European Commission

# Farming for Natura 2000

*Guidance on how to integrate Natura 2000 conservation objectives into farming practices, based on Member States good practice experiences*

Environment

**Farming for Natura 2000**

Guidance on how to integrate Natura 2000 conservation objectives into farming practices, based on Member States good practice experiences

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*Front cover: farming in Mala Fatra mountains, Slovakia, © istockphoto*

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## ANNEX D - Management recommendations for each Annex I habitat type dependent on agricultural management

**This table** shows examples of recommendations for the management of each key Annex I habitat type dependent on agricultural management. Recommendations are *not* prescriptive and management should be adapted to the local conditions, using the best available local knowledge. Experts for each habitat are available in many Member States and should be part of the design process. This table should be used in conjunction with the table describing the key habitat types dependent on agricultural management in Annex A. References are listed for each habitat type, with full details below.

**Agri dep** = dependency on agriculture from Halada et al (2011): **f** = Fully dependent on agricultural management, **p** = Partially dependent because management either prolongs the existence of the habitat by blocking succession, or enlarges/maintains an enlarged area of habitat distribution, **p/n** = Partially dependent only for some sub-types or over part of the distribution, or doubts remain concerning their dependence on agricultural management. Where Halada et al (2011) and Sipkova et al (2010) disagree, the Sipkova et al (2010) ranking is indicated in brackets. **NB** dunes with woody scrub (2160 dunes with *Hippophae rhamnoides* and 2170 dunes with *Salix repens* ssp. *argentea* (Salicion arenariae) are not included, although they are often dependent on periodic scrub clearance to prevent succession. Also not included although sometimes dependent on management: 7150 Depressions on peat substrates of the Rhynchosporion (habitat occurs in small patches within larger habitat mosaic and only requires occasional management); 7140 Transition mires and quaking bogs (require low intensity grazing if drained).

References: Halada, L, Evans, D, Romão, C and Petersen, J-E (2011) Which habitats of European importance depend on agricultural practices? *Biodiversity and Conservation*, No 20, (11) pp2365-2378. Sipkova,Z., Balzer,S., Evans,D. & Ssymanek,A. (2010) Assessing the conservation status of European Union habitats - results of the Community report with a case study of the German National Report. *Annali di Botanica*. http://laboratoriocritico.uniroma1.it/index.php/Annalidibotanica/article/view/9103

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| **COASTAL AND HALOPHYTIC HABITATS** | | | | | |
| 1330<br>Atlantic salt meadows<br><br>**p/n** | Introduction of grazing on historically ungrazed areas is detrimental, but on historically heavily grazed salt marshes and coastal meadows reduction or cessation of grazing results in a dense overgrown, species-poor sward unsuitable for grazing and breeding birds. So management depends on conservation objectives. | **Scrub**: Control invasive shrubs including *Baccharis halimifolia.* Shrubs and trees are detrimental to breeding birds because they provide viewpoints for predators.<br>**Cuttings**: should be removed Mowing may be alternative to grazing in particular sites<br>**Fertiliser:** no fertilisation | Regular flooding by brackish sea water should be maintained or restored by removal of barriers such as sea walls. Habitat usually occurs together with 1310 '*Salicornia* and other annuals colonising mud and sand' which | Only secondary habitat areas that were historically grazed or mown require management.<br>Restoration or management measures may be necessary to balance erosion or accretion of sediment.<br>Regulated tidal exchange or de-embankment through managed re-alignment of coastal defences can restore saltwater influence on degraded saltmarsh. | (BfN, 2011) (JNCC, 2007a) (Ministerie van Economische Zaken, Landbouw en Innovatie, 2012) (National Parks and Wildlife Service, 2008) (Bensettiti and Trouvilliez, 2009) (McCorry and Ryle, 2009) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | **Intensity:** vegetation is sensitive to changes in grazing, which could have knock-on effects for other species. Hence species dependent management prescriptions can be very specific based on country and tidal zone. Habitat usually occurs together with 1310 '*Salicornia* and other annuals colonising mud and sand' which may be grazed with saltmarsh.<br>**Stock type**: hardy cattle or horses preferred.<br>**Seasonality:** No winter grazing | | is also regularly flooded. | Good water quality is an important influencing factor. | |
| 1340<br>Inland salt meadows<br><br>**p** | **Intensity:** extensive, approx. 1LU/ha or less. Grazing intensity must be adapted to the site,<br>**Seasonality:** July to October. No winter grazing.<br>**Folding:** inappropriate. | Cutting can be alternative to grazing. Cutting and/or grazing should be sufficiently intensive to prevent *Phragmites* expansion.<br>**Seasonality:** In Slovakia mowing before summer is recommended *except* in areas important for nesting birds, which should be mown only after mid-June/mid-July. In France a late cut is recommended.<br>**Fertiliser:** may tolerate low input of manure (<30kg N/ha per year). | Seepage or periodic flooding by saline groundwater must be maintained.<br>No drainage permitted. | Only secondary habitat areas that were historically grazed or mown require management.<br>Protection from conversion to arable is a high priority. | (Muller, 2002) and references therein (BfN, 2011; INPN, 2011; SOPSR, 2012) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | | **Treatment of cuttings:** should be removed.<br>**Scrub:** occasional winter removal with hand mower if necessary. | | | |
| 1530<br>Pannonic salt steppes and salt marshes<br><br>**p/n** | **Intensity:** extensive. On Solonetz soils: 1 bovine/horse or 5–6 sheep/ha. On Solonchak soils, half this.<br>**Seasonality:** grazing period should be based on precipitation in previous and current year (delayed if dry spring, earlier in wet spring with early vegetation growth). Winter grazing should be prohibited.<br>**Stock type:** traditional indigenous breeds of sheep, cattle, goats, horses or buffalo. Geese suitable in some areas. Stock type should be tailored to site. | Mowing to eliminate weeds and expansive species (eg *Phragmites australis*) on pastures.<br>**Seasonality:** before summer *except* in areas important for nesting birds, which should be mown only after end of breeding bird nesting season.<br>**Method:** machinery appropriate only on dry soils.<br>**Treatment of cuttings:** should be removed as soon as possible.<br>**Fertiliser:** manure or fertiliser inappropriate. | Dams, canals and ditches should be removed (where no threat to settlements) to restore hydrological regime. | The rare primary (undrained and ungrazed) alkali *Artemisia* steppes are not dependent on management.<br>Protection from conversion to arable is high priority.<br>**Burning** may be suitable. | (Šefferová et al, 2008a)<br>(Valachovic et al, 2007)<br>(SOPSR, 2012)<br>(Batáry et al, 2007a)<br>(Batáry et al, 2007b) |
| 1630<br>Boreal Baltic coastal meadows<br><br>**p** | Habitat has a number of stable states and appropriate management varies according to conservation aims and management history.<br>**<u>General recommendations:</u>**<br>Create a diverse sward supporting a range of taxa.<br>**Intensity:** generally moderate | Mowing should be continued in any areas that were traditionally mowed. Can be used to manage expansive species (eg *Spartina*). Can be used to supplement low grazing rates. Traditional mowing followed by grazing is optimal regime for plants and | Regular flooding by brackish sea water should be maintained or restored by removal of barriers such as sea walls. Habitat usually occurs together with 1310 | **Mosaic burning** in early spring on frozen ground can be used to remove dense vegetation ("foggage") from abandoned coastal meadows.<br>**Dig shallow open ponds** for *Bufo calamita* and *Bufo viridis* breeding, and erect **fencing** that encourages cattle to trample in and around | (Doody, 2008)<br>(Lotman, 2004)<br>See (Rannap et al, 2004) for specific prescriptions. |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | **Grazing** | **Cutting or Mowing** | **Hydrological** | **Other** | |
| | grazing (5–6 sheep or 1–1.5 young cattle/ha). In Estonia, low intensity of 0.4 and 1.3 livestock units per hectare (lu/ha) recommended.<br>**<u>Tailored management:</u>**<br>Moderate grazing intensity during breeding season is important for nesting water birds to leave longer vegetation clumps as protection for nests and to avoid trampling many eggs. Grazing should start early in the spring (timing depending on the latitude). Grazing management history should guide management, together with observations and current knowledge about needs of breeding bird species.<br>**Abandoned areas** may require initial intense grazing followed by moderate grazing.<br>**Seasonality:** April–October (May in Scandinavia), or year round when intensity low (0.6 cattle/ha). **Regime:** grazing can be constant, adjusted constant (lower stocking rate in late summer) or rotational. A mosaic regime may be used | invertebrates.<br>**Seasonality:** as late as possible, after breeding bird nesting season.<br>**Treatment of cuttings:** should be removed as soon as possible.<br>**Scrub and reed**: brush-cutting in late summer (after end of breeding bird nesting season) to restore abandoned meadows, with stump removal on mown meadows. Or reed cutting and removal in winter when ground is frozen.<br>**Fertiliser**: application of manure or fertiliser is inappropriate. | '*Salicornia* and other annuals colonising mud and sand' which is also regularly flooded. | ponds to keep them open and create minimally vegetated ground for the toads to hunt. | |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | during restoration, including early season grazing to control *Phragmites* and *Typhus* Invasion.<br>**Stock type**: a mix of stock types (beef cattle, horses, sheep and/or goats) is recommended.<br>**Supplementary feeding:** should be avoided.<br>**Fencing**: Ideally, fences should go right into water so that livestock graze all vegetation, with removal in winter before ice comes.<br>**Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. | | | | |
| **COASTAL SAND DUNES AND INLAND DUNES** | | | | | |
| 2130<br>Fixed coastal dunes with herbaceous vegetation ("grey dunes")<br><br>**p/n** | Depends on management history, vegetation trends, current land use, and nitrogen deposition. Some grey dunes should be left alone.<br>**<u>General recommendations:</u>**<br>Maintenance of a fine grained mosaic of open-sand, moss-, lichen- and low grass cover.<br>**Intensity:** extensive, but enough to control scrub | Mowing occasionally used, but inferior to grazing. May be necessary to clear dense scrub prior to grazing.<br>**Treatment of cuttings:** should be removed as soon as possible.<br>**Fertiliser:** strictly no additional fertilisation (nutrient levels must be kept low). Measures to control | The habitat relies on the natural dynamics of the dune system caused by sand drift from wave and wind action, which requires modification of fixed coastal protection structures such as sea walls, and | **Fencing and path management** to limit erosion due to trampling by visitors and vehicle damage (but some small-scale erosion may be beneficial).<br>**Restoration** may involve removal of forestry plantations and/or artificial large-scale destabilisation. Protect reptile habitats when undertaking restoration measures (keep them careful & small-scale to | (INPN, 2011)<br>(VV.AA, 2009)<br>(Houston, 2008a) and references within<br>(Søgaard et al, 2007)<br>(Tahmasebi Kohyani et al, 2008)<br>(BfN, 2011) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | **Grazing** | **Cutting or Mowing** | **Hydrological** | **Other** | |
| | invasion and to maintain low level erosion dynamics.<br>**Seasonality:** moderate stocking rates in summer, higher in autumn and winter. Either year round low intensity or seasonal higher intensity.<br>**Stock type:** mix of species including sheep and horses; traditional/rare breeds often most effective. Rabbit grazing is an important influence, but reintroduction is often difficult.<br>**Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. | impacts of eutrophication on vegetation may be necessary, such as turf removal / sod cutting of tall grasses, small-scale ploughing.<br>**Scrub:** site-specific management. Mechanical or manual clearance with removal of cuttings, stumps and topsoil. Important to remove **invasive species** e.g. *Pinus spp*., *Acacia* sp. pl., *Cortaderia selloana*, *Carpobrotus edulis*, *Prunus serotina*, *Rosa rugosa* | integrated management of the whole dune system. | maintain refuges). Open patches will also benefit *Bufo calamita*. | |
| 2140<br>Decalcified fixed dunes with *Empetrum nigrum*<br><br>**p/n** | **Intensity:** light, but sufficient to suppress scrub encroachment and maintain crowberry and some open patches for mosses, lichens, herbs etc.<br>**Supplementary feeding**: should be avoided.<br>**Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. | **Fertiliser:** strictly no additional fertilisation (nutrient levels must be kept low). Measures to control impacts of eutrophication on vegetation may be necessary, such as turf removal / sod cutting, small-scale ploughing.<br>**Scrub:** cutting may be required where abandonment has led to tree and shrub encroachment. | Some subtypes require influx of groundwater. | Control of **invasive species** may be necessary. | (Pihl et al, 2001)<br>(Søgaard et al, 2007)<br>(VV.AA, 2009)<br>(BfN, 2011; Ministerie van Economische Zaken, Landbouw en Innovatie, 2012) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| 2150<br>Atlantic decalcified fixed dunes (Calluno-Ulicetea)<br><br>**p/n** | **Intensity:** light, sufficient to suppress scrub encroachment and maintain variety of ages of *Calluna*. | **Scrub:** cutting may be required where abandonment has led to tree and shrub encroachment.<br>**Fertiliser:** strictly no additional fertilisation (nutrient levels must be kept low). Measures to control impacts of eutrophication on vegetation may be necessary, such as turf removal / sod cutting, small-scale ploughing. | | Control of **invasive species** may be necessary. Removal of forestry plantations.<br>Some habitat creation through natural succession from habitat type 2130 "grey dunes". | (INPN, 2011)<br>(VV.AA, 2009)<br>(Halada et al, 2011)<br>(ICNB, 2006)<br>(National Parks and Wildlife Service, 2008)<br>(Ministerie van Economische Zaken, Landbouw en Innovatie, 2012)<br>(BfN, 2011; Søgaard et al, 2007) |
| 2190<br>Humid dune slacks<br><br>**p** | Intact dune slacks do not need management.<br>**Intensity:** extensive.<br>**Stock type:** sheep ideal, but cattle or horses preferred in wetter areas. Hardy breeds should be used eg Devon red cattle, Herdwick sheep. Rabbits should be encouraged with artificial burrows and access strips.<br>**Regime:** typically, a single stock species is used seasonally at a set density. | **Seasonality:** frequency and timing will depend on the habitat and conservation aims.<br>**Scrub:** removal may be necessary where invasion has occurred. Can be by hand or using chainsaws, brush-cutters and tractors with specialised rakes. Stumps should be treated with herbicide. Must be carefully planned and controlled. Must be followed with mowing or grazing. | Drainage canals should be blocked and water levels raised, eg using 'infiltration water' drawn from rivers. Coastal tidal and flood regime should be maintained. | Regular **'sand blow-out'** should be maintained. **Sodcutting** may be appropriate to reduce impacts of eutrophication and control succession. | (INPN, 2011)<br>(VV.AA, 2009)<br>(Houston, 2008b)<br>(Šefferová et al, 2008a)<br>(BfN, 2011; Grootjans et al, 2002) |
| 21A0<br>Machairs<br><br>**f** | **Intensity:** extensive. Stocking rates and ratio of sheep to cattle are critical.<br>**Seasonality:** summer grazing | **Seasonality:** cutting should be for hay not silage, as cut will be later in year, allowing plants to set seed. | | Machair has a **traditional rotating cropping pattern** of grazing and small areas of extensive arable crops for winter fodder. The arable | (National Parks and Wildlife Service, 2008)<br>(JNCC, 2007b) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | **Grazing** | **Cutting or Mowing** | **Hydrological** | **Other** | |
| | on mountains surrounding Machairs, and wintering on the commonage.<br>**Regime:** removal of fences and return to open grazing *or* rotational grazing. | **Fertiliser**: limited use of fertiliser, no herbicide use. | | habitat is in the more critical condition because of earlier harvesting. | (RSPB, 2012) |
| 2250<br>Coastal dunes with *Juniperus* species<br><br>**p** | Essential to support juniper regeneration.<br>**Intensity:** extensive.<br>**Stock type:** preferably sheep, but sometimes cattle | **Scrub:** scrub and tree removal may be necessary. Should be followed by grazing. | | Control of **invasive species** may be necessary.<br>**Fire prevention** measures necessary. | (INPN, 2011)<br>(VV.AA, 2009)<br>(Picchi, 2008)<br>(Fuller et al, 2010) |
| 2310<br>Dry sandy heaths with *Calluna* and *Genista*<br><br>**p/n**<br>**(or f)** | **Intensity**: extensive grazing – needs careful control of stocking levels and intensity to restore and maintain desired vegetation.<br>**Stocking type**: mixed grazing of cattle and sheep is recommended to reduce *Molinia*, however cattle should be removed as soon as there is evidence the heather is being eaten. Stocking levels need to take into account breed and age as well as species mix.<br>**Regime**: rotational grazing with variation of both presence of grazing and single stock with mixed stock is recommended to produce heterogeneous habitat that can benefit both plants and invertebrates. | **Fertiliser:** strictly no additional fertilisation (nutrient levels must be kept low). Measures to control impacts of eutrophication on vegetation may be necessary, such as turf removal / sod cutting (plaggen), small-scale ploughing (heaths were traditionally subject to peat cutting and heath harvesting, which removed nutrients).<br>**Scrub:** scrub and tree removal may be necessary, including control of woody invasive species. | | Small-scale burning of *Molinia* grass may be useful to help restore *Calluna* cover.<br>Habitat is highly fragmented – area expansion and habitat creation would be very beneficial for long-term conservation. | (BfN, 2011; Ministerie van Economische Zaken, Landbouw en Innovatie, 2012; Søgaard et al, 2007) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | **Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting inverte-brates. **Supplementary feeding** of livestock should be avoided. | | | | |
| 2320<br>Dry sandy heaths with *Calluna* and *Empetrum nigrum*<br><br>**p/n**<br>**(or f)** | Same as for 2310 | Same as for 2310 | | Same as for 2310<br>It is important to create areas with open sand in the habitat. Animal grazing is often not enough and thus other ways of regular disturbance is needed. Many high nature value areas are used or have been used for military training which has created the necessary mosaic sand structures. Burning may be beneficial for some species in this habitat. | (BfN, 2011; Ministerie van Economische Zaken, Landbouw en Innovatie, 2012; Søgaard et al, 2007) |
| 2330<br>Inland dunes with open *Corynephorus* and *Agrostis* grassland<br><br>**p/n**<br>**(or f)** | **Intensity:** very extensive, sufficient to suppress scrub and tree encroachment and maintain dynamics of open sand.<br>**Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. **Supplementary feeding** of livestock will negatively affect conservation status. | Regular cutting necessary to prevent succession to scrub or heath. | | Control/limit **sand quarrying** actions and infrastructure development.<br>Problems with invasive moss species *Campylopus introflexus*.<br>It is important to create areas with open sand in the habitat. Animal grazing is often not enough and thus other ways of regular disturbance is needed. Many high nature value areas are used or have been used for military training which has created the necessary mosaic sand structures. | (INPN, 2011)<br>(Ministerie van Economische Zaken, Landbouw en Innovatie, 2012)<br>(AOPK CR, 2007; Riksen et al, 2006)<br>(BfN, 2011) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| 2340<br>Pannonic inland dunes<br><br>**f** | **Intensity:** more intensive during first few years of restoration, then at level sufficient to provide disturbance.<br>**Regime and stock type**: variation in grazing pressure in order to maintain mosaic of open and closed swards. | **Scrub:** mechanical removal of scrub and trees may be necessary.<br>**Fertiliser:** no fertiliser input; humus layer may be removed to prevent nutrient enrichment. | | In some circumstances carefully managed winter **burning** may be suitable. | (Valachovic et al, 2007)<br>(SOPSR, 2012) |
| **TEMPERATE HEATH AND SCRUB** | | | | | |
| 4010<br>Northern Atlantic wet heaths with *Erica tetralix*<br><br>**f (or p/n)** | Undisturbed wet heath areas do not require management. However most heaths are now threatened by eutrophication and drainage.<br>**Intensity:** extensive grazing that is sufficient to keep down trees and leggy heather, but not so intense that heather is reduced and replaced by grassland eg *Molinia*. If bare peat is exposed grazing should be prevented.<br>**Seasonality**: avoid winter grazing (graze when dry) | **Scrub:** tree removal essential for restoration. Rotational heath cutting may be necessary but must avoid use of heavy machinery that causes serious compaction and erosion problems.<br>**Fertiliser:** strictly no use of manure or fertiliser, prevent eutrophication from use of fertilisers on nearby land, create buffer zones. | Hydrology needs to be managed in the wider habitat complex. Where possible, block existing drainage channels.<br>Prevent further drainage but also ensure the habitat is not flooded. | Habitat has historically been managed with controlled **burning** at interval of 2–20 years in the UK, but is not now recommended unless preceded by careful impact assessment, as it tends to damage peat and encourage *Molinia*.<br>Stop peat cutting.<br>Small-scale periodic **sod-cutting** can maintain open patches for pioneer vegetation and invertebrates and help control *Molinia*. | (Hampton, 2008)<br>(García et al, 2012)<br>(Harris et al, 2011)<br>(Newton et al, 2009)<br>(Backshall et al, 2001; Tucker, 2003) |
| 4020<br>Temperate Atlantic wet heaths with *Erica ciliaris* and *Erica tetralix*<br><br>**f** | Not recommended in Spain but considered necessary in the UK. If grazing occurs, it should be very extensive with strictly controlled stocking rates to prevent eutrophication, excessive grazing of sensitive | **Scrub:** tree removal where necessary, remove invasive species, with removal of all plant material.<br>**Fertiliser:** strictly no use of manure or fertiliser, prevent eutrophication from use of | Where possible, block existing drainage channels.<br>Prevent further drainage but also ensure the habitat is not flooded. | Carefully managed **burning** may be used in some areas at interval of 2–20 years in the UK, but not recommended in Spain unless preceded by careful impact assessment.<br>Stop peat cutting. | (VV.AA, 2009)<br>(ICNB, 2006)<br>(JNCC, 2007b)<br>(INPN, 2011)<br>(Martín and Lopez, 2002) and references therein |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | plant species, and trampling damage. | fertilisers on nearby land, create buffer zones. | | | (Hampton, 2008) (Backshall et al, 2001; Tucker, 2003) |
| 4030<br>European dry heaths<br><br>**f** | **Intensity:** extensive. Avoid eutrophication and grazing and trampling of sensitive plants from excessive stocking levels, including impact of wild grazers (deer etc.) However grazing needs to be sufficient to prevent tree colonisation and accumulation of woody material that has a high fire risk.<br>**Seasonality**: avoid winter grazing | **Scrub:** tree removal where necessary, with removal of all plant material. Control invasive species including *Pteridium aquilinum*, *Rhododendron ponticum*, *Ulex galii*, *Gaultheria shallon*.<br>**Fertiliser:** strictly no use of manure or fertiliser, prevent eutrophication from use of fertilisers on nearby land, create buffer zones. | | In some circumstances carefully managed **burning** may be appropriate with post-burn monitoring. Very sensitive to uncontrolled burning which produces large areas of even-aged vegetation and loss of plant and invertebrate species.<br>Manage human pressures to avoid erosion from recreational activities, and wild fire risk. | (García et al, 2012) (Harris et al, 2011) (Newton et al, 2009)<br>(VV.AA, 2009) |
| 4040<br>Dry Atlantic coastal heaths with *Erica vagans*<br><br>**f** | Not recommended. | **Scrub:** tree removal where necessary, with removal of all plant material.<br>**Fertiliser:** strictly no use of manure or fertiliser, prevent eutrophication from use of fertilisers on nearby land, create buffer zones. | | Control of **invasive species** may be necessary. | (VV.AA, 2009) (JNCC, 2007b) (INPN, 2011) (Martín & Lopez, 2002) (Valachovic et al, 2007) and references therein |
| 4060<br>Alpine and boreal heaths<br><br>**p/n** | Only secondary habitat areas that were historically grazed require management.<br>**Intensity:** extensive. Stocking rates must be tailored to type and age of vegetation and other local characteristics. Detailed grazing plans should | Cutting should be carefully planned and monitored.<br>**Method:** by hand or mechanical. | | In some circumstances managed b**urning** may be appropriate, but this should be carefully planned and controlled, and used only when necessary, in balance with grazing. | (INPN, 2011) (VV.AA, 2009) (Zaghi, 2008) (DeGabriel et al, 2011)<br>(Martín & Lopez, 2002) and references therein |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | be used.<br>**Seasonality:** in south and central Europe, limited to summer (June–October) based on traditional 'transhumance' regime. At lower altitudes, and further north (eg UK) grazing is year round.<br>**Stock type:** in Boreal regions, usually grazed by reindeer. In upland heathland in Scotland, mixed grazing by sheep with deer appears optimal. | | | | (Tucker, 2003)<br>(Valachovic et al, 2007) |
| 4090<br>Endemic oro-Mediterranean heaths with gorse<br><br>**p** | Habitat very variable and conservation recommendations will differ between sites.<br>**Intensity:** extensive is optimum for many subtypes.<br>**Livestock type:** sheep preferred. | **Scrub:** scrub clearance may be necessary and should be followed by extensive grazing. | | Reintroducing traditional **burning** may be appropriate in some areas but should be based on management strategies and carried out carefully where there is low risk of creating wildfires. | (INPN, 2011)<br>(VV.AA, 2009)<br>(Beaufoy et al, 2011) |
| **SCLEROPHYLLOUS SCRUB (MATORRAL)** | | | | | |
| 5120<br>Mountain *Cytisus purgans* formations<br><br>**p/n** | **Intensity:** extensive/moderate density<br>**Other:** can be used in combination with burning management | | | **Burning** may be appropriate in some areas but should be based on management strategies and carried out carefully where there is low risk of creating wildfires. | (INPN, 2011)<br>(Halada et al, 2011)<br>(VV.AA, 2009) |
| 5130<br>*Juniperus communis* formations on | *Juniperus* recruitment requires a carefully adjusted grazing regime to create and maintain the habitat mosaic. | **Scrub:** in the absence of grazing, scrub removal will be necessary. | | Carefully managed **soil disturbance** and **weeding** may be beneficial. Burning is usually not an option because of high risk of fire getting | (INPN, 2011)<br>(VV.AA, 2009)<br>(BfN, 2011; Valachovic et al, |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| heaths or calcareous grasslands<br><br>**p** | **Intensity:** grazing should be sufficient to maintain short sward and bare patches. Heavy grazing will prevent seed germination, but in some climates grazing needs to be moderately high to stop overgrowth of scrub and loss of grassland.<br>**Seasonality:** intermittent grazing may be ideal eg with removal period of 10 years.<br>**Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. **Supplementary feeding** of livestock will negatively affect conservation | | | out of control. Propagation of juniper seedlings in nursery may improve recruitment. | 2007)<br>(National Parks and Wildlife Service, 2008)<br>(JNCC, 2007b)<br>(Valachovic et al, 2007)<br>(Beaufoy et al, 2011)<br>(Lotman, 2004)<br>(Ministerie van Economische Zaken, Landbouw en Innovatie, 2012)<br>(SOPSR, 2012)<br>(Cooper et al, 2012) |
| 5210 Arborescent matorral with *Juniperus* spp.<br><br>**p/n** | **Intensity:** moderate. Should be controlled by detailed 'pasturage plans' based on accurate field surveys of habitat. Overgrazing can result in trampling of juniper seedlings.<br>**Seasonality:** preferably limited to winter.<br>**Livestock type:** sheep and goats are preferable to limit compaction and due to their grazing habits. | **Scrub:** invading scrub and trees should be cleared periodically. Older juniper should be pruned where this may encourage younger saplings. | | **Fire prevention** may be necessary in high risk areas.<br>Subtype 'primary matorral' does not require active management | (INPN, 2011)<br>(VV.AA, 2009)<br>(Calaciura and Spinelli, 2008a)<br>(Beaufoy et al, 2011) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| 5330<br>Thermo-Mediterranean and pre-desert scrub<br><br>**p/n** | **Intensity:** very extensive, adapted to degree of aridity. **Regime:** livestock should be free ranging. Various subtypes - some subtypes should receive no grazing. | **Scrub:** maintain clearings as openings for germination and young successional stages and as fire breaks. Clear away invasive trees. | | **Fire protection** measures necessary.<br>Control of **invasive species** may be necessary. | (INPN, 2011)<br>(VV.AA, 2009)<br>(Halada et al, 2011) and references therein |
| 5420<br>*Sarcopoterium spinosum* phryganas<br><br>**p** | **Intensity:** moderate to high stocking rates. Vegetation is relatively resistant to grazing pressure. Traditionally extensively grazed by goats and/or sheep. | | | **Burning**: role of fire in habitat maintenance unclear.<br>*Sarcopoterium spinosum* is capable of regeneration after fire. | (Papanastasis et al, 2002)<br>(Ramón Vallejo et al, 2012)<br>(Papanikolaou et al, 2011) |
| 5430<br>Endemic phryganas of the Euphorbio-Verbascion<br><br>**p** | **Intensity:** Vegetation is relatively resistant to grazing pressure. Traditionally extensively grazed by goats and/or sheep. | | | Control of **invasive species** may be necessary (eg *Carpobrotus, Pennisetum*).<br>**Fire protection** measures necessary. | (VV.AA, 2009)<br>(Papanikolaou et al, 2011) |
| **NATURAL AND SEMI-NATURAL GRASSLAND FORMATIONS** | | | | | |
| 6110<br>Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi<br><br>**p/n** | Only secondary habitat areas that were historically grazed require management.<br>**Intensity:** extensive.<br>**Livestock type:** cattle. Grazing by rabbits is often crucial.<br>**Regime:** grazing should be controlled; vegetation is favoured by a controlled level of trampling. A rotational regime may be suitable.<br>**Other**: use of animal medicines, particularly worm | | | Habitat occurs in small patches so management must be integrated with **management of the wider landscape**. | (INPN, 2011)<br>(VV.AA, 2009)<br>(BfN, 2011) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | treatments, must be minimal to avoid affecting invertebrates. **Supplementary feeding** of livestock will negatively affect conservation status. | | | | |
| 6120<br>Xeric sand calcareous grasslands<br><br>**p** | **Intensity:** extensive.<br>**Livestock type:** in addition to livestock (type not defined), grazing by rabbits is crucial.<br>**Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. **Supplementary feeding** of livestock will negatively affect conservation status. | **Seasonality:** mowing should be carried out only once a year maximum. Should be followed by grazing. | Habitat susceptible to drought, some areas are reliant on flooding; regimes should be maintained | Remaining areas are very small and so reliant on **management of the wider landscape**.<br>It is important to have sufficient disturbance to create areas with open sand and expose subsurface sand to maintain the necessary high pH. Due to leaching, the pH would otherwise with time be likely to fall to critical levels, at least at some sites. The disturbance from grazing animals is often not sufficient except on steep slopes. | (INPN, 2011)<br>(Pihl et al, 2001)<br>(Baranska et al, 2009; BfN, 2011) |
| 6140<br>Siliceous Pyrenean *Festuca eskia* grasslands<br><br>**p** | Grazing and trampling are critical to maintaining the characteristic species in this habitat. **Intensity:** relatively high; approx. 6–7 sheep/ha<br>**Livestock type:** preferably sheep. Some grazing by horses at the end of the summer may also be used.<br>**Regime:** grazing by sheep in afternoon or early evening is recommended. Should be controlled by a shepherd. | | | In some circumstances carefully managed **Burning** may be used in combination with grazing. | (INPN, 2011)<br>(VV.AA, 2009) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| 6150<br>Siliceous alpine and boreal grasslands<br><br>**p** | **Intensity:** very low to extensive, depending on biogeographical region. A reduction or cessation of grazing can be required, although it varies greatly geographically. **Stock type:** cattle and ponies may be used as they graze coarser vegetation than sheep. Goats should be avoided as they can access remote remaining patches of the habitat type. In the Scandinavian Alpine and Boreal regions the habitat quality is dependent on the influence of reindeer grazing. A too intensive reindeer grazing pressure can however have local negative effects. Grazing by cattle, sheep and goats has been part of traditional grazing regimes in the proximity of summer farms. **Folding:** inappropriate. | Cutting should only be used if grazing measures do not encourage a varied vegetation structure.<br>**Fertiliser**: Strictly no liming or fertiliser. | | Some grasslands are best left alone.<br>Need protection from recreational impacts eg skiing, mountain biking, especially if winter snow cover is reduced. | (Hughes, 2008) (INPN, 2011) (JNCC, 2007a) (Valachovic et al, 2007) (BfN, 2011) (SOPSR, 2012) (Valachovic et al, 2007) |
| 6160<br>Oro-Iberian *Festuca indigesta* grasslands<br><br>**P** | **Intensity:** extensive.<br>**Stock type:** sheep.<br>**Regime:** traditional regimes should be maintained. | | Water courses should not be altered. | Carefully planned and managed burning together with grazing to help control wildfires is recommended in Portugal, but in Spain the habitat should be protected from fire. | (VV.AA, 2009) (ICNB, 2006) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| 6170<br>Alpine and subalpine calcareous grasslands<br><br>**p** | Some alpine grasslands should be left ungrazed.<br>**Intensity:** extensive to moderate grazing; utilisation rate of 20–30% of above-ground plant production – eg 0.4LU/ha/yr in UK.<br>**Stock type:** foraging by wild ungulates may be sufficient to maintain the habitat; continuation of historic grazing by ibex and chamois will benefit alpine species. In the Scandinavian Alpine and Boreal regions the habitat quality is dependent on the influence of reindeer grazing. A too intensive reindeer grazing pressure can however have local negative effects. Grazing by cattle, sheep and goats has been part of traditional grazing regimes in the proximity of summer farms.<br>**Folding:** inappropriate. | Some scrub species which may encroach are also of conservation value so balance between scrub and grassland depends on which species are prioritised. | | Habitat is found over large range and is very variable so **management should be locally tailored**.<br>When the vegetative cover is altered or there is significant loss of soil, it is almost impossible to restore the original habitat. | (INPN, 2011)<br>(VV.AA, 2009)<br>(García-González, 2008)<br>(Valachovic et al, 2007)<br>(Barbaro et al, 2001)<br>(Poschlod and WallisDeVries, 2002)<br>(WallisDeVries et al, 2002)<br>(Willems, 2001) |
| 6180<br>Macaronesian mesophile grasslands<br>**P** | **Limited information available for this habitat type** | | | Habitat occurs in small patches with forest and scrub habitats. | (ICNB, 2008) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| 6190<br>Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis)<br>**f** | **Intensity:** rates should be strictly controlled.<br>**Stock type:** cattle, sheep and/or goats.<br>**Folding:** inappropriate. | Mowing should be a maximum of once a year. Should be followed by grazing.<br>**Fertiliser:** no fertilisation. | Restoration of hydrological regime. | **Goose farming** should be controlled. | (Valachovic et al, 2007)<br>(SOPSR, 2012) |
| 6210<br>Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)<br><br>**f (or p/n)** | **Intensity:** low/moderate extensive. Stocking rates vary depending on length of grazing period and rate of sward production in different regions.<br>**Stock type:** cattle, horses, sheep or goats may be used. Should be tailored to site conditions. Alternating stock types at a site where this is not usual will have negative impacts.<br>**Seasonality:** delaying grazing until end of growing season beneficial for biodiversity, except on sites dominated by bracken where it may help break up dense stands. Winter grazing may be more effective. In some areas, traditional transhumance grazing should continue. Characteristic plant species require bare patches in the sward to germinate, so a certain amount of sward | Grazing usually preferable for invertebrates, but where habitat was traditionally mown, or where grazing is not practicable, extensive mowing may be more appropriate (eg steep sub-alpine meadows).<br>**Frequency:** usually single cut, but varies from every two years to twice a year, depending on productivity.<br>**Seasonality:** late in the year, after bird breeding and plant seed-setting. Timing will vary depending on region and nature of wildlife interest, and will be earlier for fertilised meadows with greater yields.<br>**Regime:** cutting should be staggered; ideally, 5–10% of area left uncut until following year and different area left each year. Cut to about 8– | | A combination of mowing and grazing is not desirable as it does not favour the characteristic species related to one or other of the practices.<br><br>Control or eradication of **invasive species** *Robinia pseudoacacia*, which threatens *Artemisia pancicii* populations in the Czech Republic. | (INPN, 2011)<br>(VV.AA, 2009)<br>(Calaciura and Spinelli, 2008b)<br>(Beaufoy et al, 2011)<br>(Crofts and Jefferson, 1999)<br>(Harris et al, 2011)<br>(Muller, 2002)<br>(Søgaard et al, 2007)<br>(Baranska et al, 2009) (BfN, 2011)<br>(Valachovic et al, 2007) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | erosion in winter is beneficial.<br>**Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates.<br>**Supplementary feeding** of livestock will negatively affect conservation status. | 10cm.<br>**Treatment of cuttings:** should be removed immediately.<br>**Fertiliser:** no fertilisation<br>**Method:** cutter-bar mowers are more desirable than rotary mowers.<br>**Scrub:** removal may be necessary but some should be left for diversity. Large stands should be reduced by staggered yearly cutting. | | | |
| 6220 Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea<br><br>**f** | Grazing regime varies between habitat sub-types[95].<br><br>**<u>Subtype 1:</u>**<br>**Intensity:** 0.2–0.4 LU/ha/year (or higher to control woody vegetation)<br>**Seasonality:** Spring or autumn<br>**Stock type:** sheep or goats<br>**Regime:** shepherding preferable<br>**Other:** limited supplementary feeding.<br><br>**<u>Subtype 2:</u>**<br>**Intensity:** 1 LU/ha/year (on closely related dehesa systems, much lower stocking rates | **Scrub:** mechanical removal of woody vegetation may be necessary, particularly for initial restoration. Should repeat every 3–5 years and be carried out in small, irregular plots to increase structural diversity.<br><br>**Fertiliser:** use of fertilisers (particularly N and K) and pesticides should be restricted. | | In some circumstances carefully controlled **burning** management may be used in combination with grazing and mechanical scrub removal.<br>Maintenance of **traditional mosaic** distribution of agricultural plots.<br>**Field margins, beetle banks** and **fallow land** may be beneficial.<br>**Silvicultural treatment** should be used in afforested areas. | (INPN, 2011)<br>(VV.AA, 2009)<br>(San Miguel, 2008)<br>(Beaufoy et al, 2011)<br>(Fuller et al, 2011) |

[95] (García-González, 2008)

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | needed; 0.2–0.3 LU/ha/year).<br>**Seasonality:** grazing from mid-autumn to late summer.<br>**Stock type:** sheep or cattle, sometimes goats and occasionally horses.<br>**Regime:** shepherding preferable<br>**Supplementary feeding:** cattle require relatively high rates of supplementary feeding.<br>**Subtype 3:**<br>**Intensity:** 0.1 LU/ha/year (or up to 0.5 LU for short period to remove woody vegetation).<br>**Seasonality:** usually spring, sometimes autumn depending on onset of rain.<br>**Stock type:** sheep or goat<br>**Regime:** shepherding preferable<br>Regimes should be tailored to local conditions and intensity should not be increased above traditional levels. | | | | |
| 6230<br>Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and sub-mountain | Habitat is highly dependent on regular grazing at the right intensity.<br>**Intensity:** varies between regions and sub-types; eg 04–0.6LU/ha in Poland and 0.3–1.0LU/ha in Slovakia. | Mowing is usually employed where productivity is too low to support grazing.<br>Combination of mowing and grazing is traditional in many parts of Europe.<br>**Treatment of cuttings:** | | **Turf stripping** may be used during restoration. | (INPN, 2011)<br>(VV.AA, 2009)<br>(Galvánek and Janák, 2008)<br>(Valachovic et al, 2007)<br>(Chytry et al, 2007) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| areas, in continental Europe)<br><br>**f** | **Seasonality:** year-round grazing in Atlantic regions, seasonal grazing in Continental and Boreal regions. Traditional transhumance grazing should continue at higher altitudes. **Stock type:** optimum stock type varies between regions. **Regime:** rotational grazing suitable (eg 3 cycles each year) with small herds of <15 LU grazing for up to 10 days in a single location. Fencing not advised. **Folding**: permitted in some locations in Slovakia, providing pens are moved each day. **Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting inverte-brates. **Supplementary feeding** of livestock will negatively affect conservation status. | leaving cuttings on ground may be necessary in very low nutrient systems. **Fertiliser:** Generally, no fertilisation or liming is tolerated. Very low levels of manure may be suitable on low altitude grasslands. **Other:** in the absence of grazing, artificial methods to open up bare ground may be necessary. **Scrub:** clearance may be necessary for initial restoration. | | | (Háková et al, 2004) (Carlin et al, 2010) (Muller, 2002) (Ceulemans et al, 2011) (SOPSR, 2012) (BfN, 2011) (Valachovic et al, 2007) |
| 6240 Sub-pannonic steppic grasslands<br><br>**p (p/n)** | **Intensity:** very low; maximum 0.8 LU/ha. **Stock type:** sheep or goats. **Folding:** inappropriate. **Supplementary feeding:** restriction necessary to prevent nutrient enrichment. **Other:** can combine with mowing. | **Frequency:** at most once a year. **Seasonality:** mow after end of breeding bird nesting season. **Fertiliser:** no fertilisation. **Other:** can be followed by grazing. | | | (Sarbu et al, 2004) (Valachovic et al, 2007) (Zingstra et al, 2010) (SOPSR, 2012) (BfN, 2011) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| 6250<br>Pannonic loess steppic grasslands<br><br>**f** | **Folding:** inappropriate.<br>**Other:** can combine with mowing. | **Frequency:** at most once a year.<br>**Seasonality:** mow after end of breeding bird nesting season.<br>**Fertiliser:** no fertilisation.<br>**Other:** can be followed by grazing. | | Significant issue with **invasive tree species** black locust (*Robinia pseudoacacia*) and Russian olive (*Eleagnus angustifolia*). | (Valachovic et al, 2007)<br>(Illyés and Csatho, 2007)<br>(SOPSR, 2012) |
| 6260<br>Pannonic sand steppes<br><br>**f** | **Intensity:** moderate to extensive. For closed dunes, 1 sheep/ha for 2 days/year recommended. To maintain shifting dune system, initial overgrazing by goats, or sometimes sheep, should be used.<br>**Stock type:** sheep mostly used on closed dunes. Cattle on sand plains. Mixed sheep/goats can be used where succession is a problem.<br>**Regime:** rotational grazing appropriate for cattle on sand plain. **Folding:** inappropriate on all subtypes. | Mowing is used less commonly than grazing. Nearly impossible on sand steppe; more typically used for closed steppes.<br>**Seasonality:** begin after end of bird breeding season and plant seed-setting. No mowing in dry years.<br>**Frequency:** mow once a year.<br>**Regime:** leave at least 15% uncut and rotate uncut area each year. Cut to approx. 10cm. | | In some areas, objective is succession and non-intervention is appropriate. Otherwise, active management needed every 5 years at least.<br>Control of **invasive species** may be necessary through clearing and subsequent grazing,<br>eg *Robinia* trees. | (Šefferová et al, 2008b)<br>(Valachovic et al, 2007)<br>(SOPSR, 2012) |
| 6270<br>Fennoscandian lowland species-rich dry to mesic grasslands<br><br>**f** | Requires low intensity or extensive management by grazing or mowing – grazing is usually preferable for invertebrates but management must be adapted to site history. **Intensity**: | **Fertiliser:** no fertilisation.<br>**Scrub:** some limited clearance may be appropriate, but intensive clearing in a short period of time is detrimental to biodiversity as the nutrient level in the soil increase when | | | (Pihlgren and Lennartsson, 2008)<br>(Ikonen, 2011)<br>(Beaufoy et al, 2011) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | low/moderate extensive.<br>**Regime:** rotational grazing appropriate.<br>**Seasonality**: delaying grazing until end of growing season beneficial for biodiversity, except on sites dominated by bracken where it may help break up dense stands. Appropriate management varies depending on the climate and history of the site.<br>**Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. **Supplementary feeding** of livestock will negatively affect conservation status. | the roots are decaying. | | | |
| 6280<br>Nordic alvar and precambrian calcareous flatrocks<br><br>**f** | **Intensity**: Generally extensive grazing but significant variation between sites; balance and adjust grazing pressure on site-specific basis. Guideline of one LU per 5–6 hectares.<br>**Seasonality:** no grazing in winter.<br>**Stock type:** consider mix on a site-by-site basis. Generally best suited to hardy breeds of | **Scrub:** regular clearing may be necessary. Cleared material should be removed (or occasionally, burned). Never clear during bird breeding season.<br>**Fertiliser:** fertilisers and biocides should not be used. | Drainage should be prevented. | Restrict establishment of **lime and gravel pits** on surrounding land. In some circumstances carefully controlled **burning** in winter or early spring can sometimes be appropriate to clear scrub. | (Eriksson and Rosén, 2008)<br>(Beaufoy et al, 2011)<br>(Lotman, 2004) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | beef cattle, horses and/or sheep.<br>**Supplementary feeding:** should not be used.<br>**Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. | | | | |
| 62A0<br>Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae)<br>**f** | **Intensity:** extensive grazing, sufficient to prevent invasion by tall herbs such as *Peucedanum cervaria*. | Mowing 1/2 times per year.<br>**Fertiliser:** no fertilisation.<br>**Scrub:** Regular cutting of trees and shrubs (eg *Cottinus coggygria*) is necessary. | | | (EEA, 2011; Kaligaric et al, 2003) |
| 6310<br>Dehesas with evergreen *Quercus* species<br><br>**f** | **Stock type:** sheep, as cattle grazing can damage soil structure. Max threshold of 0.25 LU/ha. | Promote variation in understorey vegetation by maintaining some scrub (reptiles benefit), but maintain sufficient fire breaks.<br>Traditional management included small patches of ploughing to sow cereals or to remove shrubs to favour herb growth. | | Need to promote the **regeneration of tree populations**, can be by cycles of abandonment and opening of land.<br>**Fire prevention and management** measures. Management needs to balance demands of the range of users including grazing, hunting, gathering, bee-keeping, recreation etc. | (VV.AA, 2009)<br>(ICNB, 2006)<br>(INPN, 2011)<br>(Bergmeier et al, 2012)<br>(Pereira and da Fonseca, 2003)<br>(Surová et al, 2011)<br>(Godinho et al, 2011)<br>(Tárrega et al, 2000)<br>(Martín & Lopez, 2002)<br>(Fabbio et al, 2003) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| 6410<br>*Molinia* meadows on calcareous, peaty or clayey-sit laden soils (Molinion caerulae)<br><br>**f** | It would be favourable if a larger proportion of *Molinia* meadows were mown rather than grazed, but grazing can also be a suitable management form. Local traditional management regimes can be used as a guide.<br>**Intensity:** extensive to moderate, but grazing levels need to be adapted to each site, or even varied within a site, in order to benefit different priority plant species; eg *Liparis loeselii* requires very extensive grazing whereas *Sanguisorba officinalis*, the host plant of the *Phengaris* butterfly species, requires more intensive grazing.<br>**Fencing**: As livestock do not prefer *Molinia*, they should be prevented from grazing on other habitats, otherwise habitat will overgrow.<br>**Sheep folding:** inappropriate.<br>**Other:** use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. **Supplementary feeding** of livestock will | **Frequency:** low-intensity; one cut a year. Generally late (September), but in some areas cut was traditionally earlier (though still at end of breeding bird nesting season) and late cutting may not prevent eutrophication. Rotational or staggered management at the landscape scale allows animal species to find refuges from cutting on any one patch, and also allows species that benefit from earlier or later cuts to co-exist. It is valuable if a rotating 30% of the area can be unmown.<br>**Fertiliser:** no fertilisation is recommended. If fertilizer is used according to national recommendations, farmyard manure is preferable due to slow nutrient release and micro-nutrient content. | Very sensitive to water table changes and requires winter flooding. Typically, water tables should be raised by halting groundwater abstraction or, where this is not viable, by restricting the volume and the times at which water can be removed. | Maintain **spatial heterogeneity** to provide for needs of different taxa. Measures to reduce nutrient levels from atmospheric **eutrophication** may be necessary, such as topsoil burial, sod cutting or periodic intensive cutting or grazing.<br>At lake shores it is important that the animals can move into the water, thus creating reed-free areas at shallow water where rare plants can thrive and birds can feed. | (INPN, 2011)<br>(VV.AA, 2009)<br>(Muller, 2002)<br>(Bragazza, 2009)<br>(Cop et al, 2009)<br>(WallisDeVries et al, 2002)<br>(Valachovic et al, 2007)<br>(Crofts & Jefferson, 1999)<br>(Muller, 2002)<br>(Søgaard et al, 2007)<br>(Lotman, 2004)<br>(BfN, 2011)<br>(Valachovic et al, 2007) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | negatively affect conservation status. | | | | |
| 6420 Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion<br><br>**p** | **Intensity:** low, avoid overstocking.<br>**Stock type:** sheep or cattle. | Mowing can help maintain a mosaic structure, favouring key herbaceous plants.<br>**Timing:** dates of cutting best defined locally.<br>**Scrub:** remove plantation pine in wet depressions. Cutting of scrub may be necessary.<br>**Fertiliser:** manure fertilisation should be limited by grazing sheep at low densities after mowing. | Changes to groundwater levels should be avoided. Typically, water tables should be raised by halting groundwater abstraction or, where this is not viable, by restricting the volume and the times at which it water can be removed. | **Fencing** may be necessary to prevent trampling by wild boar.<br><br>In some circumstances carefully controlled traditional winter **burning** regime may be beneficial (eg France); however, too frequent use can lead to colonisation by fire-tolerant plant species. | (VV.AA, 2009)<br>(INPN, 2011)<br>(ICNB, 2006)<br>(Sarbu et al, 2004) |
| 6430 Hydrophilous tall herb fringe communities of plain and of the montane to alpine levels<br><br>**p/n** | Only secondary habitats where disturbance through floods and/or landslides or avalanches does not prevent succession. Historically unmanaged habitats eg cliff ledges are a refuge for grazing sensitive plants and should not be grazed.<br>Because of diversity of habitat types, management must be locally adapted.<br>**Intensity**: extensive, together with associated grassland habitats. | Because of diversity of habitat types, management must be locally adapted.<br>Occasional cutting to stop succession.<br>**Timing:** every two or three years. Control of invasive species may require more intervention. | Water quality and water/ groundwater/ snow/ ice dynamics are key influencing factor | Regular disturbance through natural events is characteristic of habitat, and will be affected by river regulation & embankment, avalanche barriers etc. | (INPN, 2011)<br>(VV.AA, 2009)<br>(ICNB, 2006)<br>(JNCC, 2007a)<br>(VV.AA, 2009) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| 6440<br>Alluvial meadows of river valleys of the Cnidion dubii<br><br>**f** | Control of access, duration and intensity are important.<br>**Intensity:** low, particularly in wet season; high stocking levels have major impact on above and below-ground biomass<br>**Seasonality:** no grazing in late wet or early dry season. Light grazing in wet season to avoid drowning grasses. After flooding, livestock off floodplains until they dry.<br>**Folding:** inappropriate. | **Frequency:**<br>**Type d)** depends on bi-annual mowing. In case of **other sub-types**, 1–2 times per year.<br>**Seasonality:** Early mowing could improve forage quality and integrate easily into farming systems. But later mowing necessary to avoid bird nesting season and plant seed-setting.<br>**Regime:** Leave stubble >8mm high.<br>**Treatment of cuttings:** remove fresh and dry biomass.<br>**Method:** light mowing equipment.<br>**Fertiliser:** Determine correct levels[96]. | **Type d)** depends on spring floods.<br>Species composition in **subtype a)** depends on duration/ timing of floods.<br>River regulation should be prevented.<br>Spring floods should only be allowed until end of April. Area should not be flooded for more than 10 days. | | (INPN, 2011)<br>(Šeffer et al, 2008)<br>(Valachovic et al, 2007)<br>(SOPSR, 2012) (BfN, 2011) |
| 6450<br>Northern boreal alluvial meadows<br><br>**f** | Not possible to give any general recommendations; decision to be made on a site-by-site basis. | If the habitat is locally dependent on traditional management, mowing is usually crucial. In Scandinavia large areas with 6450 are however kept open by natural disturbances, and not | Depends on site.<br>Restore natural spring flooding regime.<br>Damming where possible to keep site inundated in winter, | Destruction of **natural hydrological regime** may restrict restoration/management. If possible the water regime of regulated rivers should follow the natural fluctuations. | (Eriksson, 2008a) |

[96] Květ et al. (1996) found that fertiliser doses higher than 90 kg of nitrogen coupled with corresponding doses of phosphorus and potassium strongly reduced the number of species in the alluvial meadow community: the strongest reduction was recorded when using 400 kg of nitrogen per hectare. This led to a 40% loss in species diversity (Šeffer et al, 2008).

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | | dependent on recurring management.<br>**Method:** scything is preferable but labour intensive and expensive; supplement with machinery. Cut to 10–15 cm.<br>**Seasonality:** After end of breeding bird nesting season. In Northern Sweden, mowing not carried out before mid-July.<br>**Treatment of cuttings:** essential to remove.<br>**Scrub:** should be regularly removed. | at a suitable depth to prevent bottom-freezing. Meadow should dry for 2–3 weeks before mowing[97]. | | |
| 6510<br>Lowland hay meadows<br><br>**f** | Management should be adapted to local conditions, meadow vegetation subtype and historic management.<br>**Intensity:** low (sensitive to overgrazing by cattle).<br>**Regime:** after hay cutting. Grazing for a short period in spring may improve the germination rate for some spring-germinating plants by creating small patches with open soil. | **Seasonality:** no cut before mid-June to allow bird nesting and plant seed-setting.<br>**Timing**: Rotational or staggered management at the landscape scale allows animal species to find refuges from cutting on any one patch, and also allows species that benefit from earlier or later cuts to co-exist. A rotating 30% of the area | | **Intensification** reduces species richness but moderately intensive management of some meadow types is acceptable. | (VV.AA, 2009)<br>(Muller, 2002)<br>(ICNB, 2006)<br>(Cop et al, 2009)<br>(INPN, 2011)<br>(Zechmeister et al, 2003)<br>(Carlin et al, 2010)<br>(Crofts & Jefferson, 1999)<br>(Muller, 2002) (BfN, 2011; Cizek et al, 2012) |

[97] It is sometimes recommended to flood the site again after mowing, in late summer, to create good foraging conditions for ducks. However, stubble must not be drowned, reducing risk of die off.

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | **Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. **Supplementary feeding** of livestock will negatively affect conservation status. | should be left unmown. **Fertiliser:** normally no fertilization, especially not in areas that have not been fertilized previously. In northern Europe all fertilization is considered as negative for habitat quality. In eastern Europe some meadows have historically received small amounts of manure, but this should be carefully planned based on historical management and vegetation subtype. Other fertilisers and slurry must be avoided. **Other:** mowing should control Marsh horsetail (*Equisetum palustre*). | | | |
| 6520 Mountain hay meadows<br><br>**f** | **Stock type:** traditional livestock preferable. **Seasonality:** in spring and autumn; preferably sheep in spring and cattle in autumn. **Regime:** alternation of mowing and grazing possible. | **Frequency:** one cut per year, except for some mesophile subtypes which can be mown 2–3 times annually. Rotational or staggered management at the landscape scale allows animal species to find refuges from cutting on any one patch, and also allows species that benefit from earlier or later cuts to co-exist. A rotating | | Regulate and control **tourism** impacts eg through signposting, fencing and path management. Prevention and control of **invasive species** may be necessary. **Wild boar** populations may need to be controlled (eg Spain). | (INPN, 2011) (Muller, 2002) (Jefferson, 2005) (VV.AA, 2009) (Sarbu et al, 2004) (Cop et al, 2009) (Baur et al, 2006) (Crofts & Jefferson, 1999) (Dolek and Geyer, 1997) (Jefferson, 2005) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | | 30% of the area should be left unmown.<br>**Fertiliser:** normally no fertilization, especially not in areas that have not been fertilized previously. Some meadows can tolerate occasional low amounts of manure, but this should be carefully planned based on historical management and vegetation type. Other fertilisers and slurry must be avoided. | | | (Muller, 2002) (BfN, 2011) (Valachovic et al, 2007) |
| 6530 Fennoscandian wooded meadows<br><br>**f** | Differs according to traditional management.<br>**Regime:** can be used in combination with mowing, or in place of mowing. Normally after harvest.<br>**Other**: use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. **Supplementary feeding** of livestock will negatively affect conservation status. | Differs according to traditional management.<br>Late mowing once a year, normally not before end of June, though depending on the climate and tradition. Removal of fallen twigs and leaves in spring.<br>**Scrub:** removal of shrub overgrowth where necessary.<br>**Method:** often by hand.<br>**Fertiliser**: normally no fertilisation. | | **Pollarding/coppicing** trees according to traditional management (in Estonia, trees were shredded or coppiced; in Sweden they were generally pollarded). | **(Kukk and Kull, 1997)**<br>**(Losvik and Hjelle, 2010)**<br>**(EEA, 2009)**<br>**(Bergmeier et al, 2012; Daugavpils Universitate, 2011)**<br>**(Lotman, 2004)**<br>**(Vassilev et al, 2011)** |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| **RAISED BOGS AND MIRES AND FENS** | | | | | |
| 7210<br>Calcareous fens with *Cladium mariscus* and species of the Caricon davallianae<br><br>**p/n** | Primary habitat types do not require management and dependence on grazing varies from region to region.<br>**Intensity:** low, extensive (as alternative to mowing). Care needed to minimize unwanted effects of foraging and trampling, particularly on priority species.<br>**Stock type**: hardy equines eg Konik Polski horses or cattle eg Highland cattle. | Primary habitat types do not require management and dependence on mowing varies from region to region.<br>**Frequency:** one cut per year.<br>**Fertiliser:** none, or only very limited manure application (<30 kg N, <7 kg P and <50 kg K /ha /year). | | | (Muller, 2002) (VV.AA, 2009) (INPN, 2011) (National Parks and Wildlife Service, 2008) (Halada et al, 2011) (Muller, 2002) (Stammel et al, 2003) (BfN, 2011) |
| 7230<br>Alkaline fens<br><br>**p** | Mowing is generally preferable, but grazing may be suitable in sites with shallow peat or where traditional grazing has been carried out for 50 years or more such that the species composition is adapted to the trampling disturbance.<br>**Intensity:** should be carefully determined on site-by-site basis. In France, 0.2–0.8 livestock unit/ha recommended<br>**Stock type:** cattle preferable to sheep. Traditional, hardy breeds preferable.<br>**Regime:** rotational grazing | **Frequency:** mowing every second year or at 3-5 year intervals is sufficient for very wet calcareous fens and low-productivity alkaline fens dominated by mosses.<br>**Cuttings** should be removed or burned in portable incinerator.<br>**Equipment:** hand-mowing preferable, but only suitable on small scale. Use small light mowers or specially adapted tyres (low pressure twinned wheels).<br>**Fertiliser:** no fertiliser use within habitat and restricted use in adjacent land. | Restoration will involve minimising fluctuations in water column and boosting groundwater levels to soil surface level eg by blocking/ infilling of ditches. Ditching etc must also be controlled in surrounding landscape. Knowledge of hydrological conditions is necessary for effective preservation of the | **Buffer zones** and other measures in the surroundings of the fen are necessary to reduce pressures from atmospheric and aquatic eutrophication. | (INPN, 2011) (VV.AA, 2009) (Šefferová et al, 2008c) (Broads Authority, 2011) (Carlin et al, 2010) (Søgaard et al, 2007) (BfN, 2011) (Valachovic et al, 2007) |

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| | where possible.<br>**Other:** grazing not suitable on calcareous fens; mowing should be used. | **Scrub:** at some sites, cutting scrub by hand may be only option, but only economic over small areas. | structure and function of fens. | | |
| **ROCKY HABITATS** | | | | | |
| 8230<br>Siliceous rock with pioneer vegetation of the Sedo-Scleranthion or of the Sedo albi-Veronicion dillenii<br>**p/n** | Only secondary habitat type needs grazing (habitat may be the result of overgrazing of acidic grassland).<br>**Intensity**: very extensive<br>**Type**: sheep and/or goats, cattle, also wild grazers eg chamois or ibex<br>**Regime**: needs to be grazed together with the rest of the habitat mosaic of which it is part | | | | (VV.AA, 2009) (Sohlman, 2007) (Ministerio dell'Ambiente e della Tutela del Territorio e del Mare, 2008) (Valachovic et al, 2007) |
| 8240<br>Limestone pavement<br><br>**p** | Varies between different subtypes[98].<br>**Intensity:** low: less than 1 ewe/ha (or cattle equivalent; 5 ewes = 1 cow).<br>**Stock type:** cattle often preferable, at low grazing density. Traditional breeds beneficial. | **Scrub:** maintain/ reintroduce coppice and woodland management (thinning); control deer and fence coppice re-growth. | | Control **invasive species**. | (INPN, 2011) (Cumbria Biodiversity Partnership, 2006) (JNCC, 2007a) (National Parks and Wildlife Service, 2008) (Valachovic et al, 2007) |

[98] Open = restore by reducing stocking rate/ removing grazing animals. Wooded = maintain/ reintroduce coppice and woodland management (thinning); remove non-native species; control deer and fence coppice re-growth. Scrubby = remove non-native species where shade out other growth; consider coppice management.

| Habitat and agricultural dependence | Management recommendations | | | | References |
|---|---|---|---|---|---|
| | Grazing | Cutting or Mowing | Hydrological | Other | |
| **FORESTS** | | | | | |
| 9070 Fennoscandian wooded pastures<br><br>**f** | Grazing pressure must preserve a mosaic of habitats.<br>**Intensity:** low (<1.0 lu/ha); eg 0.2 cattle/ha.<br>**Stock type:** cattle, preferably older, hardier breeds.<br>**Regime:** year-round grazing closely reflects natural system; should be used where climate suited.<br>**Other:** use of animal medicines, particularly worm treatments, must be minimal to avoid affecting invertebrates. Supplementary feeding of livestock will negatively affect conservation status. | **Regime:** mowing can be an additional measure to combat unwanted vegetation, but otherwise mowing is not part of the management practices.<br>**Scrub:** some removal may be necessary to re-open site for grazing, but some scrub should be maintained; open glades should not be too wide.<br>**Treatment of cuttings:** Do not remove dead or decaying wood. Material from scrub and tree thinning can be used to increase dead wood habitat. | | Restoration may be necessary to re-open a site to grazing. Remove invasive tree species.<br>**Tree management**: Maintain clear space around old trees, pollard carefully. | (Eriksson, 2008b)<br>(Beaufoy et al, 2011)<br>(Bergmeier et al, 2012)<br>(Lotman, 2004) |