaranteed, at least for a sufficiently large sample of 6220 habitat type communities, as well as for the ecological corridors necessary to secure their long term persistence (e.g. transhumance or shorter livestock herd movements).

Control of tourism activity, when necessary

Tourism has increased dramatically over the last decades, especially in European Mediterranean coastal areas. That activity, as well as urbanisation, negatively affects 6220 habitat type communities despite the habitat being positively viewed by tourists (Pardini *et al.* 2004). As a consequence, care must be taken to avoid degradation or loss of those protected plant communities.

Livestock quality labels: ecological management

One of the most important changes in traditional management in Mediterranean areas is the reduction in extensive grazing by sheep and goat. The major cause is a decrease in the demand for their products an also a reduction in the price offered for them. Similar products are now possible from intensive systems which offer better return. As a result, traditional sheep and goat management is therefore seriously endangered in Mediterranean countries. It is obvious that climate constraints make it very difficult for Mediterranean extensive livestock systems to compete in productivity with temperate ones. Consequently, since the globalisation of markets is a reality, they should compete with high quality products. The development and promotion of 'Green' products and quality labels are relevant measures to be taken in the context of ensuring the long term survival of extensive livestock systems on Mediterranean grasslands, and hence of those on 6620 natural grasslands (Mañas & González 2004).

Shepherds

Another major constraint on the long term sustainability of extensive livestock systems on Mediterranean grasslands is the lack of shepherds, or at least of traditional shepherds. That is why actions aimed at stopping or reversing that process will surely result in benefits for 6620 habitat communities. Some measures having that objective are being taken in France and Spain, such as schools of shepherds, improvement of living conditions or subsidies for shepherds whose flocks feed on forest fire-breaks.

Land management strategies

The success of management models for Natura 2000 habitats requires the involvement and agreement of many stakeholders: landowners, users, inhabitants of nearby villages, hunters, livestock owners, public administrations, environmental associations, NGOs and many others. This is why land management agreements have proved to be a suitable tool to achieve success in many European countries, as well as in Canada, the United States of America, Costa Rica and many other countries. Most European countries are doing this through official agreements, usually including management plans and budgets for every management unit.

Special requirements driven by relevant species

The high number of endangered plant and animal species linked with the 6220 habitat type makes it very difficult to describe in brief specific habitat management measures for each one of them. However, such measures do exist and that is why specific management plans have shown to be effective for protecting individual species in almost every European country in which this habitat type exists.

As a general rule, traditional extensive management systems aimed at maintaining a mosaic-like landscape pattern are suitable for most plant and animal species linked to the 6220 habitat type (González & San Miguel 2004, Pardini *et al.* 2004, Alrababah *et al.* 2007).

Most studies dealing with the topic have stated that management systems should not be exclusively focused on conservation objectives if they are to be sustainable in the medium or long term. They should also be based on productive, economic and social considerations.

Cost estimates and potential sources of EU financing

Cost estimates

Technical and legal prescriptions, cost estimates and potential sources of EU financing for many management actions recommended for the 6220 habitat type communities have been described for Mediterranean Spain by Guil *et al.* (2007). Most of them have been used in LIFE-Nature Projects.

Grazing

Costs should cover such incentives for livestock owners and shepherds, as they are necessary to guarantee suitable species (e.g. sheep or goat instead of cattle), stocking rates, grazing systems and periods. The estimated additional costs, based on available information on this topic, from both agri-environmental measures and LIFE-Nature Projects, are between €22-200/ha-yr. Additional costs or income foregone are applicable where grazing already exists but requires changes in species, stocking rates, or grazing systems or periods. Full costs are applicable there where grazing has disappeared from 6220 habitat type communities, and frequently must cover the initial mechanical control of scrub cover. Such treatment is also necessary when grazing is aimed at maintaining fire-breaks, since grazing by itself, cannot usually prevent scrub encroachment, just delay it.

Fertilization

Phosphoric fertilization on *Poetea bulbosae* communities. Assuming 20-60 kg of P_2O_5/ha every 3-6 yr and 1 -1.5 hr of tractor (70-100kW) with driver/ha. Full costs: €50-80/ha.

Infrastructures: water points, traditional hedges, stone walls

- Creation of hedges within agricultural lands. including land preparation, plantation, protection against browsing and initial summer watering, when required: full costs usually between 500 and €1,000/km
- Water points: full costs usually around €10 /ha.

- Reservoirs (area around 2,000 m2; water volume over 50 m3): €3,500/u.
- Drinking trough: around €1,000.

Agriculture: occasional cropping on small plots of land with deeper and richer soils

- Treatment to be carried out only on agricultural land.
- Diversified crops (cereal, legumes or other) with the aim of providing food (protein – energy – minerals) in every season and every land unit.
- Land preparation and sowing: 2-3 hr of tractor with driver/ha.
- Includes traditional mineral fertilisation and seed costs.
- Full costs usually between €200-400/ha.
- Income forgone (as compared to other alternatives): around €100-300/ha.

Beetle-banks or evenly distributed patches of unploughed land

- Beetle-banks: 3 – 7 hr/km tractor (70-130 kW) with driver.
- Full costs between €100-200/km
- Costs of patches of unploughed land should cover income forgone: usually between €150-400/ha-yr.

Control of woody vegetation (scrub) encroachment

- Mechanical treatments: full costs usually between €200-600/ha
- Grazing on fuel breaks: additional costs usually between €25-100/ha, depending on livestock species, stocking rates, availability of shepherds, supplementary feeding requirements, distances, etc.

Silvicultural treatments, especially in dense conifer plantations

- Thinning or clearing of forest plantations or coppices: full costs usually between €1,000-3,000/ha, depending on tree density, tree size and topography.
- Reforestation (beating up) of dehesas: full costs usually between €25-35/plant, including protection against livestock browsing.

Reducing or banning the use of pesticides or herbicides

- Integrated strategy against pests and diseases: costs usually between €2-4/ha-yr

Restoration

- Establishment of high quality sown permanent pastures with native species on abandoned agricultural land:
- Land preparation and sowing: 2-3 hr of tractor with driver/ha.
- Includes initial phosphoric fertilization and seed costs.
- Full costs usually between €200-400/ha.
- Subsequent intense and continuous grazing is also required, but has not been included in those costs.

Land management agreements

Full costs, or additional costs when management plans are already available but these costs vary considerably, according to environmental heterogeneity, available information, management unit area and other topics.

Among the diversity of sources for EU funding, the following funds might primarily be of interest for the management of 6220 habitat type communities:

Potential sources of EU financing

EU funds for Natura 2000 in the period 2007-2013 should come from different existing Community financial instruments aiming to enhance rural, regional, and marine development in the EU. The integrated use of these resources will allow the financing of various management actions for areas with habitats listed in the Habitats Directive and included in the Natura 2000 network. Each Member State has identified the issues that are of most concern locally and has prioritized EU funds in order to address these issues. National and regional programs, which have been prepared by Member States on the basis of the EU Regulations, determine the concrete funding possibilities for Natura 2000.

Among the diversity of sources for EU funding, the following funds might primarily be of interest for the management of habitat 6220:

- The European Fund for Rural Development (EARDF). This program has potential to cover many management activities that might be relevant for 6220 habitat type communities, although the measures have to be covered in the National Strategy and related Rural Development Plans (RDPs) in order to be eligible on a national basis. However, costs for most management actions for conserving 6220 habitat type communities are mostly eligible for agri-environmental subsidies within this program.
- The European Regional Development Fund (ERDF), The Cohesion Fund and Interreg. These funds might be relevant in single cases although activities related to Natura 2000 sites mostly need to be integrated into a broader development context, and for ERDF also related to productive investments (e.g. infrastructure). However, the Interreg approach is more flexible, but it requires a European objective and partnership. Different geographical levels are defined and all of them have their specific rules, eligibility criteria and objectives.
- The Financial Instrument for the Environment (LIFE+). The 'Nature' component of LIFE+ supports best practice and demonstration projects contributing to the implementation of the Birds and Habitats Directives but only exceptionally outside Natura 2000 sites. The 'Biodiversity' component is for demonstration and innovation projects contributing to the objectives of the Commission Communication 'Halting the loss of biodiversity by 2010 – and beyond'. Both the 'Nature' and 'Biodiversity' components focus on practical non-recurring management actions (at least 25 % of the budget). When clearly justified, compensation payments for restrictions in commercial land-use are eligible under 'Nature'. Recurring management is not eligible under LIFE+.

For more information on what management measures are eligible for financial support under various EU funds, it is recommended to consult the "Financing Natura 2000 Guidance Handbook" (Torkler 2007). Furthermore, a web tool (based on that handbook) to easily determine the possible funding for Natura 2000 sites is available in: http://financing-natura2000.moccu.com/pub/index.html.

Colas & Hebert (2000) have provided a useful Guide to estimate management costs for open natural environments in France. Ferraro & Kiss (2002) and Dreschler *et al.* (2007) have proposed direct and cost-effective payments for conservation measures to generate spatiotemporal habitat heterogeneity that could be interesting for estimating costs for management actions aimed at protecting Natura 2000 habitats.

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LIFE03NAT/E/0050. Conservation of Imperial eagle, black vulture and black stork.
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