EU HABITAT ACTION PLAN

Action plan to maintain and restore to favourable conservation status the habitat type 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchid sites)

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Compilers: Concha Olmeda[1], Viera Šefferová[2], Evelyn Underwood[3], Lucía Millan[1], Teresa Gil[1], Sandra Naumann[4],

[1] The N2K Group / ATECMA

[2] The N2K Group / Daphne Institute of Applied Ecology

[3] Institute of European Environmental Policy (IEEP).

[4] Ecologic Institute EU

Contributors:

Alfonso San Miguel (Politécnica University of Madrid, Spain), Anamaria Roman (Institute of Biological Research Cluj, Romania), Andraž Čarni (Slovenian Academy of Sciences), Andy Bleasdale (National Parks and Wildlife Service, Ireland), Axel Ssymank (Federal Agency for Nature Conservation, BfN), Brendan Dunford (Burren Programme, Ireland), Cliona O'Brien (National Parks and Wildlife Service, Ireland), Daniela Gigante (University of Perugia, Italy), Douglas Evans (European Topic Centre for Biodiversity, European Environment Agency), Gergely Király University of West Hungary), Gwyn Jones (European Forum on Nature Conservation and Pastoralism), Helena Lager (Swedish Environmental Protection Agency), Hrvoje Kutnjak (University of Zagreb, Croatia), Ivana Jongepierová (Nature Conservation Agency, Czech Republic), Iveta Škodová (Slovak Academy of Sciences), James R. Martin (Botanical, Environmental & Conservation (BEC) Consultants Ltd, Ireland), Ján Šeffer (Daphne Institute of Applied Ecology), Jasenka Topić (University of Zagreb, Croatia), Joost Dewyspelaere (BirdLife International), Jørgen Lissner (Danish Environmental Protection Agency), Jürgen Dengler (Eurasian Dry Grassland Group, University of Bayreuth), Louis-Marie Delescaille (Nature and Forest Department, Belgium), Maria Long (National Parks and Wildlife Service, Ireland), Meeli Mesipuu (Estonian Seminatural Communities Conservation Association), Mihail Mihailov (Ministry of Environment, Bulgaria), Mike Edwards (BWARS, UK), Pawel Pawlaczyk (Naturalists Club, Poland), Richard Jefferson (Natural England, UK), Robert Paxton (Martin Luther University Halle-Wittenberg, Germany), Sam Ellis (Butterfly Conservation Europe), Solvita Rūsiņa (University of Latvia), Sue Collins (Butterfly Conservation Europe), Tamara Kirin (Croatian Agency for Environment and Nature), Thorsten Englisch (University of Vienna), Urs Jäger (State Office for Environmental Protection - Saxony-Anhalt, Germany), Valerijus Rasomavicius (Institute of Botany, Nature Research Centre, Lithuania).

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Picture on the front cover: Alfonso San Miguel.

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SUMMARY

The habitat type 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*important orchid sites) is protected under the Habitats Directive (92/43/EEC) and includes a wide range of grassland communities which are generally assigned to the phytosociological class *Festuco-Brometea*. It is considered a priority habitat if it is an important orchid site.

This action plan aims to guide the actions required to maintain and restore the habitat at a favourable conservation status across its range in the EU. It is addressed to all those interested and involved in the conservation and management of this habitat type, including governmental and non-governmental organisations, local communities and stakeholders, habitats specialists, etc.

Semi-natural dry grasslands and scrubland facies on calcareous substrates are present in almost the entire European continent, from lowland to mountain level. They are among the most species-rich plant communities in Europe and are key habitats for many protected species (plants, birds, insects and other invertebrates, reptiles and mammals). These grasslands are considered a high priority for conservation of wild pollinator species, such as butterflies, wild bees or hoverflies, as well as for other rare or protected species. They provide multiple benefits and ecosystem services, including carbon storage and prevention of soil erosion.

Most stands are of secondary origin, replacing former thermophilous forests, and are products of former extensive grazing and/or mowing regimes. Small-scale natural stands of these grasslands, which seem to be permanent also without grazing, occur where forest cannot grow due to edaphic factors, e.g. on very shallow soils surrounding rocky outcrops, or on instable soils on steep slopes often in combination with dry microclimatic situations. In Central Europe some of these grasslands are remnants of early Holocene steppes.

This class of dry grasslands is usually found on dry, well-drained and nutrient poor soils, from neutral to alkaline.

According to the reports provided by the Member States in 2013 under Article 17 of the Habitats Directive, the total area reported for this habitat type in the EU in 2013[1] was around 17,000 km^2, the conservation status is unfavourable in all the biogeographical regions and the trend in surface area is decreasing in most of its range. This habitat is degraded overall and is expected to continue deteriorating according to the assessments of future prospects.

Over half (57%) of the habitat surface is included in the Natura 2000 network, in 4,437 sites that cover a total area of around 9,700 km^2. The conservation status inside the network seems to be better than outside the Natura 2000 sites.

The main threats and pressures that lead to the regression and deterioration of these grasslands are:

- Cessation of grassland management. An accelerating process of area loss is ongoing in large parts of the habitat range due to the disappearance of grazing activity, which is often economically unsustainable and therefore abandoned and left to succession.

[1] According to the reports provided by the Member States in 2013 under Article 17 of the Habitats Directive

- Overgrazing can also be occurring in some areas with a negative effect on this habitat type that is adapted to low nutrient levels.
- Atmospheric nitrogen deposition is threatening the habitat in some parts of its range.
- The introduction and spread of invasive plant species can also be a threat and is often a result of other factors, such as abandonment or eutrophication.
- Land use changes, such as conversion into arable land or development of infrastructure and quarries, may cause habitat loss and fragmentation. Urbanization in areas close to agglomerations, e.g. in the surroundings of villages and cities, is also reported as a cause of habitat loss for this habitat type.
- Habitat fragmentation and a reduction in habitat connectivity is considered a threat to this habitat type in some countries, sometimes with severe losses of typical insect species such as dry grassland butterflies.

In general, these grasslands need to be maintained by regular management through extensive grazing or mowing.

The necessary conservation measures include maintenance, restoration and re-creation, depending on the condition of the grassland in a particular area.

Restoration measures are necessary in parts of their range to recover favourable area, structure and functions where the grasslands are degraded or suffered a regression.

Since regular mowing or grazing is required to ensure the conservation of semi-natural grasslands, the conservation and management of these habitats can mainly be funded through the EU's Common Agricultural Policy. Both Pillar I (direct payments to maintain farming activity, ecoschemes and associated rules to ensure permanent grassland conservation) and Pillar II (rural development measures) are useful to support grasslands management.

In particular, the European Agricultural Fund for Rural Development is the most important source of funding for grassland management for biodiversity in most EU countries, including through agri-environment measures, training for farmers on implementation of measures and investments in restoration. Structural funds, mainly ERDF, have been used for grasslands restoration and management in several EU countries.

It must be acknowledged, however, that the LIFE programme has been a main source of funding for restoration of this habitat type until now.

The overall goal of this action plan is to ensure its maintenance and restoration at favourable conservation status in the medium to long term.

The framework for action included on the next pages presents the specific objectives and key actions to achieve this overall goal.

The following sections of this document provide more detailed information about the status of this habitat type and its conservation management, including the key recommendations that underpin the framework for action.

FRAMEWORK FOR ACTION

This Framework for Action describes the objectives and key actions of this EU action plan. It is based on the diagnosis and ecological requirements and characterisation of this habitat type, its conservation status as reported by Member States, threats and pressures, conservation management experience and other relevant information that is presented in more detail in the corresponding sections of this document.

Overall goal of the action plan

To ensure maintenance and restoration at favourable conservation status of this habitat in the medium and long term (up to 2030 and 2050, respectively), along with ensuring favourable future prospects in the face of pressures and threats.

Specific objectives to ensure habitat conservation in the medium-long term

1. Stop further decline of 6210 habitat area and prevent its deterioration by ensuring appropriate management of the remaining habitat areas.
2. Establish conservation objectives objectives for 6210 at biogeographical and national level to reach favourable conservation status in the long term, and ensure that the site-level conservation objectives for Special Areas of Conservation are in line with these objectives set at higher levels.
3. Establish and implement conservation measures for 6210, including habitat restoration, with a view to achieving the defined conservation objectives at biogeographical, national and site-level.
4. Ensure ecological connectivity for 6210 across the habitat range, including by restoring areas outside the Natura 2000 network, in line with the defined conservation objectives at biogeographical and national level.
5. Improve knowledge, conservation status assessment and monitoring schemes for 6210 habitat.
6. Promote the implementation of the habitat action plan, disseminate and share knowledge and experience in protecting and managing 6210 habitat.

The table below presents key actions to achieve these objectives, together with the means and input required, geographical scope, responsibilities and suggested timescale for implementation.

Further guidance and details for the implementation of the actions are provided in different sections of this action plan, as indicated in the Framework for Action.

FRAMEWORK FOR ACTION – EU HABITAT ACTION PLAN - 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*important orchid sites) to favourable conservation status

FCS = favourable conservation status CAP = Common Agricultural Policy MS = Member State N = nitrogen

Objective 1: Stop further decline of 6210 habitat area and prevent its deterioration by ensuring appropriate management of the remaining habitat areas				
Key actions	**Activities, means and input required**	**Geographical scope**	**Responsibilities**	**Timescale**
1.1 Support **extensive farming systems and practices** that ensure appropriate management and maintenance of the habitat (appropriate grazing or mowing regimes) with adequate funding (see sections 5.1, 5.2 and 7.2 of this document):	- **Assess risks of habitat loss** and report on the scale of potential loss expected and how to address this. Identify habitat areas threatened with abandonment, intensification or unsuitable management for this habitat type. - **Identify and designate priority intervention areas** to preserve this habitat, both inside and outside Natura 2000 sites - **identify potential restoration areas** to compensate the loss of area since the Habitats Directive came into force. - Ensure that the **CAP strategic plan funds relevant measures** identified in the Habitat Action Plan, especially in the identified priority intervention areas. - **develop national** and regional **agri-environment** schemes to maintain the habitat in good condition and incentivise participation; - **support measures to increase income** from farming practices; - support sheep grazers and shepherds to **prevent attacks by large carnivores and compensate damages**; - Provide **advisory services** that promote suitable measures. - Facilitate better **connections between livestock owners and sites that need grazing** by setting up local	All areas where the habitat is currently present or can be restored to reach FCS, particularly in regions/areas where the habitat is threatened by abandonment or changes in farming practice and land use. Specifically applicable to areas where the main threats are related to under-grazing and abandonment (e.g. in ES, IT, FR, DE)	MS nature and agriculture authorities. Managing authorities for the CAP strategic plans, rural development agencies. Farmers' associations, local action groups.	Short to medium term action (within the next 2-5 years), with additional long term actions for restoration (may include local reintroduction of extinct species).

	networks or other communication channels, and if necessary providing support for livestock acquisition.			
1.2 Develop mechanisms/tools t**o prevent changes in land use that would affect the habitat** inside and outside Natura 2000 sites (see 3.4.1*).*	- Establish **appropriate rules at national or regional level under the CAP** (conditionality, permanent grasslands, eco-schemes, etc.) to make sure that no habitat is lost from areas where it is present. - Encourage Member States to **expand the areas of grassland designated as Environmentally Sensitive Permanent Grassland** under the CAP to cover 100% of the area covered by this habitat type in order to protect from ploughing and conversion to arable. - **Disseminate information about the importance of the habitat, its distribution and critical areas** for its conservation and connectivity and ensure that any possible effects of land uses changes on the habitat are properly assessed. - Include precautionary rules in the CAP Strategic Plan (see 7.2.1) to e**nsure that no measures that are detrimental to the habitat**, such as conversion of extensive grassland or promotion of intensive land-use practices, **are financed with CAP funds in habitat areas**. - Ensure that **reforestation is not implemented** in areas that are important for the conservation of this habitat. - Ensure that **no practical or legal obstacles for restoration exist**, such as preservation or compensation rules for forests after succession due to abandonment of management of dry grasslands.		MS nature authorities. Managing authorities for the CAP Strategic Plans.	Immediate action (within the next year)
1.3 Develop tools to ensure that **negative effects on this habitat are properly assessed**, including cumulative impacts of multiple activities and ongoing activities such as tourism and recreation.	- **Disseminate and make information accesible** about the importance of this habitat, its status and critical areas, and ensure that **impact assessment and appropriate assessment** of plans and projects properly take into account the conservation objectives set for this		MS competent authorities for impact assessment (SEA and EIA) and appropriate assessment	Immediate action (within the next year)

	habitat in Natura 2000 sites and its **important areas** outside Natura 2000 (see action 2.2). - Promote new (or adapt existing) **biodiversity mitigation and compensation mechanisms** that prevent or mitigate the loss of 6210 habitat due to developments (both infrastructure in rural areas and urban sprawl) and ensure net gain of the habitat.		(Art.6.3 of Habitats Directive).	
1.4. Implement measures to ensure a significant **reduction of nitrogen deposition** in the areas of habitat occurrence (see 3.4.1).	- Identify **critical areas for the habitat** in relation to N deposition and eutrophication. - Implement **measures to reduce NH_3 and NO_x emissions** from agriculture and other sources. - Implement the **limits of the Directive on the reduction of national emissions** (EU 2016/2284) for NOx and NH3. - Review regional and national air quality regulations. - Reduce and regulate air pollution with the long-term objective of **no exceedance of the critical loads / levels** that mark the limits of ecosystem tolerance.	All areas where the habitat is present and potentially affected by nitrogen deposition and eutrophication, especially in some countries like BE, CZ, LU, NL, UK, and DE.	MS Competent authorities for nature, agriculture and pollution control.	Medium term actions (within the next 5 years)
1.5. Protect habitat areas against **impacts produced from bordering areas** subject to intensive use.	- Create **buffer-zones** between the habitat and more intensively used grassland or arable land, to prevent/ lessen drift from pesticides and herbicides, lessen spread of weeds/invasive species, etc.	Habitat areas likely to be affected by chemical and fertilizers input from surrounding land.	MS Competent authorities for nature and agriculture.	Medium term actions (within the next 5 years)

Objective 2: Establish conservation objectives for 6210 at biogeographical and national level to reach favourable conservation status in the long term and ensure that site-level conservation objectives for Special Areas of Conservation are in line with those higher level objectives				
Key actions (see chapter 4.3)	**Activities, means, input & resources required**	**Geographical scope**	**Responsibilities**	**Timing**
2.1. Define **conservation objectives and strategic approaches to improve the conservation status** of the habitat at **biogeographical and national level** (see 4.3).	- Consider the **Favourable Reference Values** (result from action 5.1). **-** Analyse the **ecological diversity of the habitat**, identify **typical communities and important areas** for preservation of the habitat diversity across the EU.	All EU biogeographical regions. All EU MS where the habitat is present.	MS nature conservation and agriculture authorities.	Short term action (within next two years).

	- Analyse and review **conservation status assessments** (all parameters) at biogeographical and national level. - Discuss methodologies, approaches and strategies for grassland conservation in the **Biogeographical Seminars**, by setting up working groups with participation of experts and managers of all countries concerned.	All Natura 2000 sites designated for this habitat type.	Working groups at biogeographical level. National experts.	
2.2. Develop **national conservation strategies or plans for conservation and restoration** of this habitat type, (e.g. in the framework of grasslands conservation strategies).	- **Identify restoration needs** to improve the area, structure and function, where needed, and ways to address the main threats and pressures. - **Identify priority areas for action** at regional/ national level, including priority sites and areas for restoration, where the habitat area has been lost/reduced or is subject to deterioration, in order to contribute to achieving favourable conservation status in the biogeographical region, both inside and outside the Natura 2000 network (see 4.4 and 5.5). - Develop **technical specifications for agri-environment packages and other schemes** that will support 6210 habitat conservation.	All EU biogeographical regions. All EU Member States where the habitat is present. All Natura 2000 sites designated for this habitat type.	MS nature conservation and agriculture authorities. National experts.	Short term action (within next two years).
2.3. Review/establish **site-level conservation objectives** in Natura 2000 sites in order to maximise their contribution to achieving favourable conservation status of this habitat at the national, biogeographical and EU level (see 4.4)	- **Analyse the role of the Natura 2000 n**etwork for achieving conservation objectives set fo this habitat at biogeographical and national level. - Analyse the **relative importance of each Natura 2000 site** for the conservation of the habitat. - Where necessary or appropriate, **revise or update conservation objectives** for this habitat type in Naura 2000 sites.	All EU biogeographical regions. All EU Member States where the habitat is present. All Natura 2000 designated for this habitat type.	MS nature and agriculture authorities. Natura 2000 site managers. Managing authorities for CAP strategic plans, rural development agencies. Farmers' associations, local action groups. National experts.	Short to medium term action (within next 2-5 years).
2.4. Identify **strategic action outside the Natura 2000** network taking into account the habitat coverage in the network and **connectivity** issues (see 3.4.4, 4.3, 5.4, 5.9 and 6.3).	- **Analyse fragmentation and connectivity issues** for this habitat type across its range (at biogeographical and national level). - **Identify and inventory important areas** for this habitat outside Natura 2000 sites that contribute to the coherence of the network.			

Objective 3: Establish and implement conservation measures for 6210, including habitat restoration, with a view to achieving defined conservation objectives at biogeographical, national and site-level				
Key actions	**Activities, means, input & resources required**	**Geographical scope**	**Responsibilities**	**Timing**
3.1 In light of the conservation objectives set at biogeographical, national and site-level, **establish and implement specific conservation measures, including habitat restoration** in areas where 6210 is degraded and where it has disappeared (see chapter 5.2).	- **Identify key actions** in Natura 2000 sites and outside Natura 2000. - Develop, test and implement **guidelines on managing the habitat** with regional variation as required. - Promote at the national or biogeographical level (of Member States) the establishment of appropriate habitat **conservation measures in Natura 2000 management plans** or other management instruments and create mechanisms for their implementation. - Identify **key areas** for habitat conservation and implement tailored management measures in the areas. - Identify **priority areas for habitat restoration** and assess restoration feasibility. - Compile and implement **grassland restoration plans**. - Support restoration and conservation measures: **agri-environmental and other support schemes** including investment payments and support for collective action measures **to increase income from farming** (Pillar I and Pillar II of the CAP and other funds). - Promote **locally supported small-scale projects** aimed at restoring or conserving the habitat across its range. - Implement **monitoring and assessment** of results.	Conservation measures: all areas where the habitat is present. Habitat restoration: identified priority areas for action at regional/ national level (historical range). Areas where the habitat has been recently lost or degraded. Especially in countries and regions where a significant proportion of the historical area has been lost.	MS nature and agriculture authorities. Managing authorities for the CAP strategic plans, rural development agencies. Farmers, local action groups	Short to medium term action (within the next 2-5 years)
3.2 **Recreate the habitat in suitable areas** (see 5.3).	- **Assess feasibility** of habitat recreation. - Compile and implement a **grassland recreation plan** as required. Carry out selective introduction of grassland species via turf inoculants, seeding, re-planting or green-hay strewing. Ensure provision of regional seeds and vegetative material for grassland recreation. - Provide **technical assistance** (soil and vegetation experts, ecologists, etc.) for habitat recreation. -Provide **funding for recreation**: national and EU funds.	Countries and regions where a significant proportion of the historical area has been lost and/or fragmentation needs to be counteracted to reach FCS.	MS nature and agriculture authorities. Farmers, local action groups.	Short to medium term action (within the next 2-5 years)

Objective 4: Ensure ecological connectivity across the 6210 habitat range, including by restoring areas outside of the Natura 2000 network, in line with the defined conservation objectives at biogeographical and national level				
Key actions	**Activities, means, input & resources required**	**Geographical scope**	**Responsibilities**	**Timing**
4.1. In light of the conservation objectives set at biogeographical, national and site-level, **establish a green infrastructure conservation programme outside Natura 2000 sites**, including habitat restoration in degraded and lost areas that are important to provide ecological connectivity for the habitat and associated species (see 5.4).	- **Analyse habitat fragmentation** and identify **critical areas for connectivity.** - Results from action 2.4. Analyse the **role of the area outside the Natura 2000 network** to reduce fragmentation and improve connectivity for this habitat type. - Develop and implement a **strategy, plan or programme** to improve ecological connectivity among habitat areas and relevant associated species populations.	Identified important areas for connectivity across all the habitat range and distribution area in all the biogeographical regions.	MS nature authorities, managing authorities for EAFRD & ERDF. Farmers, local action groups, relevant Stakeholders. National experts.	Short to medium term action (within the next 2-5 years)
4.2. Implement measures to **prevent further fragmentation** through maintenance or restoration of suitable areas.	- Implemente **relevant maintenance and restoration measures** under actions 1.1, 1.2, 1.3, 3.1 and 3.2. - Provide funding and **support to the meaures required to prevent fragamentation and improve connectivity** under national and EU funds.			

Objective 5: Improve knowledge, conservation status assessment and monitoring schemes for 6210 habitat				
Key actions	**Activities, means, input & resources required**	**Geographical scope**	**Responsibilities**	**Timing**
5.1. Design and implement **harmonised methods to assess** range, area, structure and functions, trends and future prospects, which enable the comparison of conservation status between countries, considering the variability of the habitat across its natural range. (see 6.1, 6.2, 6.3)	- Share, **discuss and review the habitat type interpretation** among the Member States, e.g. in biogeographical seminars and events at EU level. - **Compare and share methods** used in the Member States and develop a set of **agreed standards and methods** for conservation status assessment and monitoring across all range States. - Define **Favourable Reference Values** (FRV).	All the habitat range and distribution area. Biogeographical regions and countries with habitat occurrence.	MS nature authorities. National experts.	Short – medium term action (within the next 2-5 years).

5.2. Develop **standard methods** to identify and quantify **threats and pressures** on this habitat type (see 6.1, 6.2, 6.3)	-Define **methodologies for assessment of threats and pressures** on the habitat. Analyse available methods. - Agree on **common standards** to assess threats and pressures on this habitat type.			

Objective 6: Promote the implementation of the action plan, disseminate and share knowledge and experience in protecting and managing 6210 habitat				
Key actions	**Activities, means, input & resources required**	**Geographical scope**	**Responsibilities**	**Timing**
6.1. Develop a **Communication Strategy** and **promote the implementation and coordination** of the Action Plan.	- **Disseminate and discuss the action plan** in regional and national events (e.g. Natura 2000 Biogeographical seminars and events, agriculture workshops, etc.). - Include all relevant conservation measures for this habitat type in the **Prioritised Action Framework** for Natura 2000 (2021-2027). - **Promote common goals and coordinated actions** in accordance with this EU Habitat Action Plan for (6210). - Support and **communicate at EU level the positive role of extensive livestock farming** for biodiversity conservation. - Develop **participatory mechanisms** to promote farmers community involvement, awareness raising and motivation of stakeholder to promote appropriate management ogf this habitat. - Promote **education /awareness-raising of local authorities, civil society organisations, policy-makers** and other relevant government departments and agencies, about the importance of semi-natural grasslands for biodioversity and the values and services they provide to society.	All countries and regions with habitat occurrence	MS nature authorities. National experts.	Short–term action (within the next 2 years).

6.2. **Exchange of information** among Member States and regions on national/regional action plans, management, conservation and restoration experiences.	- Set up **expert groups to exchange experience**. - Organise and participate in relevant **workshops, biogeographical seminars** and related events. - Promote and **disseminate best practice** and initiatives that benefit the habitat across its range.		MS nature and agriculture authorities. Rural development agencies. National experts. Farmers, local action groups. Relevant stakeholders.	Short–term action (within the next 2 years).
6.3. Develop and promote **management guidelines and good practice** for the habitat management and conservation.	- Promote expert groups, workshops, biogeographical events to **develop guidelines** and promote best practice. - Develop and distribute guidelines for farmers and relevant stakeholders, promote and support their implementation.			Short-term action (within the next 2 years)
6.4. Develop **similar approaches in support schemes** (e.g. concerning goals and types of subsidies, incentives, etc.).	- **Analyse financial needs, support schemes and incentives** with expert groups on financing in the EU funding programming processes. - Compile **regional plans**. - Develop **cooperation projects**.			Short-term action (within the next 2 years)

1. INTRODUCTION AND BACKGROUND

Under the EU Action Plan for nature, people and the economy (COM(2017) 198 final), the European Commission, in cooperation with Member States and stakeholders, committed to developing and promoting the implementation of EU Action Plans for two of the most threatened EU habitat types.

This action plan is aimed at providing guidance to maintain and restore at a favourable conservation status the habitat type 6210 - Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*important orchid sites), which is protected under the Habitats Directive[2].

These grasslands are present in almost the entire European continent, from lowland to mountain level, are among the most species-rich plant communities in Europe, and contain a large number of rare and endangered species.

This action plan is addressed to all those interested and involved in the conservation and management of this habitat type and in the implementation of conservation measures for it, including governmental and non-governmental organisations, local communities and stakeholders, habitats specialists, etc.

It is expected that the action plan will be used:

- for developing the necessary instruments on EU and national level and to establish, promote and implement actions in the context of the agricultural policy (e.g. agri-environmental schemes), projects financed by the LIFE programme, and in the context of other environmental policies and actions (e.g. to combat eutrophication, nitrogen deposition, etc.).
- for site managers, as a reference for design and implementation of conservation measures and as a knowledge base for better understanding management of grassland.

Moreover, as dry grasslands in general share similar problems and conservation management needs, this action plan can be used also to manage other grassland communities that are not exactly covered by this habitat type definition.

Management guidelines for this habitat type have been previously published by the European Commission[3]. This action plan complements and updates some of the information included in those management guidelines and tries to address all relevant aspects taking into account the different situations existing across the geographical distribution of this habitat.

This action plan includes a description of the habitat type, its distribution and conservation status, and its relations with other habitat types and species protected under the EU nature

[2] Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora - OJ L 206 of 22.7.1992, p. 7.

[3] See Management of Natura 2000 habitats: http://ec.europa.eu/environment/nature/natura2000/management/habitats/models_en.htm, and in particular * Semi-natural dry grasslands (FestucoBrometalia) 6210: http://ec.europa.eu/environment/nature/natura2000/management/habitats/pdf/6210_Seminatural_dry_grasslands.pdf

directives[4]. It examines the main threats and pressures and presents the main actions needed to address them. The measures proposed in this action plan are aimed the conservation and restoration of this habitat type wherever necessary but also address the need to improve knowledge and monitoring.

1.1 Action plan geographical scope

This action plan covers all the biogeographical regions and Member States of the European Union where the habitat type is present. According to the Reference Lists for the biogeographical regions (updated April 2018[5]), the 6210 habitat type is present in 25 Member States and 7 biogeographical regions. Some countries have this habitat type in more than one biogeographical region, as shown in the table below.

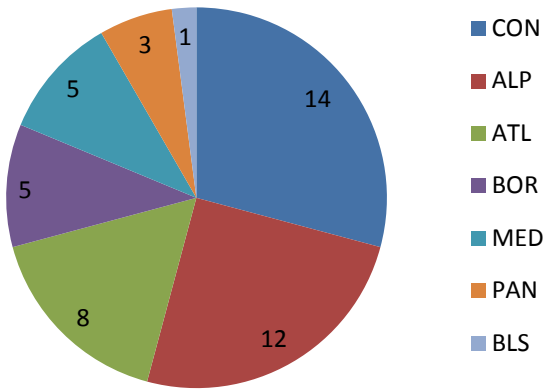
Table 1: Member States in which the habitat type (6210) is present according to Reference Lists

Region MS	AT	BE	BG	CZ	DE	DK	EE	ES	FI	FR	HU	HR	IE	IT	LT	LU	LV	NL	PL	PT	RO	SE	SI	SK	UK
ALP	X		X		X					X		X		X					X		X	X	X	X	
ATL		X			X	X		X		X			X					X							X
BLS			X																						
BOR							X		X						X		X					X			
CON	X	X	X	X	X	X				X		X		X		X			X		X	X	X		
MED								X		X		X		X						X					
PAN				X							X													X	

Member States acronyms. AT: Austria; BE: Belgium; BG: Bulgaria; CZ: Czech Republic; DE: Germany; DK: Denmark; EE: Estonia; ES: Spain; FI: Finland; FR: France; HR: Croatia; HU: Hungary; IE: Ireland; IT: Italy; LT: Lithuania; LV: Latvia; LU: Luxembourg; NL: Netherlands; PL: Poland; PT: Portugal; RO: Romania; SE: Sweden; SI: Slovenia; SK: Slovakia; UK: United Kingdom.

Biogeographical region acronyms. ALP: Alpine; ATL: Atlantic; BLS: Black Sea; BOR: Boreal; CON: Continental; MED: Mediterranean; PAN: Pannonian

Figure 1: Number of Member States in which the habitat type is present in each Biogeographical region



[4] Habitas Directive (92/43/EEC) and Birds Directive (Directive 2009/147/EC on the conservation of wild birds OJ L 20 of 26.01.2010. p. 7.

[5] Reference Lists - available at: https://www.eionet.europa.eu/etcs/etc-bd/activities/building-the-natura-2000-network

2. DEFINITION, DESCRIPTION AND ECOLOGICAL CHARACTERIZATION

2.1. Habitat definition and description

According to the Interpretation Manual of European Union Habitats (EC 2013), the habitat 6210 consists of plant communities belonging to two orders within the *Festuco-Brometea* phytosociological class: the steppic or subcontinental grasslands (*Festucetalia valesiacae* order) and the grasslands of more oceanic and sub-Mediterranean regions (*Brometalia erecti* or *Festuco-Brometalia* order). In the latter, a distinction is made between primary dry grasslands of the *Xerobromion* alliance and secondary (semi-natural) semi-dry grasslands of the *Mesobromion* (or *Bromion*) alliance with *Bromus erectus*[6].

The vegetation type is considered a priority type if it is an important orchid site, which hosts: a rich suite of orchid species, an important population of at least one orchid species considered rare or (highly) endangered on the national territory, or one or several orchid species considered to be rare or exceptional on the national territory.

Further information about the habitat definition according to the Interpretation Manual of European Union Habitats and other classification systems (EUNIS and European checklist of vegetation) is included in Annex 1.

The grasslands of the 6210 habitat are among the most species-rich plant communities in Europe in terms of the number of plant species they support per unit area, with more than 80 plant species/m^2 in many regions (WallisDeVries et al. 2002, Chytrý et al. 2015). The world records for plant species richness in areas below 100 m^2 occur in nutrient-poor grasslands, in particular in mown stands of semi-dry basiphilous grasslands (order *Brachypodietalia pinnati* within the *Festuco-Brometea*) (Janišová et al. 2011, Wilson et al., 2012, Dengler et al. 2012, Chytrý et al. 2015).

Plant communities of Bromion erecti, which are maintained by mowing in the White Carpathians (Iveta Škodová).

[6] It must be noted however that in the version EUR25 of the EU Interpretation Manual (2003), the habitat type 6240* was added and it explicitly covers the subpannonic steppic grasslands of the *Festucion vallesiacae* alliance, formerly completely included in habitat 6210.

The community type is characterised by a wide variety of grasses and herbs, in which there is at least a moderate representation of calcicolous species (that prefer calcium rich soil). Some species are associated with tall-growing vegetation, others with woodland fringes and gaps; other species are more typical of open grassland with both tall and short vegetation. The drier and more extreme subtypes include a mosaic of very species rich cryptogram communities (moss and lichen), between the higher plants or in small patches of almost bare soil.

Most stands are of secondary origin, replacing former thermophilous forests, and are products of former extensive grazing. In Central Europe some grassland sites are remnants of early Holocene steppes (Chytrý et al. 2007). Small-scale natural stands of these grasslands occur where forest cannot grow due to edaphic factors, e.g. on very shallow soils surrounding rocky outcrops, or on instable soils on steep slopes (Ellenberg & Leuschner 2010), which seems to be permanent also without grazing (e.g. in Poland).

These grasslands contain a large number of rare and endangered species, including some plant species listed in Annex II of the Habitats Directive (e.g. *Pulsatilla slavica*, *Gentianella anglica)*. The invertebrate fauna associated with this habitat, particularly butterflies and other invertebrates, is also noteworthy. It includes a number of butterfly species listed in the Habitats Directive, such as *Colias myrmidone* (Annex II) and *Maculinea arion* (Large Blue, Annex IV). The habitat is a high priority for conservation of wild pollinator species, including wild bees and other Hymenoptera, flies (for example hoverflies, robber flies, bombyliids), as well as butterflies and moths (see section 2.4 on related species and section 2.2 on benefits and ecosystems services).

2.1.1 Priority habitat identification

The priority habitat 6210 “Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) important orchid sites*” in the Mediterranean area is extraordinarily rich in orchids of the genera *Ophrys, Orchis, Neotinea* and *Serapias*.

Some grasslands communities in the Carpathians are also famous for their richness in orchids, with about 20 species of orchid occurring in this habitat (Jongepierová 1995).

In Latvia, these grasslands are considered a priority habitat whne they host some of the following orchid species: *Orchis militaris, O.ustulata, O.morio, O.mascula,* (Auniņš 2013).

The difficulty of identifying 6210* priority habitat can be related to the ephemeral nature of orchid populations in some areas. In Ireland, for instance, an impressive display of *Ophrys apifera* and *Ophrys insectifera* was recorded one year in a site during a semi-natural grassland survey while in subsequent years few or no orchids were found (O’Neill et al 2013).

Ophrys apifera (Ján Šeffer)

The danger of identifying some sites as the orchid-rich priority habitat *6210 and others as the non-priority 6210 is that the latter may actually be orchid-rich sites that were going through a 'rest period' in orchid flowering.

The approach for the monitoring and management of the two variants of this habitat could be precautionary and all-inclusive, with all sites treated as potential orchid-rich 6210* sites and managed accordingly; or a 'wait-and-see' approach could be adopted, with 6210* sites only being identified after successive years of monitoring. The danger of the latter approach is that important orchid sites are more vulnerable to deterioration because of the negative effects of scrub encroachment and abandonment on orchid seed germination, and such sites could be lost because of inappropriate management or the lack of management before their true importance was realised.

2.1.2 Dynamic stages of succession

Scrub and woody vegetation, which develops with the relaxation of management, are also considered part of the 6210 Habitat.

The interpretation and mapping of the habitat in the mosaic with thermophilous fringe communities and thermophilous shrubs is generally problematic. Such mosaics are very common, sometimes as a result of succession. The EU Habitat Interpretation Manual recommends a rather wide interpretation of 6210 habitat, including also some forms of herbaceous fringe communities (for example *Geranion sanguinei*), as key refuges for thermophilous plant species, and facies of encroachment associated with these grasslands.

2.1.3 Differences across countries and regions. Interpretation problems

The 6210 habitat type includes a wide range of grasslands communities that are generally assigned to the phytosociological class Festuco-Brometea. For instance, in France 39 sub-types are recognised (Besettitti et al. 2005).

Due to the absence of internationally standardized knowledge of this type of vegetation, the Interpretation Manual of EU habitats (EC, 2013) has considered the following habitat types:

- 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates and 6210* important orchid sites,
- 6240* Sub-pannonic steppic grasslands, and
- 6250* Pannonic loess steppic grasslands.

These habitats were defined by the combination of two criteria, (i) the presence of phytogeographically important (sub)-continental and pannonian species and (ii) the type of geological substrate. However, the contents of these three units are largely overlapping, which makes them difficult to use in nature protection and scientific practice. Based on the floristic composition it is sometimes difficult to distinguish to which habitat type the grasslands of the *Festucion valesiacae* alliance belong. This has led to different interpretations of the same habitat type in different EU Member States (Mucina et al. 2016).

The classification of particular grassland to 6210 or 6240* habitat is not always unequivocal[7]. This problem occurs for instance in the Polish-German border (lower Odra valley). In Poland it was decided not to include 6240* on the national reference list at all, thus all termophilous grasslands are classified as 6210. On the German side of the same valley, very similar grasslands are classified as 6240*. This results in the German grasslands having high habitat priority whilst the Polish grasslands do not. The coherence of the Polish approach with neighbouring countries is questioned by experts (Jermaczek 2008, Jermaczek-Sitak 2012, Barańska et al. 2014b).

France and Italy have a different interpretation of the subcontinental steppic grasslands of *Stipo capillatae-Poion carniolicae*, which are considered as part of the 6210 habitat type in France whilst in Italy they are included in the 6240* habitat.

The classification of Central European xerothermic steppe grassland communities at the level of habitats is not uniform and clear in Slovakia, Romania and in surrounding countries.

In north-eastern Europe, this habitat type is at the northern margin of its range, and the majority of the typical species, according to which habitat 6210 is described in the Interpretation Manual of the European Union Habitats, are not present. This can also create interpretation problems.

Moreover, floristic differences between the Mediterranean and temperate stands of some dry grassland habitat types have often resulted in misinterpretation and difficulties in assigning certain stands to a proper category (Apostolova et al. 2014).

More detailed information about the interpretation and definition of this habitat type according to different classification systems is provided in Annex 1.

2.1.4 Conclusions and recommendations

- It would be important to share and review the habitat type interpretation among the countries in biogeographical seminars and relevant events at EU level. Unification of interpretation across Member States is unlikely; nevertheless, Member States and national experts should be aware of interpretations in other countries. Exchange of basic data illustrating habitat identification, such as phytosociological data, site descriptions and photographs, should be promoted. Standards for such data exchange could be established at the EU level. This issue would benefit from discussions also in joint seminars among biogeographical regions (not only one by one).
- A revision of the definition given for 6210 and 6240 in the Interpretation Manual of EU habitats seems also advisable.
- Because the habitat is often an element of dynamic vegetation mosaics, the wider spatial context (i.e. the whole mosaic) should be taken into consideration in management planning. Habitat conservation planning usually should not be limited to the remaining patches of habitat 6210.

[7] In the EU Interpretation Manual, the definition of this habitat type (6210) partially overlaps with the definition of Sub-Pannonic steppic grasslands (6240*) habitat or at least the distinction between these two types is not clear enough. The habitat 6240* was subsequently added during EU-enlargement process, without correcting the overlap with the unchanged definition of the habitat 6210.

2.2 Ecological requirements

The structural and floristic characteristics of this habitat type are strongly influenced by climatic factors, topographic features, soil conditions and management practices. Understanding the key ecological requirements, which may vary at national and local level, is crucial for the establishment of conservation measures to ensure a favourable conservation status of the habitat, as required by Article 6(1) of the Habitats Directive.

2.2.1 Soil (including water and nutrients availability)

Soils are considered the most important factor determining the composition of plant and animal species of this habitat. The amount of moisture in the soil is among the most important environmental factors responsible for the variability of the vegetation of the *Festuco-Brometea* class.

In general, this class of dry grasslands is found on dry well-drained soils, from neutral to alkaline. It can be found on thin or deep soils, on calcareous bedrocks and limestone pavement, on sandy soils with a very small carbonate content and neutral reaction.

Some types of dry grassland also develop on base poor acidic soils (Chytrý et al. 2007) and can also rarely be found on base rich volcanic rock (Škodová et al. 2014) or rare calcareous volcanic outcrops (Badberg in Germany)

Key factors for the occurrence of this habitat type are low nutrient levels and periods of drought in the soil during summer in central and northern Europe. On the other hand, under a Mediterranean climate, these communities can usually exist only on soils with extra soil humidity (phreatism), on valley bottoms (e.g. in Spain); increasing summer drought and soil erosion might lead to drastic changes in structure and floristic composition, in favour of annual drought-tolerant species (e.g. in Italy).

2.2.2 Topography

These grasslands occur predominantly at low to moderate altitudes in central and northern Europe (e.g. 200-400 m), while they can reach higher altitudes in southern Europe, e.g. in Spain (altitude may vary between 400 and 2000 m), Italy, Germany and Romania (found on upland areas in the Alpine region between 300 and 800 m).

The habitat can be found on open flat areas, slopes, or slightly inclined areas in termophilous location exposed to south or west (e.g. in Slovakia, Luxembourg, Poland), on slopes in riverside valleys, alluvial terraces at a high level, and in sunny outskirts of forest (Lithuania).

2.2.3 Climate

A repeated decrease in precipitation and/or temperatures over a prolonged period can modify the floristic composition, which leads to changes in the associated animal species.

2.3 Related habitats

Other habitat types are associated or in contact with 6210 and can influence its management. Some habitats are related with 6210 in terms of dynamics and ecological succession or form habitat mosaics.

Since the gradient of environmental conditions of dry grasslands is continuous, vegetation 6210 habitat vegetation is often in transition to other vegetation types, including dunes (e.g. 2130 *Fixed coastal dunes with herbaceous vegetation (grey dunes), scrub habitats (40A0 *Subcontinental peri-Pannonic scrub, 5130 *Juniperus communis* formations), several types of grasslands and meadows (6110*, 6120*, 6230*, 6240*, 6270*, 6280*, 62A0, 6410), Alkaline fens (7230) and they may form an integral part of the complex habitat type limestone pavement (8240*). Further details about the habitat types that can be associated with or are in contact with 6210 are provided in Annex 1.

Among related habiat types which may form mosaics are also thermophilous fringe communities (for example *Geranion sanguinei*) and a variety of dry forest habitats such as 9150, 9170, 91G0 and some mediterranean, dacian an dillyrian oak- and oak-hornbeamforest, including natural “steppic” mosaics at the limit of tree growth with the *Quercetalia pubescentis* thermophilous oak forests.

Juniperus communis subsp. communis on dry grassland on limestone in Lower Austria (Stefan Lefnaer)

2.4 Related species

Some species from Annexes II, IV and V of the Habitats Directive and Annex I of the Birds Directive have a strong link with this habitat and may require some particular management for their conservation. This habitat type is particularly important for invertebrate species, including pollinators, such as many aculeate Hymenoptera, fly taxa and butterfly species. Some relevant species are mentioned below.

Plants

Semi-dry grasslands are rich in rare and protected plant species, including three species listed on Annex II of the Habitats Directive:

Gentianella anglica (Early Gentian) is a rare annual plant endemic to the UK. It occurs in calcareous grassland, mainly on steep, south-facing slopes, which receive longer periods of sunlight and where soil depth is very shallow (2-5 cm) and hence fertility is very low (WCC 1999). At most of its localities the vegetation falls into habitat 6210. It grows on bare ground or in thin turf that is kept open by a combination of grazing and trampling by livestock on thin, droughty soils. In dense turf it becomes shaded out and is unable to compete with other more vigorous species. There has been a marked decline in *G. anglica* since 1970, largely because of the ploughing and fertilising of old chalk grassland and the abandonment of grazing on remaining grasslands.

*Pulsatilla slavica** is endemic to the Western Carpathians in Poland and Slovakia and is listed as a priority species on Annex II of the Habitats Directive. In Slovakia the plant is found on grassy rock slopes and relict pine forests, rarely also in beech forests on limestones and dolomites from hilly areas to the sub-alpine vegetation belt. Collection of this plant has been noted as an important threat in Poland. In Slovakia, it is threatened by loss of habitat due to overgrowth or forestation (mainly *Pinus sylvestris* and *P. nigra*), soil erosion and trampling around tourist trails, collecting of the plants and quarrying (Mereďa and Hodálová 2011).

Himantoglossum adriaticum is a rare European endemic orchid and is endangered in many countries. It grows on calcareous soils in natural and semi-natural, dry and mesophilic grasslands or open woodlands and is restricted to a small region along the Adriatic coast in Central and South-eastern Europe. *H. adriaticum* most frequently grows in grasslands which can be characterized as the secondary succession state of the *Festuco-Brometea* vegetation class (Bódis et al 2018). It is subject to several threats including intensification of agriculture, forest management, land abandonment, invasive species, and collection. It occurs in protected areas throughout its range and continuous monitoring of the populations is recommended (Dostalova et al. 2013).

Himantoglossum adriaticum (Mário Duchoň)

Birds

These grasslands provide a habitat for many threatened or rare bird species, including many which are listed in Annex I of the Birds Directive. Several birds of prey as *Falco biarmicus* (lanner falcon), *Pernis apivorus* (honey buzzard), *Circaetus gallicus* (short- toed eagle) and *Circus pygargus* (Montagu's harrier) use these grasslands as hunting areas during the breeding season and it is therefore important to assure the presence of the animal on which they feed, such as small mammals and gallinaceous birds. An abundant food supply is a key requirement for raptors that winter on dry grassland. All these raptors require large, open areas for hunting with suitable taller vegetation for roost sites (Croft & Jefferson 1999).

Many passerine species, including *Emberiza hortulana* (ortolan bunting), *Sylvia nisoria* (barred warbler), *Lullula arborea* (woodlark) and *Lanius collurio* (red-backed shrike) use this habitat for nesting and roosting and have been strongly affected by changes in agricultural practices. Other Annex I birds breeding in these grasslands include *Burhinus oedicnemus* (stone curlew) and *Calandrella brachydactyla* (greater short-toed lark).

This habitat is also important for other bird species as *Lanius excubitor* (great grey shrike), *Emberiza cia* (rock bunting), *Emberiza citronella* (yellowhammer) and *Caprimulgus europaeus* (European Nightjar).

Loss, fragmentation and deterioration of the habitat through changes in agriculture has a direct impact on bird species. Lack of management due to agricultural abandonment or the intensification of farming, including the increased use of pesticides, artificial fertiliser and slurry, result in lower numbers of invertebrates. A reduced availability of this important winter food source has led to a widespread and ongoing decrease in the EU range of these bird species, In addition, human disturbance during the breeding season is responsible for breeding failures.

Invertebrates

Habitat 6210 is a high priority for conservation of wild pollinator species, including wild bees and flies as well as butterflies and moths. Many bees, wasps, grasshoppers, crickets, robber flies (*Asilidae*), hoverflies (*Syrphidae*), bee-flies (*Bombyliidae*) and other insects and spiders are typical of this habitat, and because of this, a diverse set of predatory and parasitic invertebrates are also typical species.

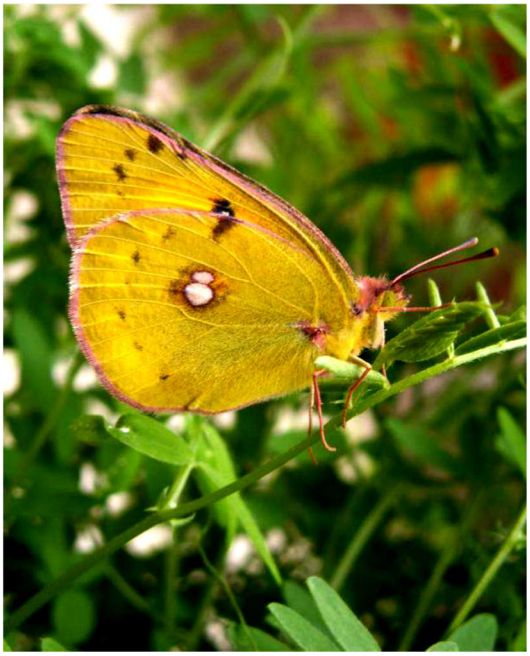
Calcareous grasslands are particularly rich in ant species as they favour warm dry situations in broken or rocky swards. This habitat also has a rich soil fauna – small arthropods, nematodes, insect larvae, earthworms. Grazed grasslands (pastures) have a diversity of saprophagous (feeding on decaying organic matter) invertebrates (insects, mites, nematodes), which depend on animal excrement from grazing animals.

These grasslands also provide an important nectar and pollen resource for many more generalist insects. During the flowering season, the grasslands host a high diversity of butterflies and other anthophilous (flower-visiting) insects – beetles, bees and wasps, thunder flies, hoverflies and other flies. A study that combined data on distribution and nectar productivity of different flowering species in the UK (Baude et al 2016), found that calcareous grassland is one of the habitats that produce the greatest amount of nectar per unit area from the most diverse plant sources.

Butterfly species associated with this habitat are noteworthy and include a number of species with specialised ecological requirements. Dry calcareous grasslands are the most species-rich habitats for butterflies in Europe (van Swaay, 2002, 2006). From the 576 species reported as native in Europe, 274 (48%) have been mentioned to occur on dry calcareous grasslands, even more than on alpine and subalpine grasslands (where 261 species have been reported) (WallisDeVries & Van Swaay 2009). Forty-four of these 274 butterfly species (16%) are endemic and restricted to Europe. From the 71 species considered threatened in Europe, 37 (52%) can be found on calcareous grasslands. Typical species include many burnets (*Zygaena*)-species and Hesperiidae, and big showy butterflies like the Old World swallow-tail (*Papilio machaon*) or the Scarce Swallotail (*Iphiclides podalirius*).

Characteristic butterfly species of calcareous grassland include the Habitats Directive species *Colias myrmidone* (Annex II and IV) and *Maculinea arion* (Annex IV), both of which are highly threatened.

Colias myrmidone is considered the worst case of a decline of a butterfly on a European scale. It has already disappeared from most countries within its European range and if actions are not taken immediately, the species will be lost from Europe. The reintroduction of this species should be considered in all countries and regions where it has become extinct in recent years, provided that sufficient habitat is restored, according to the EU Species Action Plan (Marhoul and Olek 2012).



Colias myrmidone (Ľ. Víťaz)

Parnassius apollo is associated with this habitat type in the Boreal region where it occurs in low-lying grasslands[8]. In Croatia, *Proterebia afra dalmata* (Dalmatian Ringlet) is found in this habitat, and in southeast Europe, *Pseudophilotes bavius* (Bavius Blue) is typical of this habitat. Dry calcareous grasslands are also considered good breeding habitats for *Euphydryas aurinia* (Marsh Fritillary) and *Lycaena dispar* (Large Copper) (Rūsiņa, 2017).

Dry calcareous grasslands are important habitats for many aculeate Hymenoptera such as wild bees, wasps and sawflies. Most solitary bees are specialised on certain plant species as a supply of pollen and many are specialised on calcareous grassland species. For example, in the UK, these habitats can host over 80 species, with 14 strongly associated with the habitat (Falk, 2015). Some bee species are dependent on single plant families or genera typical of calcareous grasslands, e.g. *Melitta dimidiata* on *Onobrychis* sp. and *Andrena hattorfiana* on *Knautia arvensis*. These bees have a very tight link because they depend on the pollen collected to provision their nests. A conserable number of flies (Diptera) also belong to the typical species with adaptations to the dry conditions, such as

[8] Butterfly Conservation Europe proposed that this species is added as a typical species of the habitat type in the Boreal Biogeographical Seminar (2012). In the Alps and associated ranges it only occurs in subalpine situations between 750 and 2000 m in habitat 6170.

for example bee-flies (*Bombylidae*), several hoverflies (Syrphidae: *Merodon, Eumerus, Paragus, Pipizella* species), robber flies (*Asilidae*), which require hot sunny conditions and are often a feature of calcareous grassland hillsides. Bee flies and bees require and open and heterogeneous grassland structure at the micro-scale (5-10 cm). A monotonous sward structure is not good for ground-nesting bees or predatory insects such as ants and tiger beetles (*Cicindelinae*).

Many rare grasshopper species, such as *Saga pedo, Gomphocerippus rufus* and *Stenobothrus lineatus*, are also associated with these grasslands (Alexander 2003, Sardet et al. 2015), as well as crickets like *Gyrillus campestris.*

See section 5.1.3 for a discussion of management requirements for invertebrates.

Reptiles

Reptiles linked with this habitat in some parts of their distribution range include : *Coronella austriaca* (Smooth Snake), *Zamenis longissimus* (Aesculapian Snake), *Hierophis viridiflavus* (Western Whip Snake), *Lacerta agilis* (Sand Lizard), *Lacerta bilineata* (Green Lizard), *Podarcis muralis* (Wall Lizard) (Bensettiti et al. 2005).

Mammals

Some mammal species are typical of this habitat type, particularly small rodents. The European Suslik (*Spermophilus citellus*), listed on Annex II and IV of the Habitats Directive, needs short turf (10-20 cm) usually in dry grasslands and steppes. These conditions may be lost when grazing ceases and the grass grows coarse and scrubland develops (Janák et al. 2013).

European Suslik (Michal Ambros)

2.5 Ecosystem services and benefits

Calcareous grasslands provide important benefits for society (production, employment), the environment and biodiversity, although these benefits are not always well-recognised or understood. These grasslands are extensively used for livestock grazing all over the EU, which generates income for local communities across their distribution area. Ecosystem services and benefits provided by the habitat include pollination services, soil erosion prevention, carbon sequestration, aesthetic and recreational values.

As shown in the previous section, these grasslands are key habitats for many EU protected species (plants, birds, butterflies, reptiles and mammals) and for other grazing wild animals such as deer and rodents. Habitat 6210 is a high priority for conservation of wild pollinator species, particularly wild bees but also flies as well as butterflies and moths.

Moreover, while soils under intensively managed crops are poor at carbon sequestration, pastures can sequester 0.3 – 0.6 tonnes of carbon per hectare per year (DEFRA, 2007).

Dry grasslands and steppes are the homes of ancestors or close relatives to several of our widely used herbs (such as wild basil, wild marjoram, wild thyme), garden bulbs, several spices and medicinal plants (EEA 2001).

The 6210 habitat type, visibly rich in species (flowering plants, insects, raptors) also has a high recreational value. This grassland type has long been an important feature for landscape painting and the appreciation of the countryside.

2.6 Geographic distribution

2.7.1. Area reported by the Member States

The habitat type is present in **25 countries and 7 biogeographical regions**[9]. All Member States have reported the current range and area covered by this habitat type (under reporting obligations set in Article 17 of the Habitats Directive[10]). The total area reported in 2013 amounted to 16,732 Km^2. The trend in surface area was reported as decreasing in almost half of the assessments. The largest habitat area is found in the Mediterranean region, while the range is largest in the Continental region.

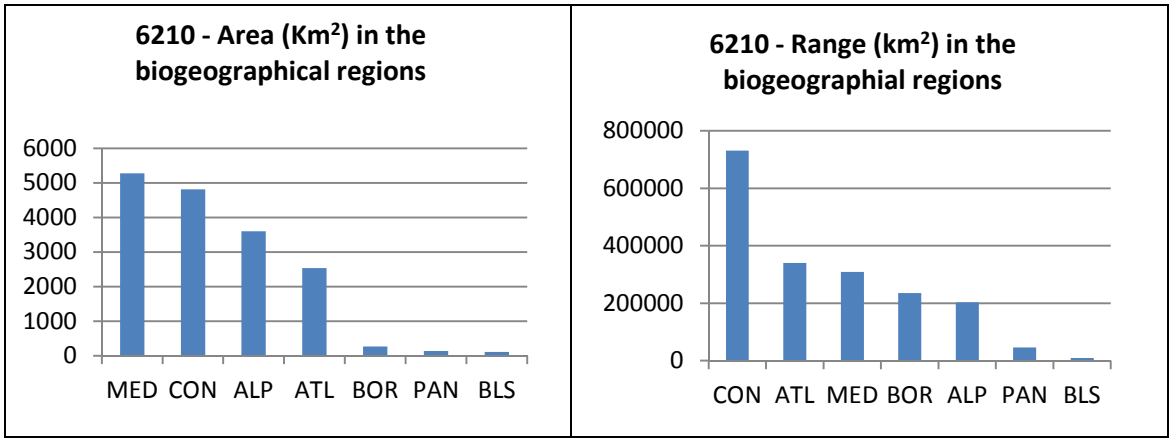
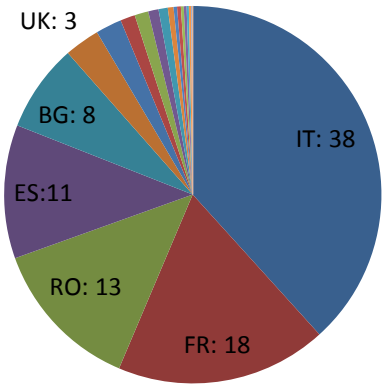


Figure 2: Surface area (km^2) and range of 6210 in each biogeographical region: Alpine (ALP), Atlantic (ATL), Black Sea (BLS), Boreal (BOR), Continental (CON), Mediterranean (MED) and Pannonian (PAN).

Although the habitat type is present in 25 countries, **nearly 90% of its reported surface is within 5 countries** (IT, FR, RO, ES and BG).

Figure 3: 6210 - Percentage of total EU area in each MS



[9] According to the EU Reference Lists. https://bd.eionet.europa.eu/activities/Natura_2000/chapter2

[10] Article 17 Dataset that contains tabular data as reported by all Member States (except Croatia) for the 2007-2012 period: https://www.eea.europa.eu/data-and-maps/data/article-17-database-habitats-directive-92-43-eec-1/article-17-database-zipped-ms-access-format . It must be pointed out that here are issues with data quality in the Art 17 reports, so the information included in this action plan which is based on these data must be taken with caution and and considered indicative.

Italy reported the highest surface area of 6210 (6,407km^2) in the 2007 to 2012 period, followed by France (3,028 km^2), Romania (2,200 km^2), Spain (1,915km^2) and Bulgaria (1.258 km^2).

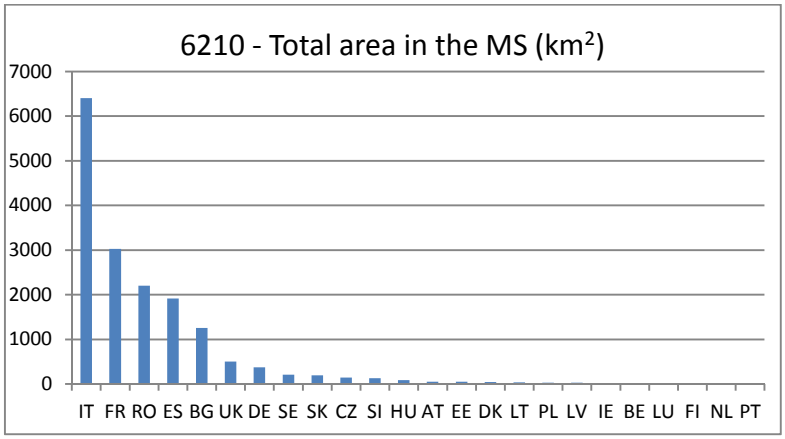


Figure 4: Habitat surface area (km^2) of 6210 in the Member States

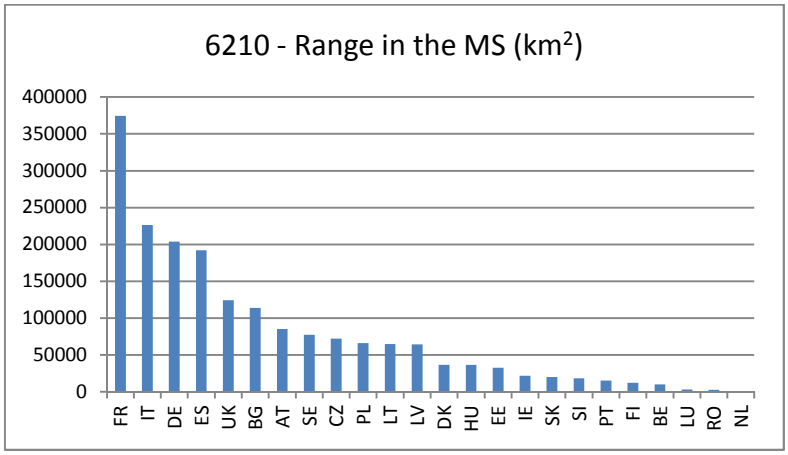


Figure 5: Range surface area (km^2) of 6210 in the Member States

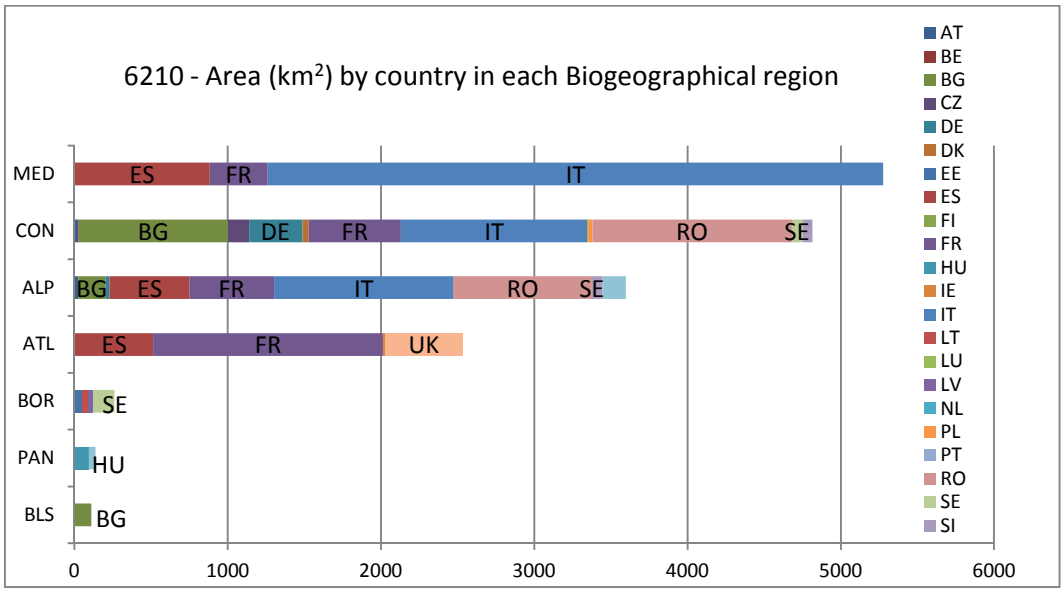


Figure 6: Area (km^2) of 6210 by Member State in each Biogeographical region (according to Art. 17 reporting for the period 2017-2012)

2.6.1. Trend of surface area

The trend in surface area was reported as decreasing in nearly half of the assessments in the 2007-2012 period)[11]. The trend was increasing in only in 4% of the assessments (BE in ATL and CON regions). Information about the trend in surface area was lacking in 16% of the assessments (BG in ALP, BLS and CON regions; ES in MED region; LU in CON region and PL in ALP and CON regions).

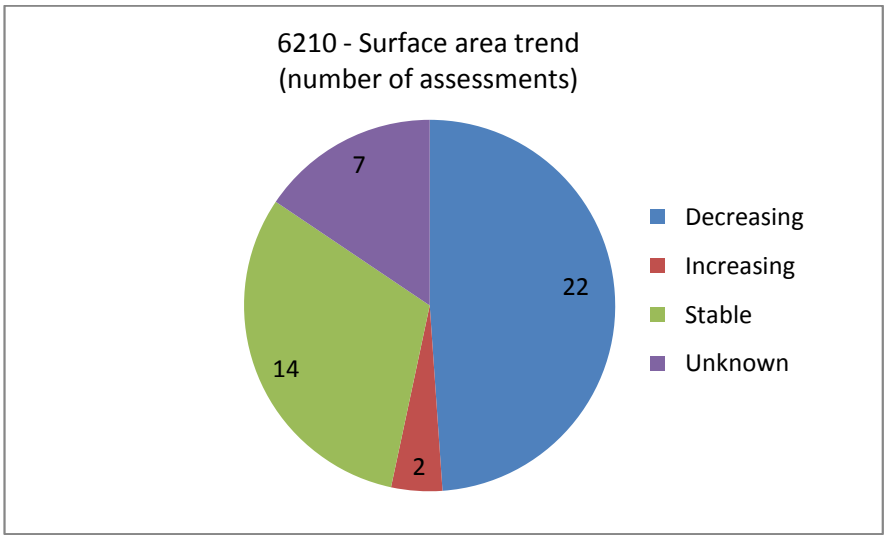


Figure 7. Trend in the area of 6210 habitat type:
number of assessments reported in each trend category

2.6.2 Distribution of the habitat 6210 in Natura 2000

Approximately **57% of the total surface of this habitat type in the EU is included in the Natura 2000 network**.

The habitat is reported with significant presence[12] in **4,437 Natura 2000 sites**.

The region where 6210 is present in a higher number of Natura 2000 sites is the Continental region. More than 50% of the sites including this habitat in this region are in Germany, Italy and France.

However, the estimated surface of habitat 6210 covered by the network is the largest in the Mediterranean biogeographical region.

Italy has the largest surface area of 6210 included in Natura 2000 but when looking at the number of sites with presence of the habitat, Germany has many sites generally with a small area of this habitat and the average size of sites is very small. Other Member States such as Bulgaria have only a few sites but with a large surface area of the habitat.

[11] In total, 45 assessments were reported for the 6210 habitat type in 24 Member States and 7 regions (Croatia did not provide a report in the 2007-2012 period) and 7 regions.
[12] Without including the sites where the habitat type is reported with Representativity D: non-significant presence.

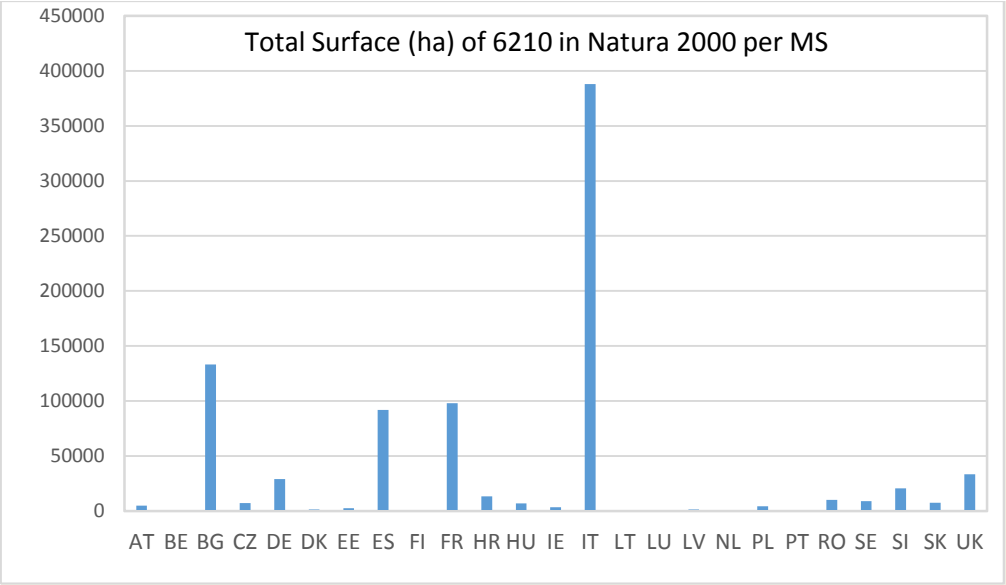


Figure 9: Total surface of 6210 in Natura 2000 in each Member States

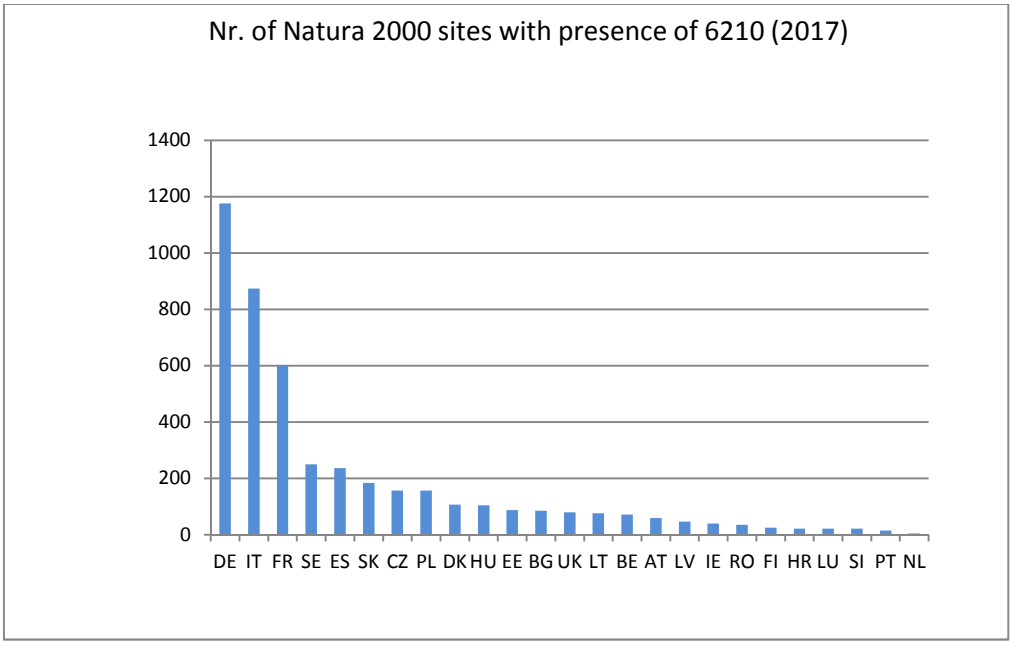


Figure 10. Number of Natura 2000 sites where 6210 is present in each Member States

The percentage of habitat surface included in Natura 2000 has also been estimated for each Member State in each biogeographical region from the Art. 17 dataset, derived from the reported total habitat area and the area within Natura 2000 (see table 4 below).

Table 4. Area and proportion of 6210 habitat in Natura 2000 (from Article 17 dataset, 2013)

BioGeo Region	MS	6210 – Total area (km2)	6210-Area in Natura 2000 (km2)	% in Natura 2000
ALP	AT	25,00	15,00	60
ALP	BG	177,00	173,68	98
ALP	DE	28,00	23,12	83
ALP	ES	522,00	227,00	44
ALP	FR	550,00	295,14	54
ALP	HR	NA	NA	NA
ALP	IT	1.173,00	418,78	36
ALP	PL	2,00	2,00	100
ALP	RO	900,00	800,00	89
ALP	SE	1,00	0,20	20
ALP	SI	66,00	48,00	73
ALP	SK	154,00	100,00	65
ALPINE		3.598,00	2.102,92	58 %
ATL	BE	0,20	0,17	86
ATL	DE	NA	1,94	NA
ATL	DK	4,10	1,00	24
ATL	ES	508,91	375,00	74
ATL	FR	1.500,00	332,00	22
ATL	IE	14,29	9,58	67
ATL	NL	0,50	0,50	100
ATL	UK	506,47	336,87	67
ATLANTIC		2.534,47	1.057,06	42 %
BLS	BG	109,61	93,01	85
BLACK SEA		109,61	93,01	85 %
BO	EE	50,00	32,00	64
BO	FI	1,40	0,50	36
BO	LT	40,00	7,90	20
BO	LV	30,00	18,00	60
BO	SE	140,00	32,00	23
BOREAL		261,40	90,40	35 %
CON	AT	25,00	13,00	52
CON	BE	4,06	4,00	99
CON	BG	972,09	902,66	93
CON	CZ	139,30	64,85	47
CON	DE	347,54	243,06	70
CON	DK	41,00	12,00	29
CON	FR	600,00	345,00	58
CON	HR	NA	NA	NA
CON	IT	1.218,47	509,18	42
CON	LU	3,10	1,86	60

CON	PL	30,00	30,00	100
CON	RO	1.300,00	1.200,00	92
CON	SE	69,00	57,00	83
CON	SI	65,00	34,00	52
CONTINENTAL		4.814,56	3.416,61	71 %
MED	ES	883,55	396,00	45
MED	FR	378,00	378,00	100
MED	HR	NA	NA	NA
MED	IT	4.015,25	1.557,46	39
MED	PT	NA	284,00	NA
MEDITERRANEAN		5.276,80	2.615,46	50 %
PAN	CZ	8,92	4,10	46
PAN	HU	85,00	78,00	92
PAN	SK	43,66	35,00	80
PANNONIAN		137,58	117,10	85 %
TOTAL	**EU**	**16.732,42**	**9.492,56**	**57 %**

3. CONSERVATION STATUS, THREATS AND PRESSURES

3.1 Conservation status and trends

*The conservation status is **unfavourable and deteriorating in most of the habitat range**, according to Member States reporting under Article 17 of the Habitats Directive.*
*Conservation status **inside the Natura 2000 network is better than outside** (35% of the habitat surface in Natura 2000 is in excellent conservation status, around 55% is in good conservation status and less than 10% is in less than good conservation status).*
The use of harmonized methods would allow better comparison of conservation status assessments, at least between countries belonging to the same biogeographical region.

The information included in this section is mostly based on data reported by Member States for the 2007-2012 period and included in the Article 17 dataset[13]. Some data from the last reports submitted by the MS in 2019 concerning the conservation status and trends reported for the period 2013-2018 are also included. It must be noted however that these data, currently available from the EEA[14], might still require some review.

The methodology used for assessing conservation status depends on data from a variety of sources. Ideally, the data should have been collected during the reporting period using comparable methods across all Member States. However, Member States have used data collected for diverse purposes and over varying time periods. In many cases, suitable data do not exist and expert opinion has been used to allow assessments to be made.

3.1.1 Conservation status at biogeographical region level

The conservation status was unfavourable in all the biogeographical regions in the previous reporting period (these data are not elaboarted yet for the last period). The area was mostly unfavourable and the worst rated parameters were future prospects and structure and functions. These assessments indicated that the habitat is degraded and was expected to continue deteriorating at the biogeographical level in the future.

Table 5: Conservation status and trends of 6210 by biogeographical region (2007-2012)

Region	Range	Area	Structure & function	Future prospects	**CS 2007-2012**	Trend in CS	Previous CS (2001-2006)
ALPINE	U1	U1	U1	U1	**U1**	-	XX
ATLANTIC	FV	U2	U2	U2	**U2**	-	U2
BLACK SEA	FV	FV	U1	U1	**U1**	=	XX
BOREAL	FV	U2	U2	U2	**U2**	-	U2
CONTINENTAL	U1	U2	U2	U2	**U2**	-	U2
MEDITERRANEAN	U1	U1	U1	U2	**U2**	-	XX
PANNONIAN	FV	U1	U1	U1	**U1**	=	U2

Favourable	FV	Unknown	XX	Unfavourable - inadequate	U1	Unfavourable - bad	U2

Qualifier (+) improving (-) deteriorating (=) stable (x) unknown (n/a) not reported

[13] https://www.eea.europa.eu/data-and-maps/data/article-17-database-habitats-directive-92-43-eec-1/article-17-database-zipped-ms-access-format. Croatia (HR) did not provided the Article 17 report in the last period and for this reason data from this country are not included in this section. It must also be reminded that here are issues with data quality in the Article 17 reports, so the information included in this section must be interpreted with caution and considered only indicative.

[14] https://www.eea.europa.eu/themes/biodiversity/state-of-nature-in-the-eu/article-17-national-summaries

3.1.2 Conservation Status of the habitat at Member state level in each biogeographical region

Conservation status is assessed every six years in each Member State, in every biogeographical region. The assessments from three reporting periods (since 2001) are now available (see summary data about conservation status reported for this habitat type in the three reporting periods in Table 6 on the next page).

Conservation status of 6210 reported for the period 2013-2018 has generally not improved. In fact, a deterioration of conservation status of this habitat type has been reported in several Member States at the biogeographical region level.

According to the last reports provided by the Member States in 2019, the conservation status is unfavourable in all Member States and regions, with the exception of Croatia in the Alpine and Mediterranean regions and Romania in the Alpine and Continental regions.

The situation is worrying in the Atlantic region, where all countries have reported this habitat in unfavourable status. Moreover, the conservation status had declined since the first reporting period (2001-2006) in Belgium, Germany and the Netherlands.

The conservation status for this habitat type has also been reported as unfavourable in all countries in the Boreal region, and with declining trend in Latvia and Sweden.

All the countries have reported the habitat in unfavourable status in the Mediterranean region and the conservation status has deteriorated in France, Italy and Portugal compared to previous reporting periods.

In the Pannonian region, the conservation status of 6210 habitat type was been reported as unfavourable inadequate (U1) in all countries although it seems to have improved from the last reporting periods in the Czech Republic.

Most of the area of this habitat type in the Continental region is in bad status (U2), less than 20% is inadequate (U1) and the only favourable status in the region has been reported by Romania, which holds just around 0.2% of the total habitat area in the region.

The conservation status had deteriorated in several cases when compared to the previous reporting period. This is the case for Austria in the Alpine and Continental regions, Germany in the Atlantic and Continental regions and Italy in the Alpine, Continental and Mediterranean regions.

The situation has slightly improved, with a change from bad conservation status (U2) to inadequate (U1) in Spain in the Alpine and Atlantic regions (due to different method and improved knowledge respectively), Poland in the Alpine region (due to improved knowledge) and Czech Republic in the Pannonian region (due to improved knowledge).

Table 6. Conservation status reported by the EU Member States for 6210 habitat in the three reporting periods available

MS	REGION	CS 2001-2006	CS 2007-2012	Trend	% in region	CS 2013-2018	Trend
AT	ALPINE	U1	U1	=	23.6	U2	-
BG	ALPINE	NA	U1	=	8.5	U1	x
DE	ALPINE	U1	U1	-	3.7	U1	=
ES	ALPINE	XX	U2	-	7.2	U1	x
FR	ALPINE	U1	U1	=	18.3	U1	=
HR	ALPINE	NA	NA			FV	=
IT	ALPINE	FV	U1	-	22.1	U2	-
PL	ALPINE	U1	U2	+	0.5	U1	x
RO	ALPINE	NA	FV		0.5	FV	x
SE	ALPINE	U2	U2	-	0.7	U2	-
SI	ALPINE	U2	U2	=	2.8	U2	-
SK	ALPINE	U1	U1	=	12.1	U1	x
BE	ATLANTIC	U1	U2	+	0.7	U2	x
DE	ATLANTIC	U1	U1	x	2.6	U2	-
DK	ATLANTIC	U2	U2	x	1.3	U2	-
ES	ATLANTIC	U1	U2	-	15.0	U1	=
FR	ATLANTIC	U2	U2	-	37.7	U2	-
IE	ATLANTIC	U2	U2	=	6.2	U2	-
NL	ATLANTIC	U1	U2	=	0.2	U2	+
UK	ATLANTIC	U2+	U2		36.2	U2	=
BG	BLACK SEA	NA	U1	=	100	U1	x
EE	BOREAL	U1-	U1	=	17.3	U1	=
FI	BOREAL	U2-	U2	-	4.6	U2	=
LT	BOREAL	U2-	U2	-	25.9	U2	x
LV	BOREAL	U2+	U2	-	23.8	U2	-
SE	BOREAL	U2-	U2	-	28.4	U2	-
AT	CONTINENTAL	U1	U1	=	5.0	U2	-
BE	CONTINENTAL	U1	U2	+	1.0	U2	+
BG	CONTINENTAL	NA	U1	=	10.7	U1	x
CZ	CONTINENTAL	U2	U2	+	10.3	U2	=
DE	CONTINENTAL	U1-	U1	-	33.1	U2	-
DK	CONTINENTAL	U2	U2	x	3.6	U2	-
FR	CONTINENTAL	U2	U2	-	17.9	U2	-
HR	CONTINENTAL	NA	NA			U1	=
IT	CONTINENTAL	FV	U1	-	8.9	U2	-
LU	CONTINENTAL	U1	U2	x	0.3	U2	-
PL	CONTINENTAL	U2	U1	+	6.0	U1	x
RO	CONTINENTAL		FV		0.2	FV	x
SE	CONTINENTAL	U2	U2	-	1.1	U2	-
SI	CONTINENTAL	U2	U2	-	1.8	U2	-
ES	MEDITERRANEAN	XX	U2	x	45.9	U2	-
FR	MEDITERRANEAN	U1	U2	-	10.7	U2	-
HR	MEDITERRANEAN	NA	NA			FV	=
IT	MEDITERRANEAN	FV	U1	-	40.2	U2	-
PT	MEDITERRANEAN	FV	FV		3.2	U1	-
CZ	PANNONIAN	U2	U2	+	6.9	U1	=
HU	PANNONIAN	U2	U1	=	84.9	U1	=
SK	PANNONIAN	XX	U1	=	8.2	U1	X

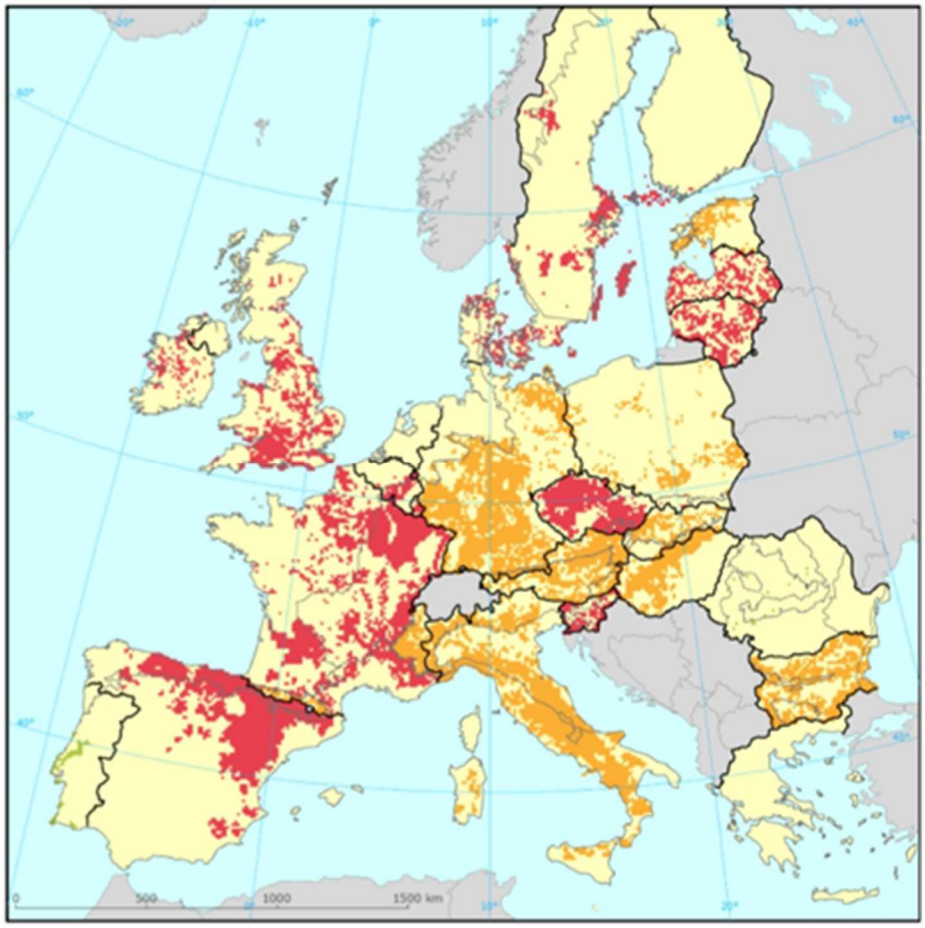


Figure 12. Map with distribution of 6210 and overall conservation status as reported by the MS for the 2007-2012 period (except Croatia).

3.1.3 Trend in conservation status of the habitat 6210

According to the last information available (Art. 17 reporting for 2007-2012), the conservation status is deteriorating in most of the regional assessments although it is mostly stable in two regions (Black Sea and Pannonian).

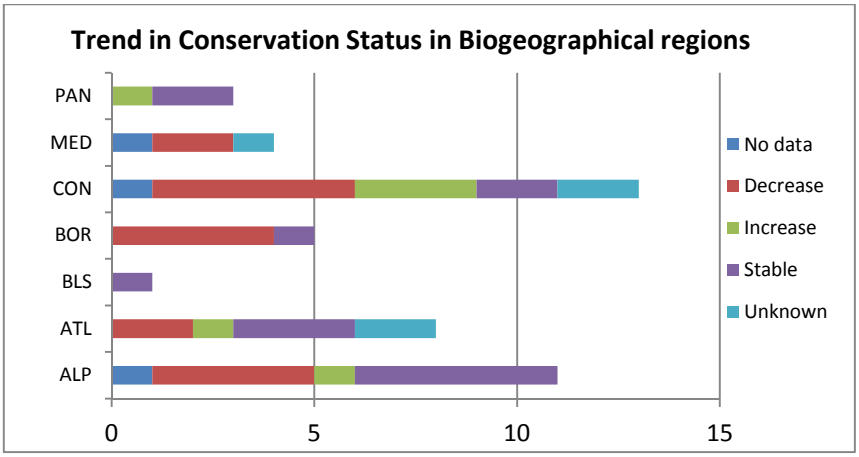


Figure 13. Trend in conservation status of 6210 represented as the number of Member States by biogeographical region in each trend category (2007-2012)

3.2 Conservation status of the habitat in Natura 2000 sites

The conservation degree of each habitat is reported in the Natura 2000 Standard Data Form for each site where the habitat is present according to the following categories:

- A: Excellent conservation
- B: Good conservation
- C: Average or reduced conservation.

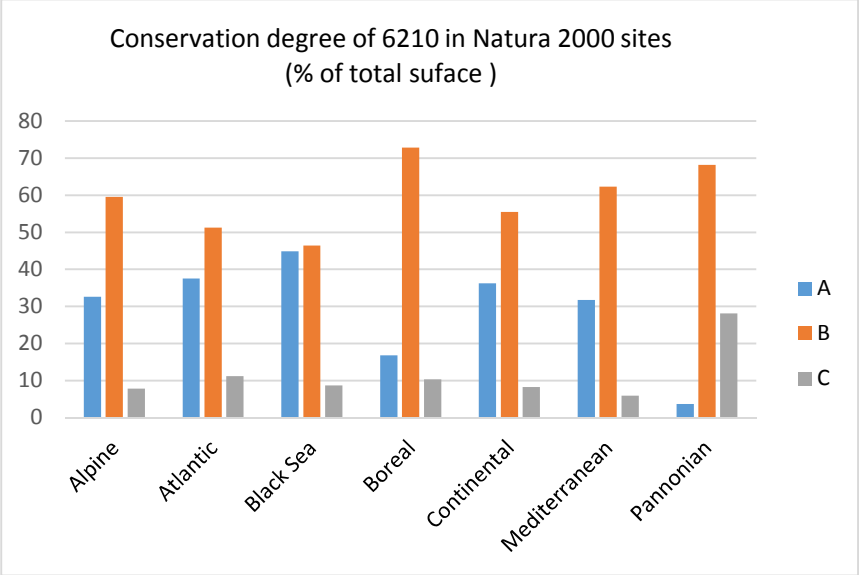


Figure 14. Percentage of total surface of the habitat 6210 in each class of conservation degree in Natura 2000. A: excellent, B. good, C: Average or reduced (Natura 2000 database, 2018)

On average, around 35% of the habitat surface in Natura 2000 is in excellent conservation status, around 55% is in good conservation status and less than 10% is in reduced conservation status.

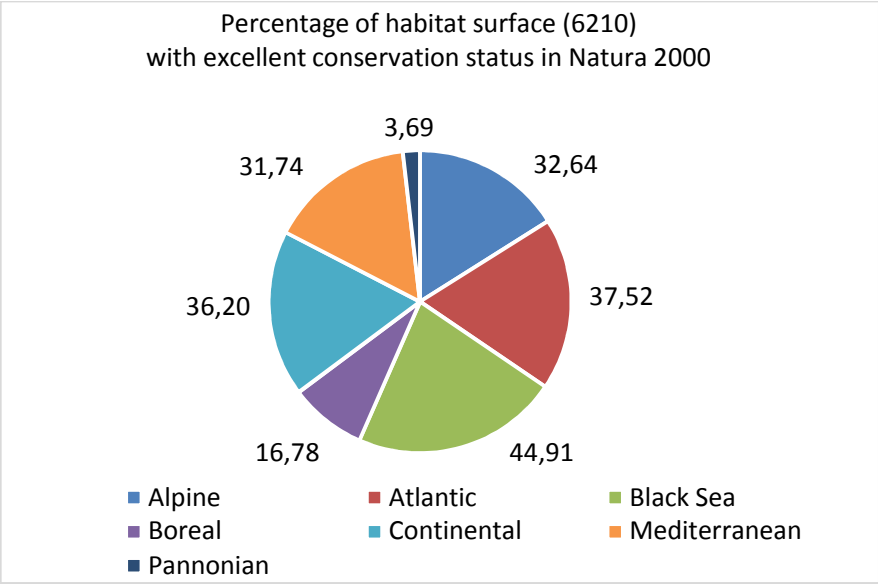


Figure 15. Percentage of habitat surface with excellent conservation degree in Natura 2000 sites in each biogeographical region

3.3 Methodologies for conservation status assessment and monitoring

Member States are required to undertake surveillance of the conservation status of the natural habitats and species referred to in Article 2 with particular regard to priority natural habitat types and priority species, according to Article 11 of the Habitats Directive and these should be the basis of the Article 17 assessments[15].

They have developed methodologies for assessing conservation status of habitat types and species of Community interest or are in the process of developing/ improving such methods. These methods usually define variables, criteria and threshold values for the key parameters (range, area, structure and function, etc.) that indicate whether the habitat type is in a favourable conservation status (FCS).

Some countries are now developing and testing standardized methodological protocols (Italy), multi criteria models (Denmark), or have developed detailed assessment matrices at local or site level as well as for monitoring purposes including typical plant species (Germany[16]) and other approaches for the conservation status assessment.

However, as concerns a description of "FCS" for the habitat 6210, there are no official references and some Member States still lack a detailed methodology to assess conservation status, as at the EU level there is only a a conceptual framework for the purposes of Article 17 reporting.

Several Member States carry out habitat mapping and collect information on habitat condition (e.g. recording biotic and abiotic factors) is carried out in several countries. Details about the methods used in the Member States where this habitat is present are provided in section 5.1. (Habitat monitoring methods).

Some Member States estimated range in the past based on incomplete survey information and relied on predicting the likely occurrence of the habitat based on soil type, altitude, and the reported presence of indicator species within a 10 km grid square (e.g. Ireland). For the reporting period 2007-2012, all Member States used the range tool, which in some cases resulted in a different estimate.

Some Member States have a good knowledge of the absolute area because of recent habitat mapping. Habitat mapping can provide a comprehensive overview of the habitat quality and fragmentation.

In some Member States, however, it seems difficult to accurately assess the area covered by this habitat type, e.g. in Spain where there are many gradual transitions that occur between *Brometalia erecti* and other syntaxa. Therefore, it is quite difficult and expensive to accurately map the distribution of these swards in a particular location, and even more difficult at a country level. Furthermore, the distribution of these communities may suffer significant variations even in the short or medium terms.

For the evaluation of structure and functions, the occurrence of typical and characteristic species is normally used. Belgium (Flanders) also use the threat status of typical species according to the regional Red list is also used in to assess structure and functions.

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[15] Reporting under Article 17 of the Habitats Directive. Explanatory Notes and Guidelines for the period 2013–2018. Final version – May 2017.

[16] https://www.bfn.de/fileadmin/BfN/monitoring/Dokumente/Bewertungsschemata_LRT_Sept_2010.pdf

Different indices are being used to define conservation status. Denmark developed a multi criteria model was developed to perform conservation status assessment, which was used along with expert evaluations in the 2013 reporting.

Variables used to define conservation status and indicators for 6210 can include the number of diagnostic species, the relative cover of woody species, the presence of elements that indicate a possible deterioration, native invasive herbs and grasses, nitrophilic herbs, invasive alien species, etc.

Indicators of good quality for 6210 habitat (based on Schaminée 2016):

- High species richness
- Absence of nutrient-demanding and ruderal species
- Long-term habitat stability
- Generally closed sward with low vegetation structure
- Traditional grazing/mowing regime
- Low cover of encroaching tall grasses, shrubs and trees.

There may be problems when using indicators for the "most typical" or "highest standard" grasslands as a basis or "reference" to compare, as this could lead to assigning "unfavourable" (U1, U2) scores for less typical grasslands even if they are well conserved. In particular, the grasslands at the habitat range limits, which naturally host a limited set of characteristic species could receive U2 or U1 scores, even if they are in fact in good status, as pointed out in Latvia or Ireland. Regional adaptations of thresholds and typical species were also used in Germany in relation to the potential/conditions of natural landscape units (Naturräume).

Ireland, applied a new protocol allowing monitoring stops to pass as good quality if a high-quality indicator species was recorded within 20m of the monitoring stop, in recognition of the fact that high-quality positive indicator species can sometimes only be occasional within an Annex I grassland community (Martin et al 2018).

Management may also be considered when assessing structure in some cases, e.g. in Estonia: "habitat is permanently managed (mowed or grazed) or is mowed or grazed recently, so the species composition has not changed; no signs of overgrowing with bushes", indicates a "very good structure".

Trends are an essential part of assessing all conservation status parameters except Future prospects. Trends are decisive for the assessment of conservation status since usually only stable or increasing trends can result in an overall Favourable conservation status (FCS).

The analysis of trends does not always follow a systematic approach. In Italy there is a proposal to start analysing trends by applying the "area, structure and function" parameters and to develop comparisons among different monitoring periods (diachronic analysis of cartographic representations and related landscape metrics; diachronic analysis of floristic/structural changes).

3.3.1 Reference sites for the habitat type in Favourable Conservation Status

The identification of reference sites for the habitat type in FCS (in each Member State/biogeographical region) could help harmonise the conservation status assessment and habitat monitoring. A similar concept is already used under the Water Framework Directive[17] . Taking into account that this habitat type is extremely diverse and variable, depending on multiple environmental and biotic factors, reference sites should be identified for every habitat subtype (soil types, vegetation units and main climatic situations).

Natural dynamics of the habitat, which depend on changing ecological factors (weather, climate, hydrology, etc.) can bring difficulties when comparing to reference localities. Such situation can be solved by regular monitoring of reference localities, which could provide sufficient data for comparison under different conditions. It should also be considered that these sites can change over time. A specific monitoring system should be developed and implemented to assess long-term evolution, especially if global changes are suspected to interfere with FCS of the habitat (see also the art. 11 monitoring obligation of the Habitats Directive and the need to have some site specific monitoring to assess effectiveness of management):

Using reference sites for this habitat type may be particularly challenging due to its high variability and floristic diversity on both local and geographical scales. The potential for each area may be very different due to environmental and climatic conditions. Some mapped areas are constrained by these factors and thus possess different potential in respect to vegetation cover. Some areas may not improve as much as others despite optimal management yet still they are important for biodiversity.

Reference sites should be identified considering floristic differences among regions and species diversity gradients. If this approach is applied, the reference sites for the habitat type should be selected in order to cover its ecological and species variability. Ideally, there should be reference localities of habitat (in optimal ecological conditions) for each biogeographical region and all other localities of habitat in this region should be compared to it. An advantage of this approach is that it would provide a much easier methodological (statistical) approach for conservation status assessment. On the other hand, national gradients of species composition due to geographical range of many typical species may lead to misleading conservation status assessments.

3.3.2 Favourable Reference Values

In order to assess the conservation status under the Habitats Directive (HD) according to the agreed method used since the reporting period 2001-2006 under HD Article 17, it is necessary to determine favourable reference values (FRVs) for the range of habitat types and species (FRR), for area of habitat types (FRA) and for population size of species (FRP). FRVs are key reference levels to define when Favourable Conservation Status (FCS) is being achieved for individual species and habitats.

[17] Annex II 1.3 (iv): “Member States shall develop a reference network for each surface water body type. The network shall contain a sufficient number of sites of high status to provide a sufficient level of confidence about the values for the reference conditions, given the variability in the values of the quality elements corresponding to high ecological status for that surface water body type”.

A recent report on methodologies and guidance to establish FRVs has been prublished with the support of the European Commission (Bijlsma et al. 2018).

Some countries are currently working on defining FRV for their EU habitat types, including grasslands. However, most Member States have no well-defined FRVs for habitat 6210.The difficulties associated with separation of dry grassland communities into different natural habitat types (e.g. in the alliance *Festucion valesiacae*: 6210, 6240* and 6250* in Slovakia) pose significant challenges to defining FRVs.

More precise habitat identification, mapping and assessment is crucial for consideration of FRVs. Possible long term negative impacts of fragmentation and other threats need to be quantified before FRV can be estimated for this habitat type.

3.3.4 Conclusions and recommendations

- The use of simple and harmonized methods should be proposed to allow comparison of conservation status assessments, at least between countries belonging to the same biogeographical region. Harmonization needs international collaboration to compare methods used in different countries. Some countries however believe an EU-wide harmonization is rather difficult due to the different site conditions, biogeography, species composition, management and socio-economic circumstances.
- It is important to consider local differences in structure and functions, to avoid that all localities are compared to the highest standards; due to geographic location or other factors some grassland may already have favourable structure and functions within the context of their local ecosystem (O'Neill et al 2013) although they do not reach the highest standards.
- It would be helpful to consider relevant parameters that are relatively easy to assess in the field or through the internet, such as the cover of bare soil, invasive species or vegetation canopy, by using a standardized evaluation protocol based on field photographs or other remote sensing techniques.
- Location of transects and relevés should be permanently marked in the field to guarantee full repeatability. Cover of shrubs should be assessed rather on the base of photointerpretation of satellite/plane/drone photos, not only as visual assessment by an observer; this would help better precision and faster identification of real changes.
- Habitat/biotope mapping can be carried out using of remote sensing techniques (satellite data, aerial photographs) for delineation of polygons of homogenous habitat types (e.g. Stanová, Valachovič eds. 2002). This approach has been applied in Slovakia, northern part of Cyprus, Romania, Montenegro and Ukraine already.
- Another approach could be to use dynamic segmentation of satellite images for identification and monitoring Natura 2000 habitats.
- A suitable approach to define national FRV could be developed at biogeographical level. Relevant criteria should be set following consistent methods/principles.
- The Explanatory Notes and Guidelines for reporting under Art 17 of Habitats Directive suggest the need to pay more attention to the methodology of monitoring schemes in order to improve the quality of trend information.

3.4 Threats and pressures

*The **most prominent pressures and threats currently affecting the habitat 6210 are the abandonment or cessation of extensive grazing and mowing**. Undergrazing is occurring in many parts of the habitat range. At the same time, overgrazing is taking place in some areas, where is negatively influencing the naturally low nutrient levels which are very important for this habitat.*

*The main consequences and effects of the pressures/threats identified are **a reduction of the habitat area and alteration of its structure and function**, including modification of species composition and disappearance of typical species.*

*Existing and potential causes for habitat degradation or disappearance **need to be addressed by management measures**. Knowledge and methods used to identify and quantify threats and pressures are important for conservation planning.*

3.4.1 Main threats and pressures identified for the habitat

Member States were asked to report the 20 most important threats and pressures for each habitat type using an agreed hierarchical list, in the reporting cycle covering the period 2007-2012 under Article 17 of the Habitats Directive. Pressures are activities which are currently having an impact on the habitats and threats are activities expected to have an impact in the near future.

Pressures and threats were ranked in three classes: high, medium and low importance. Main threats and pressures identified in the 2007-2012 Article 17 of the Habitat Directive reporting period were similar in all biogeographical regions and are coincident with those identified by the national experts during the elaboration of this action plan[18].

In all the biogeographical regions, the most important pressures for habitat type 6210 in 2007-2012 were related to inappropriate grazing, biocenotic evolution/ succession and mowing/cutting of grassland. The modification of cultivation practices and fertilisation have also been identified as important threats for this habitat type in many countries.

Undergrazing and abandonment

The most important reason for reduction in grassland area is the cessation of grassland management. An increasing process of area loss seems to be ongoing in large parts of the habitat range due to disappearance of grazing activity (e.g. in most of its southern distribution area, in Italy, Spain and France). Grazing activity on dry calcareous grasslands is often economically unsustainable today and therefore abandoned. The financial difficulties faced by livestock breeders have a long-term impact on the maintenance of this habitat type.

[18] There were however inconsistencies in how countries reported threats & pressures making comparisons difficult. The guidance to report threats and pressures was revised and the standardized "List of pressures and threats" updated for the coming reporting period (2013-2018) to avoid previous inconsistencies in how countries reported them in order to facilitate the comparisons.

Undergrazing and in an extreme situation abandonment alter the structure, species composition and functioning of this ecosystem, which also affect its related species such as invertebrates or moss and lichen communities

After grazing or mowing in semi-natural grasslands is ceased, litter accumulates very quickly, the number of species decreases and the height of the sward increases. The accumulation of litter also has a fertilising effect, as biomass is not removed from the grassland and the content of soil organic matter increases. More competitive grasses, such as *Calamagrostis epigeios, Arrhenatherum elatius* and *Brachypodium pinnatum* can dominate and suppress other species. The diversity of species declines rapidly. Annual and biennial species also disappear because the small open patches in the vegetation disappear (Rūsiņa, 2017).

Succession to scrub is the end result of abandonment and results in habitat loss, but changes in the quality of the habitat occur long before that. Very dry pastures overgrow more slowly because the moisture conditions are not suitable for scrub and tree seedlings. Succession not only changes species composition changes, but also alters the relative abundance of individual species and the structure of the vegetation. This may include changes in the relative proportions of vegetation components (grasses, herbs), the amount of bare ground, and sward height, all of which impact on invertebrates. As the structure changes so does the growth forms of some plant species which can make them less suitable as hostplants for some invertebrates.

Impacts on butterflies due to succession to woodland are mentioned in some countries, as in UK (Fox et al 2015). Many of the habitat specialist species have continued to decline in distribution or population size. However, positive conservation measures on calcareous grassland in UK over the last 10 years have led to stabilisation or increase of some species found on these grasslands, like Small Blue *Cupido minimus*, Adonis Blue *Lysandra bellargus*, Large Blue *Maculinea arion*, Marsh Fritillary *Euphydryas aurinia* (this species is also found in *Molinia* meadows -6410).

Overgrazing

Overgrazing has a negative effect on this habitat type that is adapted to low nutrient levels. High livestock densities and supplementary feeding can result in the conversion of the 6210 habitat to meadows. This is taking place for example in grassland areas located on the surroundings of villages and roads, as livestock tend to be kept in these areas without moving the animals to more distant places, or where grazing animals are grouped and kept in fences.

Overgrazing leads to typical species being replaced by other that are able to withstand more intense grazing, and which are characteristic of meadows, or nitrophilous taxa. In areas where overgrazing is too intense, problems of soil compaction, nitrification and even loss of soil cover can occur.

Overgrazing, especially during the summer, implies excessive nibbling, trampling and poaching, causing both soil erosion and a decrease in species-richness and structural diversity, with a loss of tall herbs and an increase of shrub species of little appeal to livestock.

Changes in management practices and intensification

The impact of quite subtle changes in management such as grazing pressure, can have important consequences for the conservation of typical communities and its associated fauna. For instance, changes in sward height or the amount of bare ground can have a big impact on invertebrate populations (both in terms of species composition and abundance).

Intensification of grassland management can involve fertilization and herbicide use, which reduces species richness in these grasslands, concerning both plants and animal species. As regards the effects on fauna associated with this habitat, intensification affects in particular invertebrate species.

Many pastures are now contaminated by cattle dung that has received massive doses of dewormers (antihelminthics). The persistence of treatment ranges from a few days to a few months. If the animals are treated during the grazing period, the active molecules are quickly found in the natural environment and can impact populations of coprophagous insects and insectivore species (mammals, birds, etc.). This risk can be limited by choosing less harmful and less persistent active ingredients and avoiding treatment when animals graze on sensitive areas (treating stabled livestock or on a meadow used for this purpose).

Changes in livestock management practices

To maintain economic profitability, seasonal livestock farming has evolved towards large herds, which are brought by truck to the summer pastures, whereas smaller herds formerly went up to the summer pastures on foot, grazing in their way various areas of the lowlands and valley. In addition to the impact on the environment, this also affects wildlife, due to an earlier arrival of herds in summer (May-June), in the breeding season of galliformes (black grouse, partridge, and ptarmigan). Hence the creation of "August districts" in the eco-pastoral management plans, e.g. in France, to delay the arrival of herds on some sensitive alpine pastures.

Nitrogen deposition

In some countries, the habitat is threatened by atmospheric nitrogen deposition and subsequent formation of species-poor vegetation and changes in the structure of the vegetation, e.g. in Belgium, Czech Republic, Luxembourg, Netherlands, UK, Czech Republic and Luxembourg.

An increase in the availability of nitrogen in the soil has negative effects in this habitat that requires nutrient-poor soils. Some characteristic species of the habitat disappear while other non-indigenous species that are efficient nitrogen users are favoured and the structure of the grassland become dominated by tall grasses.

Where critical loads are exceeded, there is a decrease in species diversity and evenness, decline in frequency of characteristic species and lower number of scarce and rare plants. (van den Berg et al. 2010).

Expansive and invasive species

The introduction and spread of expansive plant species is often a result of other pressures on semi-natural grasslands, such as abandonment or eutrophication (i.e. the enrichment

of soil with plant nutrients, resulting in a more fertile soil and denser and taller vegetation). As soon as these species have spread, they significantly change the environment and interspecies competition conditions for grassland species.

Seeds or all kinds of propagules of invasive species can also be propagated by livestock when they move to different areas.

Spread of invasive species is acknowledged as a threat to this habitat in several countries, as Belgium, Denmark, Hungary, Ireland, Lithuania, Poland and UK. In each country different species have been identified as a threat for the 6210 habitat. In general these plants are highly competitive and outcompete other plants species that have a conservation value in these grasslands.

Land use changes and habitat fragmentation

Land use changes, like conversion into arable land, landfills, quarries for concrete or gypsum production or for calcareous stones and development of infrastructure, may cause habitat area reduction and fragmentation.

Urbanization in areas close to agglomerations, e.g. in the surroundings of villages and cities, may cause reduction of the area for this habitat type.

Habitat fragmentation and a reduction of habitat connectivity is considered a threat for this habitat type in particular in UK and northern countries (e.g. Sweden, Poland, Belgium, Denmark) but there are few studies and methodologies or experiences available in general on grassland fragmentation.

Habitat fragmentation reduces grassland connectivity for plant species (Soons et al., 2005). It may also have an impact on invertebrate populations associated to grasslands, reducing species richness (Parker and McNally, 2002). In fragmented habitats, genetic diversity of populations tends to become poorer, thus weakening their long-term maintenance.

Habitat fragmentation is suspected to have an important impact on population dynamics and research has highlighted a genetic bottleneck for some species/populations and the existence of an extinction debt for isolated patches of habitat. The recovery process after restoration of abandoned grasslands may also be hampered by lack of colonization, due to the lack of typical species in remaining vegetation and of seeds in the soil seed bank or in the seed rain.

Habitat fragmentation is also an important issues for many typical invertebrate species, that are less mobile and either need a mosaic of different habitat elements or habitats for their life cycle or rely on metapopulation dynamics. Furthermore with climate change migrations of species to new suitable habitat will be necessary and this can be made impossible with growing habitat fragementation in the landscape.

There is a need to improve knowledge of habitat fragmentation and how it can affect the conservation of the habitat in the long term.

The impact assessment of new developments in the habitat distribution areas should give more importance to the destruction or degradation of this habitat type.

Forest planting

Forest planting has been carried out in areas formerly occupied by this habitat type in some countries, e.g. Italy, Slovakia and Latvia. Afforestation was often carried out using non-native species or species that do not correspond to the potential vegetation of the area (e.g. *Pinus* sp., *Cupressus* sp., *Picea* sp.). This is not happening often at present but can still occur for economic or hunting reasons. The planting of conifer trees can lead to a change in the pH of the soil and consequently in the composition of the plant communities. In addition, the root system of trees tends to alter the structure of the soil by fracturing chalk. Finally, shading induced by tree foliage limits access to light and creates wetter microclimates that are detrimental to the maintenance of these grasslands' species.

Forest preservation/ conservation conflicting with habitat restoration

Forestry law, aiming at enlarging or conservation of forests and other national obligations exist ind some Member States, that make it difficult to restore the habitat type 6210, once succession is well advanced and first stages of forest such as for example *Pinus sylvestris* stands have taken over. These first generation forests especially with trees that do not give too much shade, often still contain enough typical plant species or diaspores to easily restore the former habitat 6210 within relatively short time. Therefore it should be ensured that no practical or legal obstacles for restoration exist, such as preservation or compensation rules for forests after succession due to abandonment of management of dry grasslands.

Recreation activities

Recreation activities, where they can become intensive, can produce soil compaction and erosion, with subsequent negative effects on flora and fauna species related to this habitat type. Outdoor sports and leisure activities have ben reported as pressures and threats of medium and high intensity for this habitta type in some EU countries (under article 17 reporting).

Excessive trampling can cause the introduction of invasive and expansive plant species, development of ruderal vegetation and biodiversity decrease.

Plant collecting

Although plant collecting is becoming rare nowadays, orchids (not only flowers but also the bulbs) and some plant species related to this habitat type have very attractive flowers and in particular places this activity could become a threat. This action can affect the viability of some species populations, where their seed stocks are reduced.

3.4.2 Identification of areas where action is urgent to combat high pressures

Some areas can be identified as particularly important to combat the main impacts on this habitat type in some countries. The focus clearly points to the large abandoned areas that show clear signs of scrub invasion, where the income from extensive grazing is no longer profitable. Also compensation or recreation measures are often not controlled for a longer time and long-term management should be installed.

It is also important to act on areas that may be more susceptible to nutrient enrichment (e.g. in Denmark) and in areas where the habitat is highly fragmented (as pointed out in Denmark and Sweden).

Some high quality patches of this habitat which are not within Natura 2000 sites should deserve particular attention, as pointed out in Ireland (Martin *et al.* 2018).

In the European context, special attention should also be paid to the outmost areas (e.g. the transition zone from the Continental to the Boreal region), where the habitat type is not only less pronounced, but also has less resistance and a lower recovery potential.

3.4.3 Procedures and methodologies to determine and assess the main threats and pressures to the habitat

In general, there are no standard procedures and methodologies at country level to determine and assess the main threats and pressures on the 6210 habitat. Usually threats and pressures have been identified by environmental specialists in the field and their intensity was estimated based on expert knowledge.

Some countries are currently preparing standard methodologies to assess threats and pressures on habitats and species of Community interest.

Some issues that must be addressed regarding the threats and pressures assessment and reporting are linked to their unequal distribution and intensity.

3.4.4 Conclusions and recommendations

- Main threats and pressures are clear and common in all biogeographical regions and linked to the lack of adequate management. They include on one hand land abandonment and lack or reduced grazing and mowing, which result in vegetation succession with the expansion of scrubs and trees. On the other hand, intensification of grazing can lead to eutrophication, soil changes, and changes in the vegetation communities and associated fauna.
- There is a need to further study the habitat fragmentation (reduction of habitat connectivity) and its impact on the habitat conservation status.
- The spread of invasive species in the habitat needs to be further investigated and monitored.
- In general, there are no standard procedures and methodologies at country level to determine and assess the main threats and pressures on 6210 habitat and such standard methods should be developed.

3.5 Climate change effects

There is not enough knowledge about the possible effects of climate change on this habitat type. A vulnerability analysis and experiences on monitoring climate change impact on the 6210 habitat type at European level need to be further explored in order to identify adaptation measures to climate change.

3.5.1 Evidence of climate change effects on 6210 habitat

There is not much evidence of climate change effects on 6210 habitat, as this has not been assessed in detail and there seem to be no specific studies on such effects in most of the countries. In fact, climate change has not been reported in the Article 17 report (period 2007-2012) of Habitats Directive as a high threat or pressure for 6210 in any Member State.

The recent European Red List of Habitats (Janssen et al., 2016) refers the semi-natural dry grasslands 6210 to two grassland types (E1.2a, E1.1i). In one case, climate change has been included in the specific list of pressures and threats.

In Ireland, there is some evidence that the climatic factors that are important to define the range of this Annex I habitat have changed in the last 12 years. Investigation on how summer rainfall levels have increased over the last decade and how this is impacting on grassland communities is ongoing. Leahy & Kiely 2011 highlight the problems of increased flooding events (cited in NPWS 2013). During the Grassland Monitoring Scheme survey (2015-2017) one site was noted as being negatively impacted in species composition due to the wetter summers (Martin et al 2018).

In some countries (e.g. Italy) climate change related phenomena, such as increasing summer drought and temperature, are considered a threat that can affect the habitat and are probably underpinning observed cases of soil thinning and erosion, which might bring to drastic changes in structure and floristic composition, in favour of annual dry-tolerant species.

In France, some effects have been observed in the arrival of animal species of southern distribution in the Normandy region (Eure valley and Seine valley) where habitat 6210 plays a particular role in the reception and dispersal of these species.

Long-term experimental evidence in the UK indicates however that the habitat is resistant to climate change impacts (in the form of summer droughts and winter heating) (Grime et al 2008).

Climate change can also promote the development of invasive alien species that are less sensitive to changes in the environment.

3.5.2 Habitat vulnerability to climate change and its adaptation capacity

Few studies have tried to model the response of some grassland types to climate changes. Habitat types are complex entities with a dynamic nature, so modelling their future distribution should be based on their constituent elements, and in particular their characteristic plant species (Bittner *et al*. 2011). However, interspecific relations and functions also change with new arriving species or losses of species and might result in

new or modified habitat types with a different unexpected reaction toward climate variables.

At EU level there are several modelling studies done indicating that more flooding and longer droughts will occur (ICCP 2007). The simulation of the occurrence of several EU protected grassland habitat types in Europe until 2060 under the influence of climate change shows that the overall occurrence of protected grassland habitats in Europe will decrease (Bittner et al. 2011). However, for certain types of habitats, climate change could bring more favourable climatic conditions in some areas. For example, longer and more frequent droughts could increase the areas of dry grassland habitats (6120*, 6210) in Northern Europe (Rusina, 2017).

It is expected that the range of most of the species will shift north-east due to climate change. The ranges of European birds will shift by 550 km on average and diminish by 20% on average (Huntley et al. 2008). Species with lower dispersal potential than that of birds (for instance, plants and invertebrates) could be even more affected by climate change. As the ranges of species change, species communities and interaction between species will change as well. This can cause unsaturated species communities with a high risk of the introduction and spread of invasive species (Auniņš 2009).

Buse et al. (2015) report that xerophytic grasslands appear to be less vulnerable to climate change than other habitat types studied by them, while mesophilous mountain grasslands resulted very likely to be affected by climatic changes, especially in the species composition and abundance.

In Poland longer summer warm periods are predicted, which might be even beneficial for 6210 habitat. Nevertheless, some typical species as *Pulsatilla* spp., may be negatively affected by strong summer droughts or by lack of winter frost periods, as there is some evidence that frost is necessary for successful *Pulsatilla* flowering and seed production, Wójtowicz 2004).

Pulsatilla slavica (Milan Barlog)

The impact of weather variability on the dynamics of a plant community in dry grassland was studied by Dostálek & Frantík (2011) in the Czech Republic. Correlations were found between different functional groups of species and individual species and weather variability. During a 9-year study in five nature reserves, the following responses of dry grassland vegetation to weather conditions were observed: (i) wetter conditions, especially in the winter, affected the dominance and species richness of perennial grass species and the decline of rosette plants; (ii) the year-to-year higher temperatures in the winter produced a decline in the dominance of short graminoids and creeping forbs; (iii) spring drought adversely impacted the overall abundance, especially the abundance of dicotyledonous species, and the species richness. However, these relationships may be manifested in different ways in different locations, and in some cases the vegetation of different locations may respond to weather conditions in contrasting ways.

Some experts involved in the preparation of this action plan have mentioned that species-rich grasslands are well adapted to changeable weather conditions. Xerothermic species take advantage in dry years, whereas mesophytic ones take over in wetter years.

According to some experts, the habitat itself is practically independent of ground water level, and their species are mostly adapted to the dry-semi-dry conditions. Thus, direct and well observable impacts are not expected. Indirect impact (increasing vulnerability and decreasing adaptation capacity) should not be excluded because of the possibly changing management and the potential emerging role of invaders – however, such impacts can be analysed only in local case studies.

Possible effects might be linked, in some cases, to climate change effect on water due to the dependence on the shortage of water to maintain the distinctive flora and grassland structure during the dry season.

3.5.3 Conclusions and recommendations

- Due to the lack of knowledge and evidence on climate change effects on this habitat, it seems appropriate to promote studies to fill this knowledge gap, to analyse the habitat vulnerability to climate change and identify possible adaptation measures. These studies should also include typical invertebrate species and potentially vulnerable or sensitive species with metapopulations.
- In order to contrast the possible consequences of climate change, local germplasm (seeds, propagules) deriving from suitable surrounding areas might be used to reinforce structure, density and floristic composition of the existing habitat patches, however a real contrast of the causes of this pressure can only take place at larger scale.
- Preventing habitat fragmentation and ensuring connectivity will improve the adaptation capacity of 6210 habitat to climate change.

4. HABITAT CONSERVATION AND MANAGEMENT OBJECTIVES

*These grasslands are **maintained by regular management through extensive grazing and/or mowing**. **Restoration actions may also be necessary** to recover the area, structure and functions where the grasslands are significantly degraded or have disappeared. Monitoring the impact of the habitat management is also important.*

Conservation objectives and priorities can be defined at biogeographical region level** to achieve Favourable Conservation Status and to address the main threats to the habitat, e.g. improvement of area, structure, function, restoration needs. These need then **to be translated into specific objectives at the country level.

*Conservation objectives also **need to be set in Natura 2000 sites** in order to maximise the contribution of the sites to achieving favourable conservation status of the habitat.*

***Action outside the Natura 2000 sites will also be necessary** to ensure its long-term conservation, ecological variability and adequate connectivity*

4.1 Background and context

The Habitats Directive requires establishing and implementing conservation measures to maintain or restore at favourable conservation status the habitat types and species of Community interest. According to the directive, the conservation status of a natural habitat will be taken as 'favourable' when:

- its natural range and areas it covers within that range are stable or increasing,
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The Directive also requires setting up the Natura 2000 network of special areas of conservation, where the necessary conservation measures for the habitat types and species present in the sites shall be established and implemented, as well as a protection regime to avoid deterioration of the habitats and disturbance of the species for which the areas have been designated. It also requires assessing plans or projects to prevent adverse effects on the integrity of the sites.

The EU biodiversity Strategy to 2020 requires that by 2020 the Member States restore at least 15% of degraded ecosystems in their territories. The strategy also aims to achieve a significant and measurable improvement in the conservation status of species and habitats protected under the two Nature Directives. The Strategy also pays particular attention to ensuring the effective management of Natura 2000 sites, in particular through the implementation of site management plans and conservation measures, as well as to the integration of species and habitat management requirements into key land and water use policies wherever possible.

4.2 Overall objective of this action plan

With the overall aim of achieving favourable conservation status, the plan suggests the establishment of general objectives for the conservation and management of this habitat type at biogeographical level, which should then be translated into more specific objectives at country level. The plan also suggests the identification of priority sites and areas to ensure the habitat conservation and to contribute to the objectives set at a higher level (e.g. biogeographical, national) both inside and outside the Natura 2000 network.

4.3 Setting objectives at biogeographical and country level

At the biogeographical and country level, it is necessary to consider the conservation status (CS) of the habitat type and the parameters that define this status (area, structure and functions, future prospects), and to analyse the threats or combination of threats that may have caused the current status and that determine the trends.

Where CS is Favourable: the objectives should aim to maintain the habitat in the favourable status by maintaining an appropriate management system of the habitat and preventing possible threats and pressures that could affect its status.

Where CS is Unfavourable (Inadequate-U1 or Bad –U2), it should be improved. Depending on the status of the parameters that are assessed in unfavourable status, this may require:

- Improving the range
- Improving the area
- Improving the structure and functions
- Improving future prospects.

Improving the range and the area would require restoring the habitat in suitable sites, and at the same time preventing the total area of habitat and the number of habitat localities in the country from decreasing. Appropriate sites for the restoration of the habitat should be identified and selected in the countries at the biogeographical level with a view to ensure the long-term conservation of the habitat and its associated species, its ecological variability and adequate connectivity across its natural range.

Improving the structure and functions. The structure and functions of a habitat type concern its species composition and diversity, ecological functions and processes that sustain the habitat, as well as ecological connectivity. Improving the structure and functions may be needed in areas where the habitat is degraded. This involves restoration and preventing further degradation through the removal and reduction of the main threats and pressures acting on the habitat type. Improving the structure and functions of the habitat also needs to consider the diversity and distribution of plant communities and species characteristic of the habitat on a national level.

Improving future prospects usually requires addressing underlying causes of the main threats and pressures on the habitat so that the trends in the different parameters can improve. Some examples in this regard can be: to reduce deposition of atmospheric nutrients, to stop scrub expansion and invasive species, to prevent abandonment and ensure suitable management of the areas where the habitat is present, etc.

General objectives

At the biogeographical and country level, the plan suggests the following general objectives:

- To **maintain the range and the area** and where necessary **restore and increase the area, maintain or improve the structure and function of these grasslands** (depending on current status of these parameters) and **ensure favourable future prospect** on all their distribution area in the medium-long term.
- To ensure the **preservation of the ecological diversity** of the habitat type and its characteristic plant communities as well as typical invertebrate species such as pollinators across its distribution area. This could involve setting specific goals for each country considering the diversity and particular features to be preserved across the region.
- To **ensure the ecological connectivity** across the habitat range. It is important to ensure the connectivity among the areas where this habitat is present as they play an important role in the connection of populations of some species like butterflies or other relevant pollinators, among other species of fauna and flora. Creating stepping stones with target vegetation to improve landscape connectivity is necessary for the functioning of plant and animal metapopulations.
- To **share and harmonise knowledge and experience** in protecting and managing the habitat among countries in the same biogeographical region.
- To **develop similar approaches in support schemes** (e.g. concerning types of subsidies/incentives) in all countries of the same biogeographical region.

4.3.1 Targets and quantitative values for conservation objectives

Specific targets for improvement of conservations status have been set in some countries, e.g. in terms of habitat area to be restored. In other cases, only more general objectives are set. Some examples are given below. Quantitative values for conservation objectives could be better set when the FRV(s) for the habitat type are known.

Examples of conservation objectives for dry grasslands 6210 in some Member States

- *Belgium (Flanders): increase the area up to 7.8 ha, which is an increase of 875% in relation to the current area. One SCI with 6210 is ranked as an essential site.*
- *Latvia: ensuring the landscape connectivity and characteristic ecological processes (vegetation structure diversity and nutrient cycle). Restoring suitable habitats to improve the number of localities and conservation status of typical, rare and vulnerable species and their populations. Restoring and maintaining the diversity of lichen, moss, invertebrate and higher plant species and communities (Rūsiņa, 2017)*
- *Luxembourg: expansion of habitat area through development of areas with potential for extensification, restoration of habitat areas that are intensively used, as well as restoration of abandoned and degraded areas. A target of at least 350 ha has been set for the habitat restoration of the habitat (as well as restoration of the habitat areas in the mining region, which are not included in this target as they are not quantifiable). (Naumann et al 2013) Creation of an ecological network of semi-natural dry grasslands and ensure genetic exchange between calcareous grasslands.*

4.4 Setting conservation objectives at site level

As said earlier in the text, 4,437 Natura 2000 sites have been designated for the protection and conservation of this habitat type. Many of these sites have been designated as Special Areas of Conservation and conservation objectives and conservation measures have been established for these areas.

Site level conservation objectives need to be set in Natura 2000 sites in view of establishing the necessary conservation measures required for the habitat types and species that motivate the site designation[19].

Site-level conservation objectives should define the condition to be achieved by the habitat type within the sites in order to maximise the contribution of the sites to achieving favourable conservation status at the national, biogeographical or European level.

Setting conservation objectives would require an assessment of the relative importance of each site for the conservation of this habitat type and of the actual potential of each site for the habitat, which requires investigation of the following aspects:

- The importance of each site for achieving biogeographical and country level objectives.
- the current conditions of the habitat in each site and the potential for its recovery or restoration
- the historical management that have maintained the habitat or the changes and the factors that may have led to habitat degradation, and possible long-lasting impacts.

Once this analysis is completed, a review of the conservation objectives already set for Natura 2000 sites where the habitat is found could be carried out in order to adjust or improve their definition where required. Furthermore, the corresponding objectives for those sites where conservation objectives have not been set yet should be established in view of their relative importance, conditions and potential for the habitat type.

When defining site conservation objectives, the following aspects should also be considered:

- The ecological requirements of the habitat in each particular site,
- the threats and pressures acting on the site that may affect the habitat,
- the conditions in the surrounding areas, which can influence the status of the habitat in the site.

An example of quite detailed conservation objectives set for this habitat type in a particular SAC in Ireland is presented below (Table 6).

[19] Commission Note on Setting Conservation Objectives for Natura 2000 Sites (2012), available at http://ec.europa.eu/environment/nature/natura2000/management/docs/commission_note/commission_note2_EN.pdf

Table 6. Conservation objectives set for the habitat (6210) in a SAC in Ireland

Conservation Objectives for : Clara Bog SAC [000572]

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

To restore the favourable conservation condition of Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) in Clara Bog SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco- Brometalia) often occurs in close association with other grassland habitats. Two small areas (1.36ha in total) of this Annex I habitat were identified by Dwyer et al. (2007). NB other areas may be present in the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 3 for known distribution	The habitat has been mapped at two location as small patches on the esker ridge to the north of Clara Bog. NB other areas may be present in the SAC
Vegetation composition: typical species	Number at a representative number of monitoring stops	At least seven positive indicator species present, including two "high quality" species	List of positive indicator species, including high quality species, identified by the Irish semi-natural grasslands survey (O'Neill et al., 2013). This document should be consulted for further details
Vegetation composition: negative indicator species	Percentage at a representative number of monitoring stops	Negative indicator species collectively not more than 20% cover, with cover by an individual species not more than 10%	List of negative indicator species identified by O'Neill et al. (2013)
Vegetation composition: non-native species	Percentage at a representative number of monitoring stops	Cover of non-native species not more than 1%	Attribute and target based on O'Neill et al. (2013)
Vegetation composition: woody species and bracken	Percentage at a representative number of monitoring stops	Cover of woody species (except certain listed species) and bracken (*Pteridium aquilinum*) not more than 5% cover	Woody species that can occur above 5% cover are juniper (*Juniperus communis*) and burnet rose (*Rosa spinosissima*). Attribute and target based on O'Neill et al. (2013). Dwyer et al. (2007) notes encroaching scrub and bracken (*Pteridium aquilinum*) at this site
Vegetation structure: broadleaf herb: grass ratio	Percentage at a representative number of monitoring stops	Broadleaf herb component of vegetation between 40 and 90%	Attribute and target based on O'Neill et al. (2013)
Vegetation structure: sward height	Percentage at a representative number of monitoring stops	At least 30% of sward between 5cm and 40cm tall	Attribute and target based on O'Neill et al. (2013)
Vegetation structure: litter	Percentage at a representative number of monitoring stops	Litter cover not more than 25%	Attribute and target based on O'Neill et al. (2013)
Physical structure: bare soil	Percentage at a representative number of monitoring stops	Not more than 10% bare soil	Attribute and target based on O'Neill et al. (2013)
Physical structure: disturbance	Square metres	Area showing signs of serious grazing or other disturbance less than 20m²	Attribute and target based on O'Neill et al. (2013)

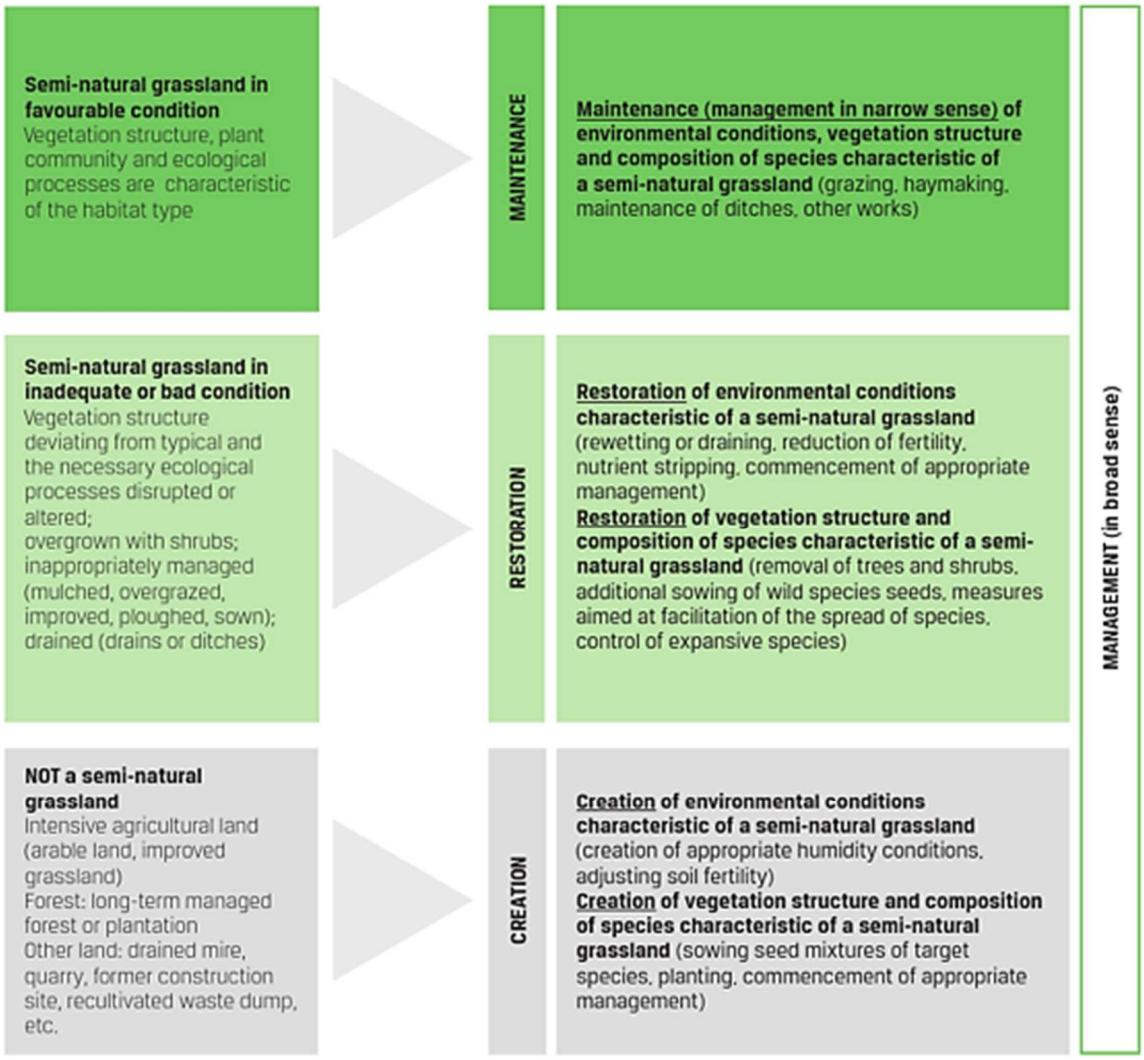
Furthermore, depending on the coverage of this habitat by the Natura 2000 network, taking action outside protected areas may be necessary to ensure the long-term conservation of the habitat, its ecological variability and adequate connectivity across its natural range, as well as for the conservation of species associated with the habitat, might require.

Table 4 on pages 33-34 provides the percentage area of this habitat type in Natura 2000 by country and biogeographical region (based on information from Art. 17 Dataset). A more detailed analysis should be carried out at national and biogeographical level, to determine the most appropriate areas to improve the conservation status or to restore the habitat.

4.4 Determining objectives and management approaches in a particular area

Depending on the condition of the grassland, maintenance, restoration or re-creation may be necessary (see definitions below).

Figure 16. Management approaches in semi-natural grassland conservation (Rusina (ed.) 2017)



Semi-natural grassland maintenance involves preserving and maintaining the species composition and structure characteristic of the semi-natural grassland and the ecological conditions and processes required for its maintenance in a favourable condition. It usually requires implementing recurring measures (grazing, mowing, etc.) often on an annual basis. Special attention is needed to also take into account management needs of typical invertebrate communities. There is a growing number of examples, where managed dry grassland sites do very well in terms of typical plant species and vegetation, however virtually empty of typical invertebrate species such as for example butterflies. Insect decline in Annex I Habitats has been shown to occur widely at least in some regions in Germany in well-protected areas (Hallmann et al. 2017) but also in other countries, as Nertherlands for instance (Hallmann et al. 2018), and is suspected to be a European if not world-wide problem. Among important factors suspected to be the main reasons are pesticides including seed-coatings, monotonous and over large areas simultaneous management such as mowing complete habitat occurrences in a site within a day or two and fragemtation. Therefore also the faunistic components need effective management.

Restoration involves improving the grassland condition where some of the grassland habitat type features or processes are still present. For example, restoration of grassland overgrown with shrubs where ecological conditions and processes that sustain the habitat are still present (e.g. soil composition and chemical properties). Ecological restoration usually includes one-off measures, like cutting trees and shrubs or grinding of roots. It can also involve more intensive grazing and mowing over a certain period of time until shrub regrowth is controlled and more extensive and regular maintenance grazing or mowing can be carried out (Rusina, 2017).

Re-creation of semi-natural grassland involves creating the environmental conditions necessary for the habitat and to introduce the habitat characteristic species in a place where the habitat has disappeared. Re-creation of habitats may be more relevant in countries where current habitat area is smaller than the area that can provide favourable conservation status for its species and communities, and where the existing area is decreasing due to abandonment, intensification or other causes that led to the habitat disappearance. Re-creation can at least partially compensate for the consequences of habitat destruction and reduction of its area.

The guiding principle is that **it is always better to protect and maintain natural ecosystems** by, wherever possible, eliminating the adverse effects and extensive pressures, as restoration of degraded ecosystems always involves the risk of failure and high costs. Many natural values may be irretrievably damaged and the resources and investments required to restore natural ecosystems far exceed the resources needed for preserving them. The costs increase with the increase in degradation level. Thus proper conservation and maintenance of natural ecosystems is always a priority, and restoration or management is to only be used as a tool to recover already degraded ecosystems. Recreated habitats often remain species-poorer even on the long term in a fragmented landscape where recolonization is harder or even impossible for some species.

In general, restoration of the former “ideal” situation (in terms of habitat area, species composition and functional processes) is only possible if there are no irreversible or significantly degraded conditions in the area and surroundings that would make the

restoration of habitat and its necessary processes impossible (Rusina, 2017, *or* Priede and Rūsiņa, 2017). Sometimes only improvement of the status is possible.

Ecological restoration or the creation of semi-natural grassland habitat is a time-consuming process. Restoration can only achieve the results quickly (e.g. within 2 years) if most of the characteristic species are still present and all the required ecological processes are taking place. However, in most cases, the restoration process takes at least 5-10 years (Rusina, 2017) and for a more complete restoration of invertebrate species populations will take several decades.

After restoration activities have achieved their expected results, maintenance measures are required to keep the grassland in good condition. Moreover, restoration and maintenance measures are often not strictly separated, but they may occur at the same time.

5. CONSERVATION AND RESTORATION MEASURES

*The **maintenance of this habitat in good condition is dependent on extensive grazing or mowing**, depending on local conditions and historic management practices. Control of scrub or invasive species may also be necessary.*

*Adapting **management to the needs of particular species** may be required depending on the conservation objectives of the sites.*

5.1 Key management practices for maintenance of the habitat in good condition

This habitat type in general is not a climax community and relies on extensive management practices over almost all of its range. The key biotic factors for its conservation are strongly related to the possibility of limiting the secondary succession. This is generally assured by the grazing activity of wild herbivores and, especially, domestic livestock (sheep, goats, cattle, horses, donkeys). Mowing may be a suitable tool for conservation on the most mesic aspect of the habitat (i.e. with a moderate supply of moisture).

Whether grazing or mowing is the most appropriate regular management for high quality calcareous grasslands may depend on the conditions and historical management of the particular areas and on the subtype of habitat present. Although most studies recommend grazing as the most appropriate management for calcareous grasslands, Fischer & Wipf (2002) found that in the upper sub-alpine region, calcareous grasslands that have been traditionally mown were favoured by mowing, rather than by grazing. There are differences in species composition in grazed and mown grasslands, which correspond to different vegetation units and subtypes. To retain the full biodiversity of 6210 habitat, a regionally adapted combination of both managements may be needed.

History and the nature of the community are very important variables when defining appropriate management regimes (Grime et al. 2000, Britton et al. 2001). In an experiment on the effects of several management regimes (grazing, mowing, and non-intervention) on the biodiversity of Dutch chalk grassland, grazing resulted in the highest level of biodiversity, non-intervention in the lowest level (During & Willems 1984). Moreover, grazing proved to be more efficient than mowing in countering the effects of increased nitrogen levels (Butaye et al. 2005).

Where there has been no previous history of mowing, the likely effects on conservation of the grassland community of a change from grazing to mowing need to be evaluated. This may be particularly critical for invertebrates. The invertebrate species present will in fact be those whose life cycles fit with the existing long-established management regime. In a similar manner, conversion from a traditional mowing regime to grazing is likely to result in changes in plant species composition (Rodwell 1992). Early flowering species, which rely on seed production for maintenance of populations, may be reduced or eliminated by such change. If there is any doubt, the precautionary approach of avoiding changes in long-established management should be adopted in order to fulfil nature conservation objectives (Crofts & Jefferson 1999).

Priority habitat with orchids (Jaroslav Košťál)

5.1.1 Grazing

Dry calcareous grasslands tend to be low productivity systems, which produce low yields of digestible herbage, and so they are usually maintained by grazing rather than mowing. Grazing plays a key role in maintaining species richness by limiting the ability of competitive species to achieve dominance. It is also the preferred option when managing for invertebrates. Except at very high stocking densities, grazing removes plant material more gradually than cutting. This can give more mobile invertebrates a chance to move to other areas within the grassland (Crofts & Jefferson 1999).

The long-term impacts of different grazing regimes, however, are not well known, particularly in terms of the invertebrate communities. Studies made on the impact of pastoral activities on calcareous grasslands in Bourgogne show that in spite of an increase in floristic diversity, the repercussions on the invertebrates can be both positive and negative, depending on the pastoral practices (Croquet & Agou 2006). Ungrazed areas are also important for the shelter or over wintering of microfauna (Pearson et al. 2006).

Grazing also has other benefits. Moderate trampling can be beneficial: the hoof action of heavy animals, such as cattle, breaks up the litter layer and tramples and crushes coarse vegetation. In addition, animal hooves create a certain amount of bare ground. This is important for the life-cycle of many invertebrates and also for types of plant that require bare ground in order to germinate and establish (Calaciura & Spinelli, 2008).

Grazing regime

The biological features of a grassland are profoundly influenced by, and in many cases fundamentally determined by, the grazing regime imposed upon it. The type of animals

used, the stocking density and the timing of grazing are all important factors to consider (note that type of animal includes species, breed, age, sex and experience).

The options for establishing an appropriate grazing regime for conservation are based on a number of different parameters:

- stock type (cattle, sheep, ponies, etc.) and stocking rates
- grazing periods (season of grazing) and duration of grazing
- grazing system (sequence and pattern of grazing events)
- penning usually outside the habitat if needed at all.

The way in which these parameters interact with each other to affect the grassland is often complex, making accurate predictions of outcome more difficult. However this also means that a desired result can often be achieved using a variety of regimes.

Grazing animals

Grasslands are maintained with different grazing animal types throughout Europe including cattle, sheep, goats, donkeys and horses. All the stock types, at low stocking densities, produce grasslands with patchy structure and mixed. The pattern and scale of the vegetation mosaic can differ according to the choice of stock: different animals may create different types of microhabitat (Crofts & Jefferson 1999).

How such low stocking densities are measured has a large effect on the effectiveness. A shepherded flock moving continuously has a high local stocking density, but may have a low wide-scale density. Low overall density stocking within a fenced area results in very selective grazing and can result in quite a different end product as stock is not ever forced to graze the less desirable components. Pasturing systems that are able to take nutrients out of the systems are preferable.

All animals graze selectively. Favoured elements of the vegetation are eaten first while less desirable plants are left until last, or not grazed at all. Grazers' selection and rejection of certain plant species in preference to others can play a key role in maintaining species richness and determining the structure and floristic composition of the grassland.

Sheep grazing (C. Olmeda)

Cattle differ greatly from sheep in that they prefer to eat longer grass and they cannot graze as selectively. Cattle curl their tongue around the vegetation and tear away plants leaving tufts of un-grazed vegetation and short grazed areas, while sheep are more selective feeders than cattle and eat the top part of the plant while they move across the grassland creating a more homogeneous structure in the vegetation (McDonald 2007a). Cattle are pullers, leaving open patches, as well as structural variety in the vegetation heights. Such 'open' structures support a range of seed- regenerated plant species, such as *Primula veris*. Sheep are lawn-mowers, promoting tillering and closing of the vegetation, fostering rhizomatous species. These two mechanisms pull in opposite directions, with consequent outcomes on the vegetation (and hence the invertebrate communities supported).

Goats can either graze or browse on bushes. Horses are able to graze much closer to the ground than both cattle and sheep and need to graze for a much longer period of time due to the difference in digestive physiology (Rook et al. 2004). Donkeys are similar to ponies in that they graze selectively. Rabbits will not graze tall grasslands, are highly selective grazers and at moderate densities they produce a patchy mosaic of small areas nibbled to different heights. Body size is also important: smaller animals select higher quality food as they need more energy relative to their body size (Rook et al. 2004).

The species of livestock has however a minor effect when grazing pressure is high; damage, in the form of an overall reduction in plant species richness, was found at sites heavily grazed by both horses and cattle (Crofts & Jefferson 1999).

Trampling effects also vary by species. The physical pressure exerted on grassland by sheep is estimated to be 0.8 to 0.95 kg per cm^2 and by cattle to be 1.2 - 1.6 kg per cm^2 (Spedding, 1971).

Maintaining the type of livestock that has been traditionally used in an area should be the preferred option and changes may lead to negative impacts. Many characteristic plant species have adapted to grazing by a specific animal tend to disappear when the type of animal is changed, as they become vulnerable to a different way of grazing (Pearson et al. 2006). The conditions in different geographical areas also determine the type of livestock that can be best used. For instance, very dry pastures in Southern Europe generally are more suitable for sheep than for cattle grazing, as the former can better withstand the extreme conditions.

However, mixed grazing can at times be beneficial, since it may create different grassland structures depending on the grazing preferences of the different animals; the food preferences of the different grazers are unlikely to coincide. The regime may require them to be grazed separately: cattle, for example, can be used to graze off tall late season grasslands initially, to be followed by sheep or ponies once the grassland height has been reduced to a level that these other grazers can cope with more effectively. Different sources of grazing need to be identified and assessed separately so that only the most appropriate adjustments are made (Crofts & Jefferson 1999).

In grasslands that have been ungrazed for some time, goats can be used to remove scrubs and bushes that have begun to grow on the site. The introduction of goat paddock grazing can be an efficient method for restoring shrub-encroached dry grasslands. It was proved in a study that investigated the impact of goat paddock grazing with a relatively high grazing pressure (0.6 to 0.8 LU/ha/year) over seven years on habitat structure and species

richness in six encroached dry grassland localities of the lower Saale River valley in Central Germany. The reduction of encroachment and the increasing number of target species correlates with the improved conservation status of these highly valuable dry grassland habitat types (Elias et al. 2018).

Grazing by goats at Special Area of Conservation Devínska Kobyla (Viera Šefferová)

Grazing pressure. Stocking densities

Grazing pressure is a measure of the amount of vegetation that a given number of grazing animals of given species and size are expected to obtain from an area of grassland during the time for which they are grazing it. When grazing pressure is allowed to exceed the carrying capacity of the grassland it would normally result in damage to the sward's ecological and productive character and this is equivalent to the concept of overgrazing. The numbers of grazers and the length of time for which they remain on the site that will determine the outcome of the grazing regime.

The grazing pressure is considered optimal if it promotes and maintains the mosaic of vegetation – leaving uneven sward lengths and producing tussocky field. This is only possible if the grazing animals are allowed to selectively graze the sward. Only extensive grazing creates an opportunity to selectively consume plants. In contrary, intensive grazing produces uniform sward height leaving less possibilities for different plant and animal species to survive.

To evaluate the livestock load it is useful to carry out a survey of pasture vegetation. The essence of maintenance grazing lies in ensuring that each year's production has been removed before the start of the next growing season. The annual yield of plant biomass sets the upper limit for the grazing pressure that can be sustained by a particular sward. Conservation objectives generally require stocking levels that are lower than the carrying capacity of the grassland. This allows a significant proportion of the sward's annual production to escape being grazed by livestock so that it can enter other food chains (e.g. invertebrate herbivores or decomposer communities) or enhances the structured diversity

of the habitat. This would need stocking levels to be reduced well below the theoretical carrying capacity of the sward in order to ensure that sufficient vegetation remained ungrazed during the growing season for meeting conservation objectives (Crofts & Jefferson 1999).

Nonetheless, in many cases it is not possible to define the optimum successional stage and hence stocking density in practice. In small habitat units it can be particularly difficult to strike a balance in grazing intensity that avoids both scrub invasion and overgrazing. It is uncertain whether this management alone is sufficient to counteract further scrub.

Timing and duration of grazing

The timing of grazing is important. Spring-time grazing has the most direct impact on the growth of plants, as this is when leaf production is at its greatest. Spring grazing intensity should not be too high to allow plants to grow and flower. Otherwise, it may have a detrimental impact on the plant community composition. Autumn grazing can also decrease the amount of food that plants are able to store over winter, reducing their vigour the following season.

As regards grazing duration, it is assumed that there is an inverse relationship between stock numbers and duration of grazing. Short periods of intense grazing may be appropriate in situations where problem weed species exist. However, the effect of short periods of heavy grazing on grassland in general is likely to be catastrophic for some invertebrate species that are dependent on continuity of grassland structure over their entire life cycle. It will be least harmful in winter when most above ground insects are in a dormant phase of their life cycle. The same annual grazing pressure can still be achieved by using a lower stocking rate but only if it is maintained over a longer period of time; the desired grassland structure is still achieved but more time is given for invertebrates to re-distribute (Crofts & Jefferson 1999).

Grazing system

The grazing system is the routine, organised sequence for moving grazing stock over an area of pasture. The various grazing systems can, in essence, be simplified down to two fundamental strategies: set stocking and rotational grazing, which can also be combined (Calaciura and Spinelli, 2008).

Set stocking system is practiced where a ‘set’ number of animals is left in a field for a long period of time, sometimes all year. At low stocking rates, set stocking can allow the ungrazed parts of grassland to develop phonologically, thus providing more ecological niches for animal species to exploit (flowers, seeds, standing and fallen dead material) (Crofts & Jefferson 1999). By maintaining low stocking rates, invasive plant species will be controlled whilst maintaining the invertebrate fauna that depend on the grasses (RSPB 2004b). Stocking density can be adjusted as required, usually being reduced as the season progresses and grassland productivity declines. Where grazing or trampling threatens particularly valued plant species, it could be necessary to create special areas in order to protect these species from grazing pressure (Colas & Hébert 2000). Orchids usually do not tolerate trampling. If a newly grown leaf rosette is damaged, it will no longer regrow. In very low density grazing systems, some orchid species can still survive and build up considerable populations. Early mowing is also unsuited for them since the species flowers

in June and July (Rusina, 2017). It is indeed possible to improve the composition and the quality of grassland swards, encouraging the regeneration of rare and threatened plants that are characteristic of this habitat, by fenced enclosures.

Rotational grazing is where the area for grazing is divided up into compartments (fields, paddocks or strips) or where the flock or herd is under the active management of a herder and the stock is moved to fresh grazing units at appropriate intervals. The animals are moved to new areas at regular and frequent intervals, progressing around the whole grazing area in a structured sequence. They return to graze the initial area when the grassland will have recovered its full productive capacity, but not yet started to flower (Brockman 1988).

Rotational grazing can be used to achieve conservation management goals, particularly when short grasslands are required to maintain the more specialised communities, which depend on them, and when the grassland area is scattered over many separate sites. This approach often works best on sites requiring winter grazing, since the objective is simply for the animals to graze as much as possible of the past seasons growth. Once this is done the grassland is ready for the onset of the new season's production (Crofts & Jefferson 1999).

For containment and in order to create several zones where the grazing will be carried out in turn, fencing for livestock is suitable.

Transhumance and transterminance. Long and medium distance livestock movements (using transhumance for movements over 100 km and transterminance for shorter distances) are a key practice for maintaining these grasslands, especially when using traditional livestock paths (*tratturi* in Italy, *draillies* in southern France or *vías pecuarias* in Spain) and preserving related traditional ecological knowledge (Otero-Rozas et al. 2013). Transhumance and transterminance help seed dispersal, especially relevant in long distance dispersal (Manzano and Malo, 2006). This dispersal and the associated genetic exchange is critic for preparing grasslands for climate change. In some EAFRD programs there are specific measures for preserving these traditional practices and its associated habitats.

5.1.2 Mowing

Mowing is appropriate where it has been the traditional management of grasslands or as an alternative where grazing, while preferred, is not a practicable option. Like grazing, regular mowing prevents the dominance of robust competitive grasses, herbs and the establishment of shrubs and trees, maintaining the grassland community as long as it is practiced. However, mowing does not create the same mosaic of habitat conditions as grazing, particularly when a homogenous mowing regime is applied (Crofts & Jefferson 1999).

Low-intensity grazing is often considered a good management technique (and even better than mowing) because it is expected to create small-scale heterogeneity through varying grazing, trampling and defecation patterns of the livestock, which should allow more species to coexist than under the homogenizing regime of mowing. By contrast, Turtureanu et al. (2014) found that plant species richness was far higher in mown than in grazed dry grasslands (+25.8 species = 51% at 10 m^2) of otherwise similar conditions, and

this difference existed across all spatial scales tested (1 cm^2 to 100 m^2) (based on Dengler at al. 2014). Sampling covered different management regimes and vegetation types of the phytosociological class *Festuco-Brometea* of the Transylvanian Plateau in Romania.

Mowing/cutting management methods are distinguished by: timing, frequency, distribution and methods.

Timing of cutting

Management of meadows for nature conservation normally involves a single late cut. Cutting dates will substantially vary according to location and the nature of the wildlife interest (Crofts & Jefferson 1999).

Late cutting can be useful to protect animal species that need a highly structured vegetation for feeding and refuge, in particular birds and insects, and to allow that late-flowering plants can produce seed. Furthermore occasional late hay cut (late August/September) (e.g. 1 year in 5) is practical on sites, which support late-flowering species (Crofts & Jefferson 1999).

Early cutting can be useful where there is a rich vegetation that would otherwise start to decompose, and to slow down the development of alien species. However, sustained early hay cutting is known to reduce species richness in meadows (Smith 1994). Cut should not take place before breeding birds have hatched or populations of “desirable” characteristic plant species, which depend on seed production for regeneration have set seed.

Frequency of cutting

The Mesobromion grasslands are generally mown once a year-sometimes even once every two years - due to their low productivity (Pearson et al. 2006), although more mesic and productive grasslands can stand two cuts (Rodwell et al. 2007). More than one cut in a year may be necessary to simulate the former grazing management where this is no longer possible.

As a general rule, however, the mowing should not be possibly carried out more than once or at the most twice, because more frequent mowing limits the possibilities of development for many animal and plant species (Essl 2005).

Distribution of cutting

It is advisable to avoid cutting the whole of a grassland area at one time, but to spread the timing of the operation so as to avoid damaging the microfauna. Reptiles, insects and spiders move either very slowly or not at all and it is therefore important to leave uncut areas where they can take refuge. Spread cutting dates also prolong the pollination phase of plants and the availability of nectar and pollen. For that reason it is sensible to exclude from cutting a small proportion (ca 5-10%) of the total area, cutting it in the following summer. This should be done every year with a different part of the surface, on rotation, going back to any particular uncut patch of land every 4-6 years (Pearson et al. 2006). Furthermore seam communities and ecotones are extremely species rich and needed for many invertebrates for example to hibernate, or use ressources in autumn and winter. Therefore these sensitive areas should not be mown every year and never the whole margin zone in the same year. These ecotones also should not be transformed into

agricultural (often sealed) paths and become barriers for species (e.g. roads on forest margins).

Methods of cutting

If possible, it would be better to use cutter bar mowers. The use of rotary mowers kills many more animals, which have no way to escape. The use of rotary mowers needs to be combined with a change in the usual height of cutting (8 - 10 cm) and a shift to cutting from the inside towards the outside if the escape of animals from the meadow is to be facilitated (Pearson et al. 2006).

Very low cutting heights should be avoided, as there is a likelihood of excessive "scalping" resulting in the creation of bare patches in the grassland. These provide favourable areas for the invasion of undesirable species. Conversely, some small-scale disturbance may be necessary for seed germination and may be beneficial for invertebrates. It is advisable to avoid using forage press machines, which cause great damage to the fauna (at least 30 to 60% mortality of bees). Cut material should generally be removed to avoid nutrient enrichment of the grassland.

5.1.3 Management for wildlife

It is important to remember that the historic management at a site will have shaped the range of taxa found there and this pattern should be maintained where known. A rich array of species have adapted to the grazing or mowing regime traditionally applied in an area. Many of these species also benefit from the margins and areas of transition between one vegetation type and another, and their management requirements may vary.

Adapting management to the needs of a particular species is not always advisable as there may be impacts on other interest features. It seems generally advisable to use management approaches that can benefit different species groups present on the site.

When defining the grassland conservation priorities from a species conservation point of view, attention should be paid to the presence of locally or nationally rare species.

Invertebrates – habitat structure and management requirements

Depending on the grassland type and plant species composition, a unique set of invertebrate species (insects, spiders, snails) can be present in dry calcareous grasslands. These grasslands provide an important nectar and pollen resource for many insects. During the flowering season, a high diversity of butterflies and other anthophilous insects – Coleoptera (beetles), Hymenoptera (wild bees, wasps, etc.), and Diptera (e.g. hoverflies), is observed. There may also be many grasshopper and bush cricket species (Orthoptera). These Orthoptera need low or open vegetation to be able to leap and for their thermal requirements. This depends completely on species and also life stage e.g. *Decticus verucivorus.*

This habitat has also a rich soil fauna – small arthropods, nematodes, insect larvae, earthworms. Grazed grasslands can have a diversity of saprophagous (feeding on decaying organic matter) invertebrates (insects, mites, nematodes), which depend on animal excrement. Areas trampled by livestock and free sand patches are important for insects in dry pastures.

Local invertebrate populations have evolved strategies adapted to traditional management practices. If there is a long history of grazing or mowing on a site, with a known management pattern, this should be continued to ensure adapted invertebrate life strategies can be maintained. Different levels of grazing produce different sward types, from very short grass to long grass with shrubs. All sward types are valuable for species of conservation importance, and some important species actually require more than one type per site or even detailed mosaics of micro-habitats (Alexander 2003).

Very short swards tend to favour open ground species including predators and foliage feeders, and - where the short sward is maintained by large herbivores - dung fauna (Alexander 2003). Areas of bare soil trampled by livestock and open sand patches are important for insects in dry pastures, especially bees and wasps.

However, excessive and badly timed grazing could create soil disturbance that reduces the diversity of epigeal (soil surface) beetles and land snails (Rusina (ed.) 2017). Excessive grazing can completely degrade the invertebrate fauna.

Taller flowery swards, maintained by periodic grazing followed by relaxation of grazing pressure, tend to favour plant-feeders associated with flowers, fruits and buds (Alexander 2003). Denser, coarser grasslands with few flowers but abundant litter favour decomposer species, as well as providing cover for roosting and overwintering (Alexander 2003). Tussocky areas are important structural components of grassland for spiders.

Many insect species require a mosaic of features rather than one single feature alone, and often the site needs to be in a complex landscape with additional features available within easy flying distance (Alexander 2003, Ssymank 1991 for hoverflies). Many species rely on the presence of trees and shrubs, scrub and woodland within the habitat or close by.

Butterflies usually exist in a network of local populations with some exchange of adults between them to form a metapopulation. Management should aim to maintain this population network across the landscape, accepting that not every locality may be suitable at any one time (though some core sites will be) (van Swaay et al 2012). Butterfly populations can be badly damaged, or can even become extinct, following intensive and uniform management (van Swaay et al. 2012; Westrich 2018).

Bees dependent on one or a few flower species can be strongly affected by removal of such resources through grazing or mowing at the time of maximum flowering, so again rotational management is a reasonable approach. If an entire site is grazed or mown within a few days or weeks, this vastly reduces the site's conservation status for insect flower visitors.

Varying the grazing pressure temporally and geographically has a very different effect to applying the same procedure every time. Such variation allows invertebrate populations to cope with localised removal of resources which would otherwise be fatal to an annual life-cycle.

For invertebrates, it is important that the scale of rotation or variation of management should not be greater than around 100 m, which corresponds to the maximum foraging range of most of the smaller solitary bees (Zurbuchen et al. 2010a, b).

Insects do not have long-term resting stages and therefore need continuity of habitat from one generation to the next (unlike plants with a seed bank capable of remaining viable for many years). Continuity of management is therefore essential for the invertebrates. At the same time, a rotational impact over a longer period than a year is beneficial to invertebrate populations, as species which over-winter in seed heads are not removed by annual cutting, whilst bees benefit which are associated with flowers which bloom after early hay cuts.

Habitat management recommendations for invertebrates (van Swaay et al 2012, Alexander 2003):

- Create areas of bare soil and open sand patches on south facing slopes with grazing animals and periodic scrub cutting interventions.
- Maintain spring flowering shrubs such as *Prunus spinosa* and areas of late summer flowering plants (Asteraceae, Fabaceae, Campanulaceae etc.)
- Maintain mosaics of habitats by using shepherded grazing or periodic grazing followed by periods with little or no grazing to keep patches with tall grass and shrubs.
- Restore suitable habitat patches to provide corridors and stepping stones linking the core populations of mobile invertebrates with meta-populations.
- If the habitat is mown, cutting dates should be varied as much as possible across each Natura 2000 site so that not all areas are cut within a narrow time window. Ideally a mosaic of small scale cutting should be implemented, replicating traditional management before mechanisation. Margins and ecotones need special attention and should never be cut completely.

Managing dry calcareous grasslands for wild bees

- Solitary bees require a combination of their specialised foraging plants and their nesting habitat in close proximity. For example, *Andrena fulvago* requires late-flowering yellow Asteraceae and sparsely vegetated soil in which to mine its nests.
- Bumblebees require a landscape that provides a long time-span of flowering resources (different species have different preferences for flower types); nesting areas (either in litter on the ground or, more usually, old underground small mammal nests); mating areas; and hibernation areas usually underground).
- Where mowing is used it is normal practice to remove arisings. However, there is a small group of bees which nest in old snail shells e.g. *Osmia bicolor* and *Osmia aurlenta*. These shells can be removed under the raking up, effectively removing one of the partial habitat components essential for the successful completion of the life history. There is no easy answer to this, some form of rotational management being often a reasonable approach.
- Efforts should be directed to increasing very small-scale structural heterogeneity, such as open patches of soil that benefit wild bees (Murray et al. 2012).

Managing dry calcareous grasslands for butterflies of the Habitats Directive

- *Maculinea arion* requires a short-grazed vegetation suitable for the plants *Thymus* species and *Origanum vulgare* and ants (*Myrmica* species especially *M. sabuleti*). The ideal vegetation height is different in different parts of its distribution range, typically less than 2-3cm high in the northern part of its range while it can be >20cm in southern regions (EC, 2009). The most significant factor for successful reproduction is that the plants on which the eggs are laid and the ant hosts of the larvae are close together (Casacci et al, 2011). This also helps other species living as larvae in ant nests with similar biology like for example the genus *Microdon* from hoverflies.
- *Colias myrmidone* requires patches of the larval food plant *Chamaecytisus ratisbonensi*s on warm dry grassland within a varied habitat mosaic with some forest edges and open forests. The grassland must be extensively and unevenly grazed, so that patches of scrub and rough grass are left where caterpillars can hibernate in the litter layer (van Swaay et al 2012). Overgrazing by sheep is harmful as they eat the fertile shoots of the food plant, as is burning.
- *Parnassius apollo* requires the presence of host plants *Sedum* spp. in rocky places with shallow soil, such as rock outcrops, dry stonewalls, or stone terraces (Gimenez Dixon, 1996). It needs extensive livestock grazing or mowing that maintains an abundance of nectar plants such as thistles, without pesticide use and removal of flowering weeds (van Swaay et al 2012).

Where grassland restoration is necessary and a suitable management regime is to be reinstated, the conditions for invertebrates in general could be improved by promoting flower-rich grassland for both generalist flower-visiting species and, where possible, specialist flower feeders.

Birds

The composition of bird species depends on several factors. Moisture regime, terrain, grassland vegetation height and structure during the breeding season and the presence of various landscape elements affect birds most. These parameters are generally determined by whether the grassland is mown or grazed. During the breeding season, some species spend the entire time in the grassland – both feeding and nesting, while other species use it for foraging only and breed in other nearby habitats. During the passage migration (spring and autumn), the number of bird species in the grasslands can also be important depending on the location (Rusina (ed.) 2017).

Grazing maintains low vegetation, making it easier for the grassland birds to access soil and providing heterogeneous height of mosaic-type vegetation, which can provide suitable conditions for some birds nesting on the ground. On the other hand, grazing can create the risk of nest trampling (Pavel 2004).

Understanding how grassland management, such as timing of mowing, affects birds is very important as it can influence the number of species that can feed and breed on grasslands. Early cutting can affect the breeding success of ground-nesting birds by destroying nests

before the young have fledged. Delaying hay cutting increases the abundance of seeds and invertebrate prey for birds; however, increasing sward height and density can impede access to food and limit the grassland attractiveness as a food source. If breeding birds are likely to be present, it is wise to carry out a survey during the spring and identify what and where they are. Nesting locations can then be avoided when the meadow is mown, leaving areas with nests to be cut later, after the young have fledged.

Furthermore, conservation of the diversity of bird species requires retaining shrubs and trees in certain areas, which has to be considered when scrub and tree removal is planned. This will also promote the structural diversity of the grassland and create ecological niches for grassland bird species that require open land.

Mammals

The growth of vegetation in the spring offers opportunities for small mammals, but these are short term as the subsequent cutting and grazing makes the habitat largely unsuitable. However, any pockets of tussocky grassland and taller herbs that are managed on a longer rotation within the habitat mosaic can be beneficial for small mammals such as harvest mice (*Micromys minutus*).

5.1.4 Managing conflicts of interest

In the conservation and management planning of semi-natural grassland hábitats, conflicts can arise when there are species that require different environmental conditions and therefore can react to management differently. In these cases, the conservation objectives of the site will define which is the priority species. Either the main value of the grassland is selected and the management approach is adapted to that (in such cases other nature values can suffer and decrease over time), or a compromise is chosen that will preserve all target species, even if each species will occur in a smaller number or proportion.

Insects, for instance, need open areas alternating with scrub areas, on a scale of one square meter, while birds or mammals need more extended areas, on the scale of one hectare (Croquet & Agou 2006). The desirable sward structure or mosaic of structures for a particular grassland site will depend on the particular nature conservation objectives.

Late mowing can reduce nest and chick destruction of certain bird species but it can also reduce the number and diversity of plant species, because it causes the accumulation of soil nutrients and leads to the excessive growth of certain grass species that suppress the diversity of other plant species. A compromise in this case would be mowing early with the use of bird-friendly mowing methods (animal scaring devices, mowing direction), or mowing only part of the area. The diversity of plant species will be preserved at the expense of a slight decrease in certain bird species breeding success in the specific grassland, since some nests could still be damaged. In general, however, both plant diversity and the target bird species population will be retained.

In all cases, the conservation priority and the conditions of the grassland should be evaluated, avoiding trying to transform the grassland into a system that will not be sustainable due to local environmental conditions. When assessing the conservation priority, one should consider the potential threat to species in a wider context, giving highest priority to species whose populations are globally endangered (according to IUCN

criteria), and then to species and habitats endangered on an EU or regional level (annexes of the Birds Directive and Habitats Directive, EU and national Red lists of species). Finally, the national and local threat level should be evaluated. If the main value of the grassland is a species rather than the habitat as a whole, then management should be selected to ensure the survival of the species. It should be noted that different protected species have different requirements.

The possible solutions should be considered in the context of the conservation objectives for the site. Some solutions may conflict, so action taken will be determined by overriding objectives.

Some examples of the measures that are considered appropriate for the conservation of this habitat type in different countries are presented below.

Management for 6210 habitat maintenance in some EU countries

In ***Germany***, two major subtypes of the habitat 6210 can be distinguished depending on the historical land use and management they rely upon: traditionally extensively mown habitats of 6210 and extensively grazed ones. Both groups have different vegetation types and characteristic species and their own regional variation. For the subtype created by mowing, the typical conservation measure is mowing once a year or in some variants mowing every 2-3 years only. The date of mowing depends on the species composition, e.g. different kinds of orchids, and is mostly conducted in the high summer between mid-May and mid-August. To conserve and improve the structural diversity, the mowing should be carried out in sections at different times (Ackermann et al. 2016). For example, one-third of each site was mown each year always combined with removal of the cut vegetation (to prevent nitrogen enrichment of the soil) during the LIFE project "Trockenrasen Saar". For the subtype created by grazing, extensive grazing with sheep (possibly together with goats to reduce the growth of shrubs) or extensive mixed grazing with large herbivores is appropriate[20]. Partial periodic shrub removal is necessary in most areas. Ecotones to forests, shrubs, etc. with fringe vegetation are very important to preserve a high proportion of characteristic invertebrate species that need these during their life cycles, and are essential to maintain functions such as pollination services.

In ***Ireland***, the main conservation measure is extensive grazing with periodic scrub removal in areas where the 6210 habitat is still found. The Grassland Monitoring Scheme (Martin et al 2018) recorded the following measures having positive impacts on the sampled 6210/*6210 sites: non-intensive cattle grazing; other non-intensive grazing with sheep, horses, and mixed grazing; grazing by non-domestic animals such as hare, rabbits and deer; scrub removal. Mobile flocks of sheep, often referred to as 'flying flocks', are a way to reinstate grazing of abandoned sites for short periods each year. Flying flocks are preferable to mobile cattle herds as there are more restrictions placed on the movement of cattle to prevent spread of animal diseases (Martin et al 2018). However, the different grazing outcomes for different stock patterns need also be taken into account when considering 'preferences'. For sites where there is no stock-proof fencing or hedges, the use of virtual fencing may need to be investigated. For other sites, changing the timing of grazing could prove crucial to restoration; for example, grazing in spring can help control rank grasses that are not palatable later in the year.

[20] Guidance on extensive pasturing of Annex I habitats is published in Germany including all aspects of pasturing intensity, techniques, livestock keeping and many good practice examples from projects (Bunzel-Drüke et al. 2015).

In ***Italy***, developing and applying grazing plans are proposed for the maintenance or re-instalment of the traditional extensive management activities, based on pastoralism and use of domestic livestock (sheep, goats, cows, horses, donkeys) and, when possible (limited to the mesic types), regular mowing. These plans should include specifications on the type and number of animals, dedicated surfaces, livestock residence time and movements, number of water points etc. Scientific supervision to the development of grazing plans should also be provided, considering the type of plant communities forming the habitat and taking into account the ecological conditions including altitude, soil, exposition, slope, climate (micro-, topo- and macro-climate), biogeographic context, natural potential vegetation. Collecting local germplasm from typical/dominant/rare 6210 species in each homogeneous territorial context and conserve it in dedicated structures (germplasm banks) for future interventions for habitat reinforcement or restoration are also proposed.

In ***Poland***, extensive grazing is considered the typical and standard conservation measure for this habitat type. According to the Polish experiences, intensity should be not higher than 0,5 cow or 4.5 sheep or 3.1 goat per ha. The grazing animal species matters also. If possible, restoration of historic management is recommended, some animal species may be used for specific local situations: horses against *Calamagrostis epigeios*, goats against shrubs expansion. Mowing is useful only in specific circumstances. In some situations it may even cause negative changes, as the expansion of meadow grasses and decreasing of termophilous species. In general, it should not be used as "grazing replacement", but may be used for some specific subtypes of grasslands together with grazing (see Barańska et al 2014). Burning can be considered a controversial conservation tool, but may be useful in some circumstances. In some cases, spring illegal burning of grasslands by farmers is common and seems to be a local factor maintaining grasslands in the landscape. In other situations, there is evidence that burning can promote negative changes, as *Calamagrostis epigeios* expansion. Further studies and experiments are needed.

In ***Romania***, maintaining the habitat requires in particular ensuring the suitable intensity of grazing, cutting, or a combination of both. The site-specific objectives and local/regional land use and livestock husbandry traditions, practices and techniques are taken into account. Agricultural support schemes, including agri-environmental measures can be used for funding grasslands management.

In ***Spain***, the most important conservation measure is to preserve extensive livestock management. Sheep and goat herds have decreased much more than cattle. They are suitable species for preserving the 6210 EU habitat through grazing. Equids are also interesting livestock species for the 6210 EU habitat type conservation, but their numbers are currently very low in Spain since horse meat demand is also very low.

In ***Scotland (UK)***, this habitat is particularly dependent on a level of grazing which is high enough to maintain a varied sward height, including areas of short sward in which smaller and less vigorous species can persist, but low enough to permit flowering and not lead to soil erosion. Over much of the uplands, continued relatively high levels of grazing by sheep and deer, combined with the attractiveness of the habitat for grazers, mean that the extent of the feature is unlikely to have declined in any significant way, although over-grazing can also have negative impacts. Some damage from human recreational trampling is reported locally. Mechanisms to address pressures related to agricultural or sporting activity (grazing and trampling) exist (SNH 2013). These are largely dependent on adoption by land managers of agri-environment schemes or on the Joint Working process by which government agencies engage with land managers to seek solutions to inappropriate herbivore impacts. The latter can escalate into statutory processes. Conservation measures are implemented through designation (SAC, SSSI), statutory procedures (Deer Act Section 7), agri-environment schemes (SRDP) and management agreements (SNH).

5.2 Grassland restoration

Grassland restoration planning should be started by setting a clear objective, i.e. determining what the restored grassland should be like. What will the environmental conditions be, what ecological processes will take place, what vegetation and species can be restored. Objectives can differ depending on the restoration possibilities. Depending on the degree of degradation, grassland restoration takes at least 5-10 years (Rusina, 2017). High quality restoration and high species diversity including invertebrates usually takes much longer time spans (e.g. see German Red list of biotopes, Finck et al. 2017).

When planning grasslands restoration in a site, one should always consider the environmental conditions (climate, soil, geological and hydrological conditions, landscape fragmentation and its impact on species populations), economic (financial constraints) and social conditions (public, often also funders', opinion). Action will be more successful if the planning includes a risk assessment.

Restorative mowing and grazing are more intensive than regular mowing and grazing. It is the simplest, but the most time-consuming method if applied as the only measure for the restoration or creation of a semi-natural grassland. By using this method, the vegetation is allowed to develop naturally from the local species pool (Rusina 2017).

Restorative mowing alone is applicable only in places that have been abandoned comparatively recently, where neither shrubs and trees, nor tussocks are interfering with mowing. While restoring or creating a grassland, the frequency of mowing and the intensity of grazing must be adapted to the site conditions. Too fertile sites and sites dominated by expansive species must be mown at least twice per season or grazed intensively. In some cases light overgrazing is required. Restorative mowing and grazing can fail in sites which have been intensively fertilised. If the soil is too fertile, undesirable ruderal or nitrogen-demanding tall grass plant communities may develop (Rusina, 2017).

The most efficient method of habitat restoration in some countries is winter grazing, without the additional feeding of animals. Modification of the grazing regime might be necessary to reach the results within a desirable time frame. Additional mowing could be required in the areas only partly grazed by animals (Rusina, 2017).

Experiences with restoration of the 6210 habitat in some EU countries

In ***Belgium***, since 2000, important restoration works have been implemented, especially in Natura 2000 sites with the support of LIFE funding. Restoration works involved scrubs and trees cutting, destruction of stumps and woody debris and implementation of appropriate management by grazing or mowing. As most grasslands have been abandoned and afforested for a long time (sometimes more than 100 years), trees and shrubs regrowth need to be regularly cut, which is time consuming and expensive. Reconstitution of the herb layer depends on the presence of typical species in the close vicinity and/or their persistence in the wooded grasslands or in the soil seed bank. When typical species have disappeared, reintroduction by hay or seeds may be necessary. Due to local characteristics of the remaining grasslands, sheep grazing was used, associated when possible with goat grazing. Rotational, short-duration, high density grazing is used in the regeneration and restoration phase. Due to the disappearance of professional shepherds, animals are grazed in permanent or semi-permanent (electric) fences. The period and duration of grazing depend on local characteristics (layer productivity) and species to protect. Agri-environment funds are provided for management by local breeders.

In ***Lithuania***, the main restoration tools include: removal of woody vegetation; stopping the spread of the local expansive flora (e.g. *Calamagrostis epigejos*). Extensive grazing and mowing are used as supporting tools.

In ***Luxemburg***, the national habitat action plan identifies the following measures (Naumann et al 2013): Restoration of all abandoned and scrubbed areas through scrub removal and reinstatement of grazing (target: around 50 ha of calcareous grassland and 50 ha of the grassland complex in the mining region). Regular control (every 3-5 years) to prevent scrub encroachment, with regular cutting or grazing. Creation of new areas of calcareous grassland through green hay transfer on suitable bare soils and expansion of existing fields onto neighbouring patches through manual transfer of seed (target: around 20 ha). Protection of highly threatened characteristic plant species through ex-situ cultivation and reintroduction to strengthen existing stands and reintroduce into newly created and degraded areas. Measures to reinstate genetic exchange between existing areas of habitat (ecological network).

In ***Poland***, a LIFE project - 'XericGrasslandsPL - Conservation and restoration of xerothermic grasslands in Poland - theory and practice' (LIFE08 NAT/PL/000513, Jan 2010 – Dec 2013) targeted around 225 ha of xerothermic grassland habitat mosaics in 8 Natura 2000 sites in NW and SE Poland. The project initiated the process of regeneration on 20.2 ha of grassland habitat 6210: removing scrub or tree thickets, removing invasive alien herbaceous plant species (including *Heracleum sosnowskyi*) and reinstating grazing (Baranska et al., 2014). In degraded areas, xerothermic grasslands were restored by removal of the topmost soil layer, sowing xerothermic species' seeds, transplanting well-preserved patches of grasslands etc. By 2015, the condition of the grazed grasslands was significantly improved, with a reduction in the share of expansive species (ryegrass, sand reed and shrubs) (Murawy Life 2015). The grazing period was cut to 3 months (June-August) partly as a result of the improved condition, and partly due to drought, which further limited the expansive species and allowed the development of xerothermic species.

In ***Slovakia***, a LIFE project (LIFE10 NAT/SK/080) carried out a restoration plan for this habitat that was discussed with relevant stakeholders in the SCI Devínska Kobyla. The measures involved mechanical removal of woods and scrubs on 58 ha of overgrown dry grasslands, eradication of black locust and re-introduction of grazing mainly by goats since 2015. The impact of restoration management measures was monitored predominantly on the habitat type 6210* at different stages of succession. As a result of clearing of secondary succession area, a significant increase in the number of light and thermophilous species, such as *Pulsatilla grandis, Plantago media, Jurinea mollis, Astragalus onobrychis, Carex michelii, Chamaecytisus austriacus, Thesium linophyllon, Linum tenuifolium* was recorded after two years of monitoring. The total number of species in 2016 was higher than before the management intervention. These species were likely to be present in the soil seed bank and could germinate when the surface was open. Ensuring grazing management and removal of sprouts are an important prerequisite for a favourable development of vegetation on the areas under consideration. The species composition in the spring after the management intervention already showed a gradual increase of the species. The optimal method of management is sheep grazing, or sheep and goat mixed herds grazing, which can weaken and gradually eliminate the shoot of woody plants. The rotation of more extensive and intensive grazing is an optimal solution for the development and maintenance of a favourable status of priority grassland habitats. Two new micropopulations of the Bee Orchid (*Ophrys apifera,* an IUCN Red List Species) were recorded in the site as result of the restoration measures implemented by the project. The Adriatic Lizard Orchid (*Himantoglossum adriaticum*), listed on Annex II of the Habitats and endangered in Slovakia, was also recorded on the site in 2017 (up to 600 individuals).

5.2.1 Managing scrub

Management measures should aim at keeping scrub encroachment below a suitable percentage cover (e.g. 30%) of the total surface (Pearson et al. 2006). It must be taken into account, however, that the individual species collectively known as “scrub” are important habitats in their own right, as long as the balance with open grassland is retained.

To offset scrub colonisation and maintain the desired balance, it is possible to remove some older stands because long-established scrub results in the accumulation of nitrogen in the plant biomass as well as in the enrichment of the soil in nutrients. When trees and scrub are removed, shoots will often sprout from roots and stumps and should be removed.

Sometimes the operation need only be done once, then followed by grazing or mowing. At other times, further and complementary cutting measures, using machines, or further mulching and hoeing are needed in the first years (Essl 2005). Where it is not possible to remove scrub in this way, it is advisable to use browsing and/or rotational cutting to maintain stands.

Where scrub has begun to recolonize, seedlings could be removed immediately. The check for new plants could be carried out the following spring, and hand-weeded or lifted as appropriate. The aim could be to have a mix of scrub in succession present, from plants that are at ground level to more mature bushes that have trunks. Insects benefit from a diversity of age, leafing and flowering periods. It is therefore wise to carry out an invertebrate survey before clearing fell scrub. Also, annual removal of a little scrub at different stages of development saves a lot of hard work in the long-term whilst maintaining that vitally important habitat and food source for birds (RSPB 2004b).

Cutting of scrub should be carried out in autumn or winter, in order to avoid damaging the wild fauna during the reproductive period. Cutting between early September and the end of February avoids the bird-breeding season, while cutting at the end of winter allows birds and mammals time to eat any berries. Cutting can be carried out with special hedge trimmers that do not damage small fauna (Pearson et al. 2006).

Rotational grazing may be an appropriate way of controlling scrub as long it is carefully monitored to prevent over-grazing or excessive trampling (Buglife 2007). Donkeys can browse encroaching scrub, providing useful scrub control on semi-natural vegetation. Cattle are particularly good at knocking down and opening up tall coarse vegetation such as bracken and scrub. Goats can strip bark and, if used carefully, will produce structural diversity. Sheep do not tackle areas of long grass as readily as cattle or ponies, but they are efficient browsers of low scrub, able to remove leaf material completely from selected bushes. Moreover some breeds of sheep are good at pushing through scrub, but younger animals and lighter breeds are prone to getting caught up in it. It is therefore advisable to start with a low stocking rate for the species and breed (c 0.25LU/ha), monitor the effects and adjust accordingly (Crofts & Jefferson 1999, RSPB 2004d).

Grazing alone however generally is not enough to manage scrub. A grazing regime based on winter grazing, for example, will usually need to include provision for regularly repeated scrub clearance to remove the gradual accretion of woody plants (Crofts & Jefferson 1999). Therefore, in some cases it is advisable to mow in conjunction with grazing. The best time

to do this depends on the wildlife present. Insect eggs and larvae are often the most vulnerable. Avoid mowing until late summer/autumn to allow time for flower and grass seeds to drop, or late winter/early spring to give over-winter shelter for insects.

5.2.2 Control of weeds and invasive species

A weed may be defined as a species that is undesirable to the purpose/objective of grassland management. Under certain conditions some plant species (e.g. thistles, bracken, ragwort) can excessively multiply, quickly replacing communities that have a greater conservation value (Pearson et al. 2006). These plants are highly competitive, often toxic, and once established they produce a heavy shade in the growing season, which discourages other plant species (including orchids) to establish (Crofts & Jefferson 1999). Weed infestation can be prevented by good management practices, for instance, avoiding large areas of bare land, which provide opportunities for invasion and spread of weed species.

After their establishment the following measures can be implemented (Crofts & Jefferson 1999):

- hand control techniques: 'spudding' or cutting (not suitable for ragwort) at just below ground level, or/and hand-pulling (this is only really suitable on small areas), just before target weed flowers open; hand pulling needs to be undertaken over a period of several years if it is to have any effect;
- mechanical pulling or cutting: for thistles and ragwort, pulling should take place after maximum extension of the flower stalk but before seeding and it will be required in successive years to reduce the extent of perennial target species. A better approach is to mow the plant as the flowering stem elongates. This may need to be repeated during the year. Repeated cutting (topping) may prevent seeding and reduce the vigour of weeds but it does not kill the plants and they may regenerate vigorously from the stem base. As with mown grass, cuttings should be removed from the site ;
- targeted grazing control;
- chemical control: although manual control methods are usually most desirable, and the use of chemical products is not generally allowed, targeted herbicidal control (spot treatment, weed wiping) of such species will often be acceptable on nature conservation sites particularly where continued grazing/meadow management is essential for meeting nature conservation objectives. It must be taken into account that weed-wiping is non-selective and often can seriously damage other conservation interests. If needed at all, a selective application only to target weed plants is recommended.

The removal of the weeds should be carried out at an early stage of development when it takes little effort and can obtain easily good results.

Control programmes should be carefully planned, considering also other possible effects; in certain cases total eradication of weeds, even if possible to achieve, could be detrimental for wildlife.

5.3 Grassland re-creation

The creation of grassland should be started by assessing the environmental conditions on site (moisture regime, soil properties, vegetation, species availability), which will determine feasibility of the habitat re-creation. Re-creation requires the assistance and participation of soil experts, hydrologists and ecologists, as well as experts in vegetation and those groups of organisms that are important in the habitat to be created. A grassland creation plan should be developed in a similar way as a grassland restoration plan (Rusina, 2017).

Substrate, desired time frame, and site proximity to areas of grassland similar to the target type will dictate which establishment techniques are most appropriate for habitat creation and establishment (Ashwood, 2014). Different options can be considered.

Natural colonisation of bare substrates may be suitable where long establishment time frames are acceptable and species-rich calcareous grassland communities are adjacent. If lowland calcareous grassland existed in the area prior to disturbance and subsequent reclamation, a seed bank may remain in the existing substrate and should be assessed using germination trials. Natural colonisation can produce species-rich habitats that are appropriate to the local area. The process tends to be very slow and it may take several decades to establish a stable community.

Natural colonisation can be accelerated through the selective introduction of grassland species via turf inoculants, green-hay strewing. Turf inoculants can be taken from adjacent donor areas and incorporated into the bare substrate. These can be either whole turf fragments or plugs of grassland containing desirable species. If there is doubt about the type of donor Calcareous Grassland, a vegetation survey should be conducted by a trained botanical surveyor. In some cases planting of precultivated specimens from local or regional seeds may be more successful.

Where either natural colonisation or turf inoculant methods are being adopted, it can be advantageous to first sow a pioneer/nurse mix. The benefits of thinly sowing pioneer species include the stabilisation of substrates, and the rapid creation of an attractive sward while leaving sufficient bare soil to allow natural colonisation to occur.

Green-hay strewing is a useful alternative to turf inoculants or natural colonisation. It involves taking freshly cut hay containing seeds from local calcareous grassland, and spreading this over the site to be colonised. Ensure that the hay is cut after flowering but while the seeds are still attached; good working knowledge of the target species and when their seed is at point of dispersal will yield best results. Hay should be spread within 24 hours of collection to prevent the spoiling or loss of seeds during storage. Using a local source means that a closer match can be made between the new and existing grasslands and the grasses will be of native genotype; it will also help to keep transport costs to a minimum.

Where a local calcareous grassland donor site is not available, a commercial seed mix may be used as a starter sward. Seeding can be undertaken using seed collected from a local donor site. Care must be taken not to deplete the donor site of seed by over-harvesting. Alternatively, seed may be bought. It should not contain interspecific (*Lolium* ×*hybridum*, *Trifolium pratense* × *T. medium*) nor intergeneric hybrids (×*Festulolium*) or polyploid varieties (tetraploid species of *Lolium* and *Trifolium*). A reputable seed house will supply

seed mixtures suited to the climate and principal soil conditions of your site. Seed should be of local provenance, where available.

Wildflowers and grasses are normally sown together as grasses help to stabilise the soil and provide important cover in winter. The proportion of grass seeds in the mixture should be low enough to ensure establishment of herbs and leave space for natural recolonization of additional species. Seed is normally sown in September/October, either by hand or using agricultural machinery such as slot seeders and seed drills, which maximise the area sown for the amount of seed used (Crofts and Jefferson, 1999). It is recommender that seed is spread on the surface, nor drilled into the soil, and most machinery can be set to do this. It is vital to mow frequently, up to 3 times in a year, in the establishment year in order to control dominant annual species. The overall objective is to establish the more perennial species, which compete less strongly in the first year than annuals. This is especially so where there is a large burden of arable weed species (see Nowakowski and Pywell 2016).

Whichever establishment method is selected, it is important to recognise that it will take several years for the grassland to establish and develop into a stable community. Appropriate management of the grassland is essential for allowing a species-rich community to develop and be maintained.

Recreation of calcareous grassland on degraded ex-arable land has been implemented for example in southern England (Fry et al 2018), using species selected from a calcareous grassland plant community type (*Bromus erectus* grassland), which is the dominant grassland community of the region and is typically used as a target community in restoration programmes. The opportunity to re-create semi-natural dry grassland is increasingly used in the UK, e.g. through innovative and imaginative roadside schemes. One roadside re-creation project in south west England only started in 2012, the site now supports species-rich vegetation and 30 butterfly species (half the number of UK species) have been recorded since its establishment.

Grassland habitat recreation in UK within roadside schemes (Sam Ellis)

5.3.1 Habitat management and monitoring after recreation

Calcareous grassland should only be created where there is strong commitment to a long-term management regime, directed by a site management plan. Management is required to prevent domination of the sward by scrub and other aggressive species and to maintain high species richness. Grassland establishment typically takes 3 to 5 years. During this period a regime of cutting and light grazing is required; exact requirements will be site specific.

Typically, first-year cutting regimes will not be necessary for grassland established on bare mineral substrate, though may be required for richer sites to keep the sward shorter than 10 cm. Mowing must be timed to avoid conflict with ground-nesting birds. Mowing encourages tillering; it also reduces competition from rank species and the encroachment of scrub.

After mowing, cuttings should be removed from the site. If the sward has seed available, this may be used for hay strewing on other sites. The grassland should be mowed once in the second and third years after the flowers and grasses have set seed. Grazing by rabbits, cattle and sheep should be controlled or prevented during these first 3 years to allow the grassland to become established; that is, for seedlings to develop sufficient root systems to prevent uprooting when grazed. Once the grassland is established, light grazing can begin.

Long-term management through grazing and/or cutting is essential for maintaining species richness. Historically, grazing and in some regions mowing has been the typical management technique; however, mowing may be suitable for small sites and those on gentle slopes. Cattle and sheep can provide year-round grazing management if used at low stocking rates, though this depends on site productivity. Unproductive sites may only be suitable for winter grazing; though this must be monitored for poaching – the compaction or physical breakdown of soil structure under the feet of heavy animals.

Grazing should aim to produce a mosaic of grassland of varying lengths, and small patches of scrub (e.g. no more than 25-30% of the total area). For example, different types of grazing animals are selective in the plants that they eat and can be used to create the mosaic. Cattle consume coarser herbage and trample more heavily than sheep. The trampled patches create gaps for new plants to establish. More detailed information on management can be found in Crofts and Jefferson (1999).

Even where the creation works take place in a very suitable location, evaluation of the management practices is required to assess establishment and long-term success. A site-specific long-term management plan is required. This should include a monitoring and evaluation programme that will enable the management regime to be adapted as necessary.

Monitoring of lowland grassland habitats recreation could include:

- Extent of the grassland establishment: % ground cover, bald patches and presence of leaf litter.
- Sward composition: grass to herb ratio, positive indicator species, negative indicator species, species with local distinctiveness
- Typical species composition, including a selection of indicator species from different taxonomical and functional groups such as pollinators (aculeate Hymenoptera, Syrphidae, Lepidoptera) and epigäic and endogäic groups (predators and decomposers).

Re-creation of grasslands on arable land in the Czech Republic

Converting arable land to species-rich grassland requires a long time. Its success is not only dependent on restoration method and composition of the used seed mixture, but also on the local conditions of the site to be 'regrassed' (Jongepierová & Malenovský 2012, Jongepierová et al. 2012, Scotton et al. 2012, Ševčíková et al. 2014). The restoration of insect communities is more successful in landscapes with a large area of semi-natural species-rich grassland in the close surroundings, as specialised phytophagous insect species have a limited ability to spread (Woodcock et al. 2010a, 2010b). The most frequently used re-creation methods are briefly presented below.

Spontaneous succession. Mere succession may restore grasslands only at very dry or conversely at very wet sites, where establishment of shrubs and trees is disabled, and where permanent meadows or pastures have been preserved in the close surroundings. In abandoned arable fields at dry sites in the warmest parts of the country, monitoring has showed that older swards are coming to natural steppe vegetation in their species composition (Jírová et al. 2012). Regular mowing however is needed normally from the third year after abandonment of a field. Restoration of grasslands with an ecologically favourable species composition takes approximately ten (Lencová & Prach 2011) to twenty years (Prach et al. 2014), but plants and some groups of vertebrates may require a longer period of time until the original diversity of species-rich vegetation is restored.

Commercial seed mixtures. The sowing of commercial legume-grass seed mixtures is the most frequent way of large-scale conversion of arable land to grassland. Even though this cannot be regarded as ecological restoration, such initially species-poor swards may be supplemented with target plant and animal species with time, especially if these species still occur in the surrounding. This is confirmed by monitoring results from the Bílé Karpaty Mts. (Prach et al. 2014, Jongepierová et al. 2018). In places where subsequent colonisation by desired species is limited for their absence in the surrounding, they can be added to swards created by sowing commercial grass mixtures by means of sowing or planting.

Regional seed mixtures. Regional seed mixtures are collected, reproduced and applied in a particular area without plant improvement processes. Their species composition is based on that of the natural communities of the area (Scotton et al. 2012). The species, especially herbs, also support a high diversity of animals which are dependent on them for food or other reasons. The main advantage of this method is that it helps maintaining the natural genetic variability of populations to a considerable extent, thereby preventing a spread of foreign genotypes or even non-indigenous species or varieties. Instructions on how to obtain and use regional seed can be found in several publications (Scotton et al. 2012, Jongepierová et al. 2012, Jongepierová & Prach 2014, and Ševčíková et al. 2014). The main principles are:

- Seeds can be obtained from a grassland as part of freshly mown grass biomass (green hay), which is applied immediately to the tract to be restored. This method is mainly used in the Netherlands and Germany, not only on arable land, but also at other sites, e.g. fly ash deposits (Kirmer et al. 2014).
- If the cut biomass is dried after mowing, the hay can be used directly as a seed source or be threshed out before use (threshed hay).
- When harvesting with a combine harvester the sward is mown and threshed right at the site.
- In brush harvesting the seeds are combed out of the standing sward.
- In case of need, a smaller amount of seed can also be collected manually.
- It is advised, with regards to the complicated seed collection (different sizes and ripening times), to cultivate plants in seedbeds.

On a large scale, species-rich regional seed mixtures for grassland creation on arable land have to date only been used in the Bílé Karpaty Mts., where an area of over 600 ha has already been 'regrassed' this way (Jongepierová 2008, Jongepierová & Prach 2014, Prach et al. 2013, 2015a, Jongepierová et al. 2015).

Transfer of upper soil layers or turf blocks. Upper soil horizons can be spread over the site to be restored or entire turf blocks can be transferred to it. However, this is not only technically and financially demanding, but also the damage caused to the source site poses a problem. This method can be justified on a small scale or in places where the source site is being lost (e.g. progressing mining or building). Some experiences in impotent sites with steppe flora in Czech Republic have been carried out (railway tunnel at Obřany, lime-pit at Hády and the Dálky quarry near Čebín), with positive results as regards the steppe species survival on the new sites, but hardly any of the transferred xerophilous species have expanded to the surroundings or if they did, only very slowly.

5.4 Planning for conservation management in a specific area

As the habitat features, conservation values and context (history and development) are very different between the various countries and biogeographical regions, it is important, when planning the management for the habitat, to take into account the following general aspects which will allow sensible management decisions to be taken:

- Site-specific objectives and targets with reference to the conservation status of species;
- Local/regional land use and livestock husbandry traditions, practices and techniques – the conservation values of today are often the result of the land use and grazing regimes of the past.

Although it is often neither possible, nor appropriate nor necessary, to mimic historical management, it should if possible be informed by existing knowledge and experience.

A detailed examination of the site conditions will help to identify the best techniques and methods for habitat maintenance or restoration and assess their suitability for the particular situation, also considering the available resources, to assess the extent to which the objectives can be achieved and anticipate possible obstacles.

Key aspects to consider when planning for grasslands conservation and management (Rusina, 2017)

Ecological considerations

- *Connectivity in the landscape* is very important for the long-term survival of grassland species. It ensures their movement from one grassland to another and maintenance of sufficiently large and genetically diverse populations. Thus, it is more important to improve/restore grassland located in a system of other grasslands or a larger area rich in semi-natural grasslands than isolated grassland in a forested or intensive agricultural landscape. The restoration will also be more successful in this case as species will be able to easily disperse to the restored grassland from other grasslands.
- *Grassland areas* are important for the conservation of plants, birds, and invertebrate species. Therefore, if other factors (see below) are similar, restoration of larger grasslands should be prioritised.

- *Grassland biodiversity* – the higher it is, the more important it is to restore such grassland.
- *Presence of protected species* – if a protected species has survived in the grassland, the conservation of such grassland should be prioritised over the grassland which has no such species.
- *Changes of grassland environmental conditions*: it is preferable to restore grasslands where the environmental conditions are less changed.

Socio-economic considerations

- *Long-term management perspec*tive: grasslands with a higher probability that they will be permanently managed after restoration should be prioritised. Restoration is only worth planning in places where long-term grassland management is expected. Otherwise, the financial means invested in restoration will be spent unsustainably and provide only a temporary benefit (or none at all) for the conservation of biodiversity (depending on the immediate success of restoration). *Grassland multifunctionality*: priority is grasslands where more diverse use is expected after restoration, for example, where management not only ensures biodiversity, but also provides animal feed for farming, the grassland is used for tourism, gathering of medical plants or environmental education. However, even if the grassland is not used to produce animal feed, its management is still considered to be production – production of nature values and biodiversity.
- *The attitude of the local community, local municipality, the owner and manager*: the more the local community appreciates biodiversity and its benefits, the better the prospect of maintaining restored grassland in the long term.
- *Restoration costs in relation to the expected results*: grasslands that can be restored with minimum investments and maximum benefit (the expected restoration success is very high) should be prioritised. Grassland maintenance costs should also be considered in the planning stage, including financial planning. The cost or income related to the materials created in habitat restoration or management – wood, mown biomass, removed topsoil, etc. should be considered. It may be difficult to find a practical application for such materials and then the removal and further disposal of such habitat restoration "side products" can lead to significant extra costs.

Grassland restoration and maintenance objectives can be achieved by different solutions. Methods and techniques can vary significantly both in terms of financial and time resources, therefore a thorough feasibility study and evaluation of alternatives must be conducted to select the best solution. Selection of restoration and maintenance works and procedures is determined by three aspects: ecological conditions of the site, available resources of species and the desired timeframe for the achievement of the objective.

Restoration and management should be carried out according to an individual restoration and management plan for the particular site. Key steps of a grassland restoration and maintenance plan development are summarised below.

Planning steps for grassland restoration *(adapted from Rusina ed. 2017)*

1. Collect information about the conditions in the area, including key ecological processes for the conservation of the grassland type: vegetation, animal and plant species composition, soil characteristics, terrain, moisture regime, drainage system and status, past and current management, etc.
2. Establish the grassland maintenance or restoration objective, e.g. achieve or maintain a favourable condition of the habitat (structure, ecological processes and characteristic species composition) and prevent its degradation. Consider possible conflicting management priorities and define the preferred options (see section X.X).
3. Assess the suitability of the current management for the achievement of the objective and define the necessary adjustments, as required.
4. Identify the required habitat restoration or maintenance measures and methods and their combinations. Different parts of the same grassland may require different restoration or maintenance measures. For example, in the part of grassland with an abundant population of a protected plant species, restoration measures will focus on favourable condition of this species, while elsewhere the objective will be to ensure suitable vegetation structure for certain animal species (e.g. birds, butterflies), and elsewhere to restrict expansive species. In such cases, it is desirable to map the required measures.
5. Identify ecological and landscape constraints and advantages for the implementation of restoration or maintenance measures.
6. Identify socio-economic, legal and financial constraints and advantages of restoration or maintenance measures, e.g. including costs, legal restrictions for restoration or maintenance measures on the one hand, and possible incentives, financial resources, support from existing programmes, etc.
7. Detailed specification of grassland restoration or maintenance objectives considering environmental, legal and socioeconomic constraints and advantages, e.g. improvement of habitat vegetation structure, improvement of conditions for a specific plant, bird or other species.
8. Developing the restoration and maintenance activity schedule. Planning the sequence and time of the required restoration and maintenance works, depending on the initial condition of the grassland.
9. Developing restoration and maintenance success monitoring, including periodic evaluation, to introduce the necessary adjustments in the restoration and maintenance process.

5.5 Criteria to prioritise measures and to identify priority areas for action

Prioritization can play a fundamental role for obtaining maximum effectiveness in conservation activities, optimizing costs and time for monitoring and management, and evaluating the appropriateness of management activities. With this aim, specific criteria for prioritisation of actions can be defined.

The following criteria are considered useful to prioritise conservation action on this habitat type:

- Geographical situation
- Time of abandonment

- Nature of the actual vegetation
- Degree of scrub encroachment
- Feasibility, e.g. accessibility of the area with necessary technology, etc.
- Contribution to reaching FCS at biogeographical or regional scale

An example can be represented by the prioritization manual developed for the Life Project LIFE13 NAT/IT/000371 “SUNLIFE - Strategy for the Natura 2000 Network of the Umbria Region". In this document, on one side, the intrinsic features of the habitat are given a prominent role: habitat priority, habitat representativity/rarity at regional scale, plant community richness (phytocoenotic diversity), number of actual/potential Annex II-IV species, number of actual/potential Red List species. On the other side, prioritisation takes into account extrinsic traits that help emphasize the real risk of degradation, such as: anthropic pressures, conservation status at national level, and intrinsic risk of transformation (dynamic processes).

In Latvia, the following general criteria are considered:

- Habitat-specific species, including protected ones, are at risk of local extinction due to deterioration of habitat quality and isolation; reduction of its distribution range is expected in the forthcoming decades;
- The habitat is the only or almost only locality of at least one species listed in Annex II to the Habitats Directive or in the Birds Directive, or species which is very rare (with very few localities), protected in Latvia, or it is important for migration, breeding or other important part of species life cycle, or it is a habitat of protected species with rapidly decreasing distribution.

As regards the selection of Natura 2000 sites of the highest importance for the protection of the priority habitat types, the following criteria are considered (at least four criteria must be met):

- In the particular Natura 2000 site there are significant areas covered by the specific habitat and/or this habitat is very typical with high representativity (at least B), which is important for the provision of favourable conservation status in the whole country.
- The restoration of this particular habitat in this area is important for the conservation of the habitat type at a national level or at level of the EU Boreal biogeographical region.
- Loss of the habitat in this Natura 2000 site may reduce its distribution range.
- In the particular Natura 2000 site, the habitat is degraded, but capable to recover; restoration will lead to a significant improvement of the condition and/or will increase the habitat area.
- It is possible to ensure sustainable habitat management and favourable protection regime.
- The estimated habitat restoration costs in the particular Natura 2000 site are adequate to the benefits.
- Habitat restoration in the particular Natura 2000 site does not have adverse effects on other protected habitats or important species, and/or does not raise environmental or socio-economic problems.

5.7 Main stakeholders to define and implement the measures

In general, a broad engagement and partnership of relevant stakeholders is considered essential to effectively implement the necessary conservation measures. Implementing participatory approaches that involve the following stakeholders are considered important for the design and implementation of the conservation measures:

- Farmers, landowners, land users.
- Site managers, public administrations (national, regional, local).
- Nature conservation institutions and organisations.
- Agriculture institutions and organisations.
- Scientific advisors and supervisors.
- Advisory services and technical assistance to help farmers with implementation.
- NGOs.
- Local communities.
- Local tourist operators and entrepreneurs (dry grasslands reach in flowering herbs are often attractive landscape elements, grazing animal products may be used as local products).

5.8 Challenges, difficulties and possible solutions

Important challenges and difficulties are related to the necessity of developing a self-sustaining economy in marginal areas hosting the habitat 6210. The widespread ongoing processes of abandonment are the result of the collapse of the montane economic systems, which are not competitive with the modern, large-scale productive systems. An approach to counteract this process should go through the development of sustainable productive systems that can guarantee the maintenance of the local populations.

Technical problems may also derive from the need of scientific supervision for a correct sustainable use of 6210 dry grasslands. These systems are extremely fragile and might be seriously damaged by over-use. A proper management should take care of the local, ecological, floristic, biogeographic characteristics of the used grassland and select the most appropriate type and numbers of grazing animals (Frattegiani et al., 2017). All the farmers and productive enterprises should be supported by dedicated monitoring programmes which might guarantee adaptive management.

Other possible constraints and solutions for the implementation of conservation measures are presented below:

- Before grazing can be restored, the fields must be cleared of scrub and water supply points for the cattle restored or built. Farmers are often not able to fund this themselves before they can receive CAP direct payments for the land, so funding for restoration must come from an external project, and sometimes also the labour.
- On habitat 6210 mineral levels are generally low in grazed forage throughout the year and without supplementation mineral deficiencies are likely, particularly in Phosphorous, Copper, Cobalt and Selenium. Therefore, supplementation is required through use of mineral licks, concentrate supplementation or mineral boluses. However, the phosphorus delivery to livestock must be done in a way which minimises effects on species richness and diversity.
- The grassland may require regular management of scrub and invasive weeds, including invasive alien species, and this is labour intensive. Low labour intensity habitat

management would increase farmer's capacity to regularly do this work. This will also ensure that the land continues to remain eligible for CAP direct payments.

- On some locations (e.g. the Aran Islands in Ireland), the fragmented nature of the farms and the small parcel size means that the grazing period for a particular parcel of land may be short. Access to these small parcels of land to move the cattle around need to be ensured and the movement of cattle has to be facilitated the so that the optimal grazing regime on fragmented parts of the farm can be maintained.
- The identification and field mapping of the habitat is still problematic in some areas (e.g. in Poland). Not all valuable sites are well-mapped and assessed, which may cause problems with owner identification and conservation measures planning and implementation).
- Logistic and organisation problems with restoring/implementing of grazing. In many regions, the field animal grazing is presently not a component of the local agricultural system. For implementing grasslands grazing, all logistic elements (the animals, the barns, fencing, water, winter food) must be organised especially, which is difficult, costly and consumes human resources. As a result, grazing is replaced by mowing in some projects, which is not always the optimal management for grasslands.

5.9 Conclusions and recommendations

- Conservation objectives and priorities can be defined at biogeographical region level to achieve Favourable Conservation Status and to address the main threats to the habitat, including identification of restoration needs to improve the area, structure and function, where needed.
- Conservation objectives defined at the biogeographical need to be translated into more specific objectives at the country level and then at site level. The action plan suggests the identification of priority sites and areas to ensure the habitat conservation and to contribute to the objectives set at a higher level (e.g. biogeographical, national) both inside and outside the Natura 2000 network.
- Site-level conservation objectives should define the condition to be achieved by the habitat type in the respective sites in order to maximise the contribution of the sites to achieving favourable conservation status at the national, biogeographical or European level.
- Moreover, depending on the coverage of this habitat type by the Natura 2000 network, taking action outside protected areas may be necessary to ensure its long-term conservation, ecological variability and adequate connectivity across its natural range, as well as for the conservation of species associated with the habitat.
- The maintenance of this habitat in good condition is dependent on extensive grazing or mowing, depending on local conditions and historic management practices. Control of scrub or invasive species may also be necessary.
- A detailed examination of the site conditions will help to identify the best techniques and methods for habitat maintenance or restoration and assess their suitability for the particular situation, also considering the available resources, to assess the extent to which the objectives can be achieved and anticipate possible obstacles.

- Key aspects to consider when planning for grasslands conservation and restoration include ecological and socio-economic considerations, which determine the management and restoration possibilities. Restoration and management should be carried out according to an individual restoration and management plan for the particular site.
- Adapting management to the needs of particular species may be required depending on the conservation objectives of the sites.
- The re-creation of grasslands may be necessary or appropriate in some situations. Its feasibility should be properly determined with the assistance of relevant experts (on soil, hydrology, ecology, vegetation, etc. A grassland creation plan should be developed in a similar way as a grassland restoration plan.
- Important challenges for the conservation of these grasslands are related to the difficulties for maintaining a self-sustaining economy in marginal areas hosting the habitat 6210. A widespread process of abandonment of traditional grassland management is ongoing. An approach to counteract this process should address the development of sustainable productive systems that can guarantee the maintenance of the local populations.

6. KNOWLEDGE AND MONITORING

Improving knowledge and methodologies for assessing conservation status, threats and pressures and the implementation of appropriate monitoring schemes are also important for the conservation planning of this habitat type. It would be advisable to set up harmonised methodologies to monitor the conservation status of 6210 habitat and the evolution over time at appropriate scales. The monitoring schemes should cover the high variability of 6210 habitat type.

The effectiveness of management measures should also be monitored and assessed using appropriate indicators that can provide evident indications of the results achieved.

6.1 Habitat monitoring methods

As already mentioned in the section on Conservation status assessment, habitat monitoring schemes and protocols are available or are being currently developed and improved in several EU countries.

Usually monitoring is carried out in selected sites and plots, or through monitoring transects, where the main habitat features are recorded and relevant criteria and thresholds are applied to the parameters used for conservation status assessment (area, structure and functions, future prospects).

The monitoring surveys can cover a percentage of the habitat distribution, and the sample should be sufficient to represent the overall habitat variability and different conditions.

Some relevant examples of the habitat monitoring schemes and protocols available in EU countries are provided below. A recent overview on develpping monitoring systems in the EU Member States is given in Ellwanger et al. 2018.

In ***Germany***, the Federal Agency for Nature Conservation, in close cooperation with nature conservation agencies of the Federal States, developed recommendations for monitoring and assessment of the conservation degree of natural habitats and species of common interest based on surveys of individual occurrences, e.g. sites and detailed expert knowledge (BfN und BLAK 2017). The assessment of the parameter “structures and functions” of habitats is based on several criteria (completeness of typical habitat structures and species composition, pressures) examining key attributes of the habitat. The assessment of these key attributes is compared to set thresholds which reflect the condition of the habitat.

For the habitat 6210, the criteria “completeness of typical habitat structures” comprises the number and coverage of characteristic structural types (e.g. therophytes, pioneer, short or multi-layered grassland, patchy vegetation with open ground, bryophytes, lichens, thermophile borders or shrubs) as well as the coverage of herbs (excluding disturbance indicators). The coverage is measured in percent. To achieve an excellent assessment (A), the coverage of typical habitat structures for example has to be at least 75 %. If the coverage of typical habitat structures falls below 50%, the structures are average or partially degraded (C). The completeness of the typical species composition is assessed by experts based on a national reference list of characteristic plant species, which can be adapted at regional level.

The criteria "pressures" is divided into the subcriteria coverage of disturbance indicators (e.g. indicators of eutrophication or fallow, neophytes), direct damages of the vegetation (coverage; including the reason of the damage, e.g. caused by trampling), coverage of shrubs due to lack of management, coverage of reforestation/ planted trees, management deficits and other pressures of the habitat 6210. The coverage is measured in percentage, e.g. coverage of disturbance indicators of 5% or below and no occurrence of invasive neophytes leads to the assessment "no or low impact of pressures" (A), over 25% to the assessment "high impact of pressures" (C). Management deficits and other pressures are assessed by experts.

The ***Irish Semi-natural Grasslands Survey (ISGS)*** established habitat monitoring methods in Ireland[21], including habitat assessment criteria for 6210 (O'Neill et al 2013). A new Grassland Monitoring Survey (GMS) of habitat 6210 was carried out in 2015-2017 (Martin et al 2018). The survey covered 55 sites with 6210/*6210, 237.83 ha of habitat, representing 17% of the 1,416 ha of the habitat that is currently recorded, focusing on the best quality sites. The GMS assessed area, structure & functions, and future prospects at each site.

Area was assessed by examining the current extent of the habitat and comparing it with that mapped in previous surveys, or by comparing areas across different series of aerial photographs and satellite imagery (Martin et al 2018). Area losses are expressed as percentage loss on an annual basis over a specified period.

Structure & functions were assessed by means of several criteria that examine key attributes of the habitat compared to the set benchmarks or thresholds that reflect the habitat when it is in favourable condition (Martin et al 2018). The criteria are examined and assessed on plots of fixed size delimited on the ground using a measuring tape or quadrat square.

The structure & functions criteria were established based on a national dataset to provide guidance for ecologists on the recognition and assessment of 6210 habitat in Ireland (Martin et al 2018). During the GMS, these criteria were reconsidered on a site-by-site basis and modified to ensure that they were relevant to assess local differences. For habitat 6210/*6210 upland areas, which can often be bryophyte-rich, the bryophytes *Ditrichum gracile*, *Hypnum lacunosum*, *Scapania aspera* and *Tortella tortuosa* were included as positive indicators.

Future prospects were assessed by examining the current pressures, future threats, and beneficial management practices operating on the habitat, and the future expected trend of area, structure and functions.

The ISGS monitoring method was also used in a survey of 25 orchid-rich calcareous grassland sites (*6210) in 2014 (Curtis and Wilson 2014, cited in Martin et al 2018).

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https://www.npws.ie/sites/default/files/publications/pdf/IWM%20102%20Annex%201%20Grasslands.pdf
http://www.botanicalenvironmental.com/projects/habitat-studies/national-baseline-surveys/irish-semi-natural-grasslands-survey/

The ***Italian Manual for Habitats monitoring*** (Angelini et al., 2016; Gigante et al. 2016a, 2016b) defines specific standard monitoring protocols for each Annex I Habitat type present in Italy, including for the habitat 6210

The parameter Area is defined as the effective surface occupied by the habitat (Gigante et al., 2016c). The cartographic representation is recommended at a scale 1:10:000. The Habitat should be mapped each 6 years by way of photo-interpretation combined with field surveys. The CS based on the area can be then analysed by comparing the cartographic representations from different periods (diachronic analysis) and quantifying changes and trends. Additionally, the analysis of landscape metrics (such as total surface, fragmentation, patch surface, patch distance etc.) is recommended to point out useful details on the CS.

The parameters "structure" and "function" have been defined with reference to the main features of the plant communities forming the habitat: complete list of species, total cover, dominant species presence/cover, typical species presence/cover, orchid species presence/cover, disturbance-indicator species presence/cover, alien species presence/cover, dynamics-indicator species presence/cover. These data should be sampled in permanent plots (16 m2) every 6 years. The number of sampled plots should be proportional to the habitat's total and local area and to its general/local variability. The optimal sampling period, both for the Apennine and Alpine areas, is May-June (July) in the hilly districts, June-July-August in the montane districts.

The CS based on structure and function can be then analysed by way of diachronic analysis of the values assumed by these indicators. Trends in presence/cover of alien, dynamics-indicator, disturbance-indicator, dominant/typical and orchid species can provide robust indications on the CS of the monitored Habitat.

A complete set of typical species cannot be provided a-priori at the national scale, due to the enormous floristic richness of this habitat and its huge local variety. For this reason, besides the typical species already reported in national and European manuals (EC, 2013), the task to point out target species has been entrusted to the regional authorities. In some regional experience, dominant species with a dominant/diagnostic role at regional level have been provided (e.g. in the Monitoring Manual produced by the Project "SUNLIFE" LIFE13 NAT/IT/000371" where *Bromus erectus*, *Brachypodium rupestre* and *Stipa dasyvaginata* subsp. *apenninicola* are indicated).

Additionally, there is an indication to consider human activities, in particular to register and quantify the ongoing activities of grazing or mowing, as well as other parameters of biological relevance such as presence of insects and birds.

In France, a method for monitoring the state of conservation of agro-pastoral habitats in Natura 2000 sites has been developed (Maciejewski *et al*., 2013).

The identification and monitoring of habitats is being tested using satellites images. For instance, the location, classification and dynamic space-time monitoring of habitats in Slovakia is tested based on novel methods for filtering, segmentation and tracking of Sentinel-1 synthetic aperture radar (SAR) data, Sentinel-2 multispectral imaging data and their combination. The image processing software will allow accurate location of Natura 2000 habitat areas in static and dynamic Earth observation data up to a precision of pixel resolution. Moreover, by the developed software it will be possible to monitor

continuously the habitat dynamics with alarming option in case of abrupt changes in condition or fragmentation of Natura 2000 protected areas.

6.2 Criteria to select monitoring sites/localities

The monitoring plots should properly represent the regional distribution of the habitat and its variability. Samples should be collected both in and outside Natura 2000 sites.

The number of sampled plots should cover all the habitat diversity (considering all the possible subtypes) and sufficient to have a statitistically sound result.

Data provided by the monitoring sites should be able to point out statistically significant trends in conservation status as well as in key biological and structural parameters. The sampled plots should include both stands with a good and a bad conservation status.

The use of aerial photograms and cartographic survey is certainly useful to provide a first overview of areas in major need of investigation. Although a net of permanent plots is the basic starting point, additional points might later be needed based on the Habitat's actual development.

A minimum percentage of the national area for 6210 should be monitored within each reporting period. Part of the areas could be selected using a random stratified approach and another part from 'nationally important' sites. Monitoring can sometimes focus too much on large well-studied sites so there could probably be a cut-off of 10 ha for 6210 sites and where sites are selected for monitoring are larger than 10, ha then the site should be divided into ~10 ha proportions and one area chosen.

The number of sampled plots could be scaled at regional level in a country. This can give appropriate relevance to the high diversification of a habitat in a country. It can be also a suitable way to share the monitoring responsibility among all the involved administrations.

A robust sampling design should take into account all these aspects, and for this reason it is very difficult to define it at national scale in countries with a very large surface and high diversity of this habitat type, like Italy. In these cases, it may be advisable that some criteria are set on a national scale and then applied at regional level based on a detailed knowledge of the territory, both inside and outside N2000 sites.

In Lithuania, a monitoring system has been set based on the habitats inventory results (2014). The main criteria for the selection of permanent monitoring areas include:

- Monitoring of the habitats of Community importance (range and area) is carried out in 64 monitoring squares, representing 10.27% of the total number of squares in the country.
- Samples of each habitat type should make at least 10% of all the inventoried habitat polygons in the country (for 6210 habitat type, the selected monitoring polygons make 15.43% of all inventoried); and
- Share of monitoring squares in protected and not protected areas amounts to 27.26% and 72.74% respectively.

Observations in each monitoring square / permanent monitoring area are carried out at least two times during the reporting period.

In Slovakia, permanent monitoring localities (PMLs) for habitats were selected through stratified selection process in GIS, based on the following criteria (Šefferová et al. 2015):

- Area size (0.5 – 70 ha).
- Target habitat dominance within the area of PMLs in case of habitat complexes.
- Proposal and assessment of PMLs within each biogeographical bioregion (Alpine, Pannonian) independently.
- Geographical coverage – distribution of PMLs within the entire area of the habitats, to avoid large gaps and to avoid their concentration at a single location.
- Capturing of diverse quality, in order to capture representativeness to a large degree, i.e. to include in the PML network the localities with high quality as well as degraded sites.

286 PMLs of the 6210 habitat were used in 2015. The habitat is mainly distributed in the Alpine biogeographical region, although several sites are also located in the south of Slovakia in the Pannonian region. There were 81 PMLs of the priority habitat 6210*.

Assessment of conservation status using simple indicators – example from Denmark

The conservation status of 6210 grassland as well as other habitat types can be assessed using data acquired during a standardized, replicable mapping procedure. The method is useful to assess the conservation status for single occurrences as well as on any area level (Natura 2000-site, country, biogeographic or the entire EU). The method is also useful for recording changes in status over time.

The conservation status is evaluated from the scores given to weighed indicators for structure (structural-index) and weighed scores of plant species occurring in a 5-m radius circle on an area with homogenous vegetation characteristic of the habitat type (species index).

The structural indicators considered for 6210 are: 1) vegetation structure, 2) hydrology (not relevant for 6210), 3) management, 4) threats/pressures and 5) specific structures characteristic to each habitat type.

Each plant species has been assigned a value between -1 and 6. The negative value is given to problematic or invasive species, adventive/agricultural species are given 0 and remaining plants a value between 1 and 6, the higher values assigned to vulnerable/rare species only found at the floristic best sites.

The numbers for each indicator or plant species are entered in to a formula that returns a value between 0 and 1. The indicator values have been calibrated: 0-0.2 = bad conservation status, 0.2-0.4 = poor conservation status, 0.4-0.6 = moderate conservation status, 0.6-0.8 = good conservation status and 0.8-1.0 = high conservation status.

In Denmark all occurrences of habitat types in the N2000 sites are mapped every 6 years. The management plans of these areas propose that at least 75 % of the mapped occurrences should have a conservation status that is either good or excellent. The management of the sites thus aims at securing the conservation status of occurrences that are good or high and to improve the status of occurrences that are bad, poor or moderate by undertaking the necessary actions.

6.3 Conclusions and recommendations

Improvement of knowledge and methodologies for assessing conservation status, threats and pressures and the implementation of appropriate monitoring schemes are highly relevant for the conservation planning of this habitat type.

The generic definitions of the parameters used for conservation status assessment (area, structure and function) leave a wide range of interpretation to each country and makes a serious control of trends and processes very difficult at the EU scale.

Harmonised standard criteria and procedures for monitoring the habitat could be agreed at EU level. An expert group could be set up to develop appropriate standards for the monitoring of this habitat type (variables, parameters, criteria, thresholds). A common methodology should be developed based on scientific evidence, adjusting variables, parameters, criteria and thresholds by biogeographical region.

Thresholds, just like FRVs, are challenging because there are not always clear references to definitely set the ideal combination of traits to define the "favourable" condition. The variables and the involved processes are extremely diversified.

Being 6210 a secondary habitat, which can be replaced by (or itself replace) other Annex I habitat types, an ideal quantification of its optimal distribution is rather arbitrary and can depend mostly on global balances and strategical opportunities.

Methodological protocols based on standard tools and vegetation science (vegetation relevés, list of species and cover values, and vegetation mapping) would contribute to produce a significant amount of time- and geo-referred data, which might be appropriately processed at national and European level. The existence of already developed tools for the storage, retrieving and processing of large data sets, shows that this is possible and desirable[22].

The following objectives are proposed:

- Improve habitat monitoring schemes for this habitat type.

  It is considered necessary to set up harmonised methodologies at least at biogeographical level to monitor the conservation status of 6210 habitat and the evolution over time. The monitoring schemes should cover the high variability of 6210 habitat type.

- Define and prepare harmonized methods for the assessment of conservation status.

  The methods to assess the different parameters (range, area, structure and function, trends and future prospects) should allow comparison of conservation status assessments, at least between countries belonging to the same biogeographical region. Harmonization may need international collaboration and comparing methods used in different countries. The methods should also consider the different conditions and features existing for the habitat.

  The identification of reference sites for the habitat in each MS/biogeographical region could help harmonise the conservation status assessment and habitat monitoring. The selection of these sites should cover the ecological variability of the habitat across its

[22] See, e.g., EVA - http://euroveg.org/eva-database-obtaining-data , or VegItaly - http://www.vegitaly.it/

natural range. Ideally, there should be reference localities with the habitat in optimal ecological conditions for each biogeographical region.

- Prepare appropriate methodologies to define Favourable Reference Values.

  Some countries are currently working on methodologies to define FRV for the EU habitat types, including grasslands. These methods should be compared and harmonised so that similar approaches can be used by all the countries to define FRVs for this habitat type.

- Prepare standard methodologies to identify and quantify threats and pressures

  In general, there are no standard procedures and methodologies at country level to determine and assess the main threats and pressures on 6210 habitat. Some countries are currently preparing standard methodologies to assess threats and pressures on habitats and species of Community interest (e.g. Spain). The methods available should be compared and analysed in order to agree on common standards to assess threats and pressures on this habitat type.

- Improve knowledge about the habitat fragmentation

  There is not an adequate knowledge about the fragmentation of this habitat type. This gap should be tackled in order to allow for the design and implementation of appropriate measures to improve habitat connectivity where necessary.

- Supplementing the vegetation-oriented monitoring with monitoring also fauna biodiversity (in particular invertebrates typical for grasslands) would be advisable.

6.4 Monitoring effectiveness of the action plan and conservation measures

To assess the validity and effectiveness of management measures, it would be enough to carry out a serious, scientifically supervised monitoring activity of the habitat by applying standard scientific protocols. Habitat monitoring should provide evident indications of the results of management (effectiveness, ineffectiveness, damage).

Some possible indicators to assess the effectiveness of management measures could include the following:

- Area of habitat in favourable conservation status.
- Variation of area covered by the habitat, overall and in selected locations.
- Increase of managed areas, increase or maintenance of favourable status in managed areas, improving status of typical species, regression of unwanted species (e.g. too high amounts of bushes or fringe species, nitrophilous species).
- Diversity of habitat-typical, endangered or rare species, occurrence of problematic species.
- Floristic composition. High native species diversity. Vegetation structure, indicator species (both positive and negative and from different groups of organisms, incl. soil biota), umbrella species.
- Faunistic composition. High native species diversity. Functional structure of guilds, ecosystem services and representation of a typical species composition over all major taxonomic groups, especially invertebrate well represented and in good status

- Grassland-related biodiversity (presence and status of typical plants and invertebrate species).
- Key parameters of the successional processes (cover and height of scrub). Scrub encroachment.
- Surface under appropriate management.
- Cost of measures and funding.

6.5 Review of the action plan

It would seem appropriate to review and adjust the action plan every twelve years, to cover two reporting cycles (under Article 17 of the Habitats Directive), given the slow time for habitats to react to changes.

Nevertheless, the implementation of the actions could be reviewed every six years in order to check the activities implemented and intermediate results, detect possible gaps, difficulties and constraints that would need to be resolved.

7. COSTS, FUNDING AND SUPPORTING TOOLS

7.1 Cost of conservation measures

Costs of management and restoration are quite variable depending on the environmental conditions (e.g. topography) and the habitat status (e.g. scrub encroachment, degree of deterioration). Cost assessment is one of the most important steps in the preparation of grasslands management plans, and should follow some key principles.

7.1.1 Cost assessment

Cost assessment is one of the most important steps in the preparation of grasslands management plans. Cost varies over time and can rarely be generalised for specific types of work or a set of actions required to improve the habitat condition. Costs for similar works can differ greatly – depending on the geographic location, complexity of works, availability of workers and special equipment, as well as other factors. These guidelines are meant for use over an extended period of time, therefore exact costs are not given.

Costs must be assessed separately for each action or for the whole work in a particular place and time.

The following principles should be used by developers of nature conservation plans and large projects (e.g. LIFE) to estimate the cost of habitat management and restoration activities for a period of 2–5 years, at a large site or over several Natura 2000 sites.

In small areas (up to 1 ha), as well as in cases where management is regular or certain parameters are known (for example, annual mowing, pasturing, digging or filling up of ditches of certain size), the cost can be generally equated to works performed elsewhere, or by interviewing the potential workers and agreeing on the total cost of all works.

Key principles for determining reasonable costs of planned actions
(Jātnieks & Priede, 2017).

- After the evaluation of a site scheduled for management, choose the most appropriate actions, methods and technical means. A species and habitat conservation expert should be consulted to ensure that habitat management and restoration actions are chosen correctly.
- It is advised to divide the works into parts, by timing and by types of work. For example, by determining the pricing of each job (including manual work and use of particular equipment) separately and summing up to obtain a more objective assessment. The costs and efficiency of works often depend on the season, for example, rewetting of wetlands should be carried out in the dry season, otherwise the cost can grow unpredictably, but the objective may remain unrealised or the quality may be poor.
- Calculate direct costs in appropriate units: man-hours, person-days, the cost of equipment per hour, cost of materials per area or volume depending on the works (m^3, km, kg, ton). The number of units required for all the works should be assessed and summed up. Experience shows that mistakes in these calculations are common, therefore it is always advisable to use both available information on similar, already implemented works (such as reports on projects, specific works), and the experience

of institutions (Nature Conservation Agencies, Rural Support Service, municipal and non-governmental organisations). If the set of planned activities consists of various works not performed before or their pricing is not available, at least three potential contractors can be surveyed. In this case, the result can be obtained faster, however the risk increases that unforeseen costs that can complicate the reaching of the objective may arise during the works.

- Assess the indirect preparatory costs of habitat management and restoration works – site surveying, expertise, technical regulations, permits and agreements provided for by the regulatory enactments. This involves working time, transport and administrative costs, which are often inadequately assessed. The time and means to inform the public and explain the necessary steps must be scheduled in complex work projects.
- Consider regional cost differences and the availability of contractors at a distance of up to 30 km from the planned activity site. The costs may rise significantly if executors and/or equipment must come from a larger distance. For this reason, specific activities that require special equipment or skills (e.g. topsoil removal) will always be more expensive than simple activities (mowing, shrub felling, topsoil grinding).
- Entrust cost assessment to professionals – managers, managing specialists, practitioners, entrepreneurs – and schedule this job and adequate funding.
- Include potential income related to habitat restoration and management in the financial planning – wood, mown grass, removed topsoil and other materials. Ideally, they can be used, at least partially, on site (for example, for the construction of dams in rewetting) or removed from the area and used elsewhere (such as wood chips or wood, reeds for roofing, biomass for animal feed, cogeneration, or as a seed-containing material of target species for species introduction elsewhere), peat – for composting or gardening. However, in practice, these materials rarely find a practical application if the volumes are low, extraction sites are dispersed over a wide and hard-to-reach area. Therefore, it should be considered that the use of habitat restoration "by-products" may not always be economically beneficial.

Costs and support payments in different Member States

Costs of 6210 habitat management measures are available from several countries and show a significant variation according to site conditions and type of activity. Some examples are provided below.

In Germany, 450 Euro/ha is the cost reported for grazing and prevention of the growth of scrub and trees by farmers, but the cost for grassland restoration may amount to 3,000–8,000 Euro/ha.

Costs for ensuring appropriate grazing in Poland vary from 300 to 3000 Euro/ha/year. The lower figure is the cost of the incentive payment if the landowner has the livestock required; the higher cost corresponds to the market price of contracting the full grazing service (with renting animals and all necessary equipment included).

In Luxemburg, biodiversity management contracts for mowing this habitat have a cost of 420 Euro per ha.

Management costs were evaluated in the Rural Development Programme 2014-2020 for Latvia for the calculation of support rates for the agri-environmental measure "Managing of biodiversity in grasslands". For the habitat type 6210 the calculated management costs were 86 Euro/ha (mowing once per year and collecting of hay, no other expenses included). The calculated support rate was 206 Euro/ha (the support covers income foregone).

In Estonia, a support system for mowing or grazing of 6210 gives 85-250 Euro/ha per year depending on the management regime (applied only in protected areas).

In Hungary, mowing (if physically possible and acceptable as management method) costs about 100 Euro/ha/year.

Grassland restoration has generally a higher cost than maintenance activity.

The cost of shrub removal/eradication reported in Poland amount to 2,000-3,000 Euro/ha. In addition to this, removal of sprouts may be necessary over 5 consecutive years, which cost around 1000 Euro/ha/year.

Eradication of invasive species in Hungary can cost between 800 and 2000 Euro/ha.

In Latvia, the cost of restoration of this habitat type, where it is overgrown with shrubs, in complicated topography with a lot of manual work needed (tussock, dense litter layer) is about 3200 Euro/ha over 3 years (Jātnieks, Priede, 2017).

The Estonian support system for restoration of 6210 pays up to 590 Euro/ha depending on density of bush- and tree-layer, which is applied only in protected areas.

In Lithuania, some nature management plans show that restoration and maintenance of a good conservation status can cost between 400 and 8500 Euros per ha of 6210 habitat over 3-5 years. This greatly depends on the initial state of the habitat, its size and geographical location.

7.2 Potential sources of financing

The Common Agricultural Policy is the most important source of funding for conservation management and maintenance of these grasslands.
Other frequently used sources of EU funding are LIFE and European Regional Development Fund and European Territorial Cooperation (INTERREG) projects.

The main funds used for restoration, conservation management and monitoring of the habitat and to raise public awareness are national funds and EU funding from the Common Agricultural Policy (CAP), particularly rural development programmes, the LIFE programme, and the European Regional Development Fund including European Territorial Cooperation (INTERREG) projects.

7.2.1 Common Agricultural Policy funding

Regular mowing or grazing is required to ensure the conservation of semi-natural grasslands, therefore the conservation and management of these habitats are mainly funded in the context of the Common Agricultural policy. Both Pillar I (direct payments to maintain farming activity and for permanent pasture conservation) and Pillar II (Rural

Development) are useful to support grasslands management. Rural Development Programmes (co-funded through the European Agricultural Fund for Rural Development and Member States) is a particularly important source of funding for grassland management for biodiversity in most EU countries, through agri-environment measures, training for farmers on implementation of measures, investments in restoration, etc.

There is evidence, however, that current CAP support to calcareous grasslands is not sufficient to ensure adequate restoration and management and prevent abandonment or intensification. More efforts are needed to foster the use of agri-environmental measures and other support schemes under the CAP to promote the conservation of grassland habitats of Community interest.

Agri-environment measures

Agri-environmental measures have been used to promote conservation management of valuable grasslands in the EU. Some interesting experiences have been implemented with successful results, but uptake of agri-environmental contracts is still far too low in many regions. Higher payments and in some cases simplification of the rules for the farmers managing the habitat are needed to promote and strengthen the use of agri-environmental measures for extensively managed grasslands. It is also important to ensure that funding is available for investments in restoration actions, for example for restoring fencing or other field boundaries, water supply and gates needed to re-establish grazing systems, and for periodic scrub removal.

A particularly relevant approach is the implementation of ***results based schemes*** which allow both a focus on achievement of positive results for biodiversity conservation and greater flexibility in management decisions adapted to each site. An example for habitat 6210 is provided in the box below.

The Burren Programme: a locally led results-based agri-environment programme

The Burren Programme is a locally-led agri-environment climate measure under the Irish Rural Development Programme (RDP) 2014-2020. It is a 'hybrid' programme in the sense that it funds both results-based habitat management and complementary non-productive capital investments. The payment is awarded based on a scoring of the habitat condition of each field. The key criteria are: grazing level, litter level, absence of damage around feed sites and natural water sources, absence of bare soil and erosion, low level of encroaching scrub, bracken, purple moor-grass, agriculturally-favoured species / weeds, field retains its ecological integrity[23].

An important feature of the programme is that all participating farmers are allocated an annual allowance of 100 Euro per ha/year to undertake restoration work (e.g. scrub removal, fencing, gates, dry stone wall repair and reconstruction, water features, tracks) up to a maximum of 7,000 euro per year. They are asked to propose jobs (with description, map and estimated price) to the programme team, who are responsible for final approval. The programme team also obtain all required permits for the work and maintain a database of farmers willing to undertake contract work for other farmers who are not able to do the work. The scrub removal actions mean that the land continues to be eligible for the direct farm payment.

[23] Burren Programme M1 Score Sheet for Winterage – type Pastures.
http://www.burrenprogramme.com/wp-content/uploads/2015/08/M1-Winterage-Score-Sheet.pdf

Another important feature is the one to one farmer advice: advisors paid by the farmers visit the farm every summer to score each field condition and provide direct advice on the programme, cross-compliance and any other agreements the farmer has. The farmer then receives every year the record of scores for each field and management recommendations for how the field score could be increased next year. Farmers who are not happy with the scores can visit the programme field office and obtain one to one feedback on their scores and management options.

Eligibility for direct payments or other forms of farm income support

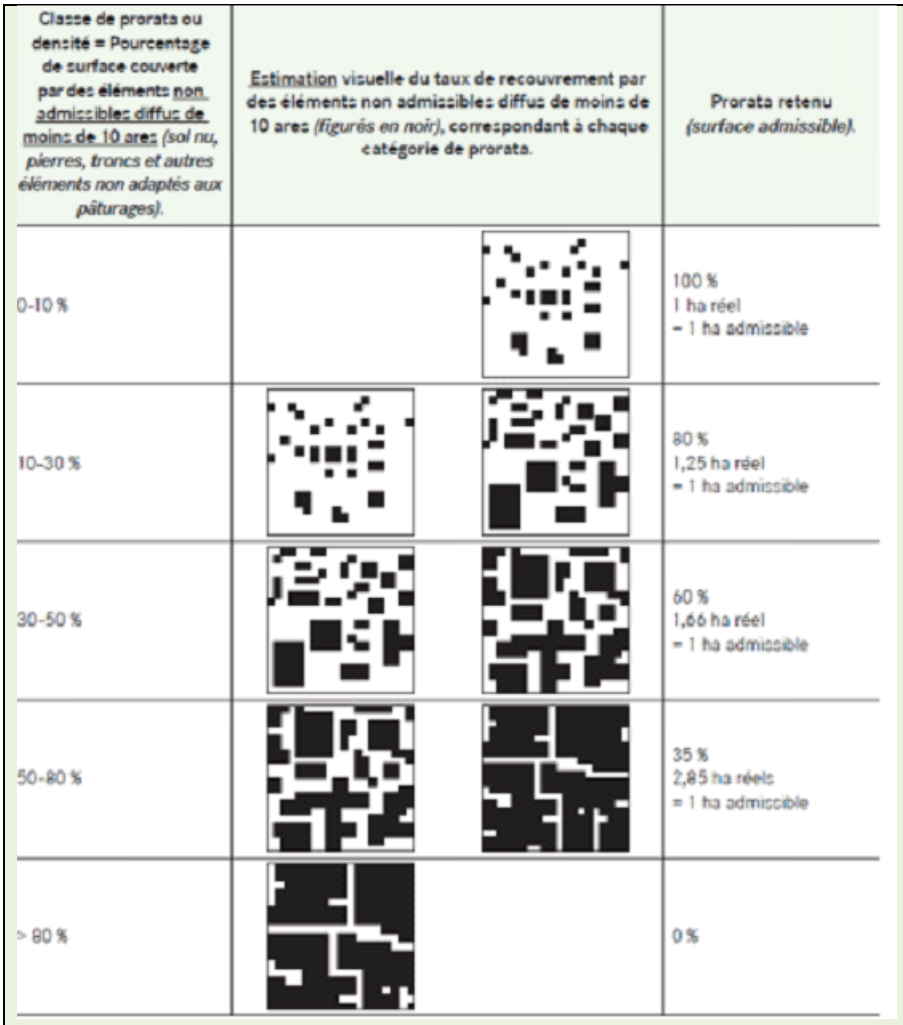
A key problem with Common Agricultural Policy support for habitat 6210 and other semi-natural grasslands has been that the presence of scrub and other landscape features made the land ineligible for direct payments. This has either preventing access by farmers and grazers to the most valuable source of funding for ongoing maintenance, and encouraged scrub invasion and land abandonment, or led to farmers removing all scrub from the land and thus destroying much of its conservation value. Such land can now be eligible for direct payments under the CAP if Member States choose to adapt the eligibility criteria to not pastures that include non-herbaceous vegetation[24], but the eligibility is limited in extent and subject to certain conditions, which are difficult to comply with and to control. France provides an example of how this was done to benefit habitat 6210 (see box below).

Eligibility of semi-natural grasslands with scrub for direct payments in France

The national authority in France has dedicated significant resources to designing a pro-rata system to comply with the EU regulations and at the same time make it possible for farmers to get direct payments for grazed range land with scrub, including habitat mosaics with 6210. The pro-rata system is used to calculate the payment rate taking into consideration only grazable elements; excluding ineligible features (e.g. rocks, non-grazable trees). It concerns pastoral areas with a ligneous cover that can be dominant, some wooded pastures (with grazable elements under the trees) and grazed oak and chestnut groves, even if grazable features are not present. A typology of ligneous element grazable taking into account the width and height of the bushes and a national list of inedible species have been established to exclude non grazable elements (inaccessible bushes for instance).

Source: Oréade-Breche case study for Alliance Environnement (2019). Evaluation of the impact of the CAP on habitats, landscapes, biodiversity. Study for European Commission DG AGRI.

[24] Since the 2017 Omnibus Regulation (Regulation (EU) 2017/2393) allowed Member States to expand the definition of permanent grassland to include shrubs and trees that produce animal feed but that are not directly grazed by animals.



Source of diagram: Ministry of Food and Agriculture and Payments and Services Agency (ASP), Guide national d'aide à la déclaration du taux d'admissibilité des prairies et pâturages permanents, 2018.

Advice and support to farmers

Support to farmers to facilitate their access to relevant schemes and assist them with the implementation of appropriate measures is also very important. This support can be provided through the Farm Advisory Services funded under the CAP but there are also interesting experiences that involve local or regional authorities and NGOs in encouraging grasslands conservation measures (see box below).

Initiatives from civil society play an important role in motivating farmers and spreading awareness of the importance of species-rich grassland. More cooperation and support among the stakeholders to create a self-sustaining management should be encouraged.

Romania Târnava Mare farm advisory service

In Romania, in the Târnava Mare area, the NGO Fundaţia ADEPT Transilvania has set up a farm advice service linking biodiversity conservation, Natura 2000 habitat and species conservation obligations, and rural income support, in cooperation with local communities and the Romanian Ministry of Agriculture and Rural Development and Ministry of Environment and Forests. Its vision is to achieve biodiversity conservation at a landscape scale by working with small-scale farmers to create incentives to conserve the semi-natural landscapes they have created. The service has helped the small-scale farmers gain eligibility for CAP direct payments, helped design and promote targeted agri-environment schemes, and opened up marketing opportunities for farmers. The service has helped the small-scale farmers gain eligibility for CAP direct payments. Around 60% of the holdings in the area are below the minimum size (1 ha total, made up of minimum 0.3 ha parcels) required to receive direct payments under CAP Pillar 1 in Romania. However, the NGO has facilitated arrangements whereby active farmers rent land from neighbours, and qualify for payments according to the amount of land they manage. In addition, the municipalities, which own the common grazing land and do not qualify for payments, have agreed to long-term rents with grazing associations so that they can apply for agri-environment contracts. This has brought large areas of land into CAP funded management schemes and out of the risk of abandonment.

Targeted funding for grassland management for conservation of particular species

Tailoring agri-environment measures to protected species is possible and there is extensive experience in the EU with numerous species, including fauna associated with 6210 grasslands. In England, for instance, there are interesting experiences with grassland management for endangered butterfly species (see box below).

Higher tier agri-environment scheme tailored at Marsh Fritillary butterfly on chalk grassland

Populations of the Marsh Fritillary butterfly (*Euphydryas aurinia*), that had become almost extinct in large parts of Europe due to the loss of wet and chalk grasslands, have stabilised or are increasing as a result of implementing a targeted agri-environment scheme in England. The occurrence of the species on chalk downland of habitat 6210 is a recent event as many wet grassland sites disappeared through drainage and agricultural improvement, whilst grazing pressure was reduced on downland allowing the host plant to grow in more favourable sward heights.The agri-environmental scheme funds management options that create an uneven patchwork of short and long vegetation on chalk grassland, using extensive grazing by cattle or traditional horse breeds, and selective mowing and scrub removal. Cattle and horse grazing is funded rather than the traditional sheep grazing usually used on chalk downland, as cattle and horses create a less evenly grazed sward.
Source: Ellis et al (2012)

Support under CAP for adding value to the produce of farms

Many farmers on Natura 2000 and HNV grasslands face challenges selling their products, because they are often small producers in remote areas where there are few customers who can pay premium prices. On the other hand, some are well-placed to take advantage of direct marketing to eco-tourists and tourist services such as hotels and restaurants. In some regions, farmers have built up successful direct marketing connections to supermarkets. The range of support for farmers seeking to add value to their produce

includes support for setting up producer groups, developing quality schemes for agricultural products, and setting up labelling and Protected Designation of Origin designations.

A local labelling scheme supporting calcareous grasslands: Altmuehltaler Lamm

The Altmuehltal region in Bayern (Germany) is characterised by juniper scrub on calcareous grasslands. Shepherded sheep flocks produce high-quality lamb meat and wool. Shepherds and landowners in the regional co-operative agree to graze at least half their sheep within the nature reserve Altmuehltal, feed only locally produced supplementary feed, and follow guidelines for animal welfare, grazing density, and a ban on pesticide and fertiliser use. The shepherds are guaranteed a fair price for their animals, and the lamb meat is sold in local hotels and butchers under the Altmuehltaler Lamm label.

7.2.2 LIFE projects

Numerous LIFE projects have developed measures to improve the conservation status of 6210 habitat, focusing on restoration, conservation measures and raising awareness.

Some examples of successful projects that have restored significant areas of 6210 habitat are given in the box below.

Successsful LIFE projects for the restoration and maintenance of 6210 habitat

In **Ireland**, the AranLIFE project (2014-2018) on the Aran Islands has delivered restoration measures to improve grazing management and tested results-based scoring in fields that contain 6210/*6210[25]. The project improved the conservation status of over 700 ha of a mosaic of habitat 6210 with limestone pavement (habitat 8240). The actions that improved grazing management were: improved access and grazing management through restoration of the laneways and drystone walls; removal of encroaching scrub and bracken; installation of infrastructure to provide water for grazing livestock; actions to correct mineral imbalances in livestock (mineral licks, concentrate supplementation or mineral boluses); working with farmers to increase the supply of grazing animals and record grazing times and biomass outputs to calculate optimum grazing rates (McGurn et al 2018).

In **Poland**, the LIFE project LIFE08NAT/PL/000513 carried out shrub removal, grazing, restoration by topsoil removal, and tested experimental conservation methods on 226 ha of dry grasslands (Barańska et al 2014; see also section 5.3). The project significantly improved the condition of several hundred hectares of grazed grasslands, with a reduction in the share of expansive species (ryegrass, sand reed and shrubs) (Murawy Life 2015). This represents the restoration of around a tenth of the calcareous grassland habitat (6210) in the polish Natura 2000 network. The project also published a detailed habitat action plan and guidance for 6210 restoration in Poland.

In **Slovakia**, a LIFE project was carried out in the SCI Devínska Kobyla (LIFE10 NAT/SK/080), where the area of dry grassland communities had been reduced by 61.1% compared with 1949 levels (Hegedűšová, Senko 2011). Based on a restoration plan, which was discussed with relevant stakeholders, 58 ha of overgrown dry grasslands were cleaned by the mechanical removal of woods and scrubs, eradication of black locust and re-introduction of grazing mainly by goats since 2015. The impact of restoration management measures was monitored predominantly on the biotope 6210* at different stages of succession.

[25] https://www.aranlife.ie/

A list of recent LIFE projects targeted to conservation of dry grasslands is included in the Annex.

7.2.3 European Regional Development Fund and other EU funds

The European Regional Development Fund (ERDF) has been programmed by some Member States to offer opportunities for funding grasslands restoration and management, for example in Lithuania, Poland, Romania, and Slovakia. The European Territorial Cooperation Fund (previously known as Interreg) also offers opportunities for bilateral Natura 2000 conservation projects, which has provided funding for grasslands management in Hungary.

7.2.4 Other approaches and support tools for grazing and shepherding

The decline in shepherded grazing over recent decades has had negative consequences for large areas of semi-natural grazed habitats. The limited availability and high cost of skilled shepherds is a widespread problem throughout common grazing land areas in many regions of South and Eastern Europe (García-González, 2008; Pardini and Nori, 2011).

Initiatives to address lack of grazing animals for abandoned sites, such as mobile sheep flocks, are being implemented in some areas in Ireland. Mobile flocks of sheep, often referred to as 'flying flocks', are a way to reinstate grazing of abandoned sites for short periods each year. Sheep flocks may be purchased by local nature authorities and then rented out for management by shepherds or grazers.

In France, there are initiatives from local authorities on communal lands, natural reserves and Regional Natural Parks to carry out and develop eco-grazing projects with a view to maintenance or restoring grassland habitats (in particular of 6210). These actions have often been accompanied by support to farmers to ensure the sustainability of the investment. For example, CEN (Conservatoire des Espaces Naturels) Normandie Seine manages numerous sites on limestone slopes on which it implements habitat conservation actions 6210. Extensive grazing is the main management measure implemented. To do this, the Conservatoire owns and manages a herd of animals of different breeds (cattle, horses, goats, and sheep) which allow them to implement a suitable management of calcareous grasslands.

In the Bourgogne Franche-Comté region, a programme financed by the State is carried by the Chamber of Agriculture of Haute-Saône, accompanied by management structures (Conservatoire des Espaces Naturels de Franche-Comté), and scientific institutions (National Botanical Conservatory of Franche-Comté-Invertebrate Regional Observatory, University of Franche-Comté, University of Lorraine, INRA, VetAgro-Sup of Clermont-Ferrand) in order to bring concrete solutions for farmers by type of grassland, including dry to very dry pastures of type 6210 (guide in preparation).

7.3 Main funding gaps and difficulties

A key challenge for the funding of 6210 habitat is to fund the restoration actions and other arrangements (e.g. purchase or access to livestock) needed to restart grazing management. The LIFE programme (and in some cases structural funds) are the main

financial source to support restoration of valuable grasslands and reintroduction of traditional farming practices. It appears that there are limited financial resources at national level to promote conservation of this habitat and it is a challenge to ensure continuity of recurrent management measures such as grazing once EU funding from LIFE projects finishes.

There are also difficulties to finance grasslands restoration with RDP funds. There is not a good track of expenditure of agro-environmental payments related to Natura 2000 conservation objectives. Programmes for promotion and marketing of semi-natural grassland products are not sufficiently developed.

Compensatory payment systems for landowners in Natura2000 sites as well as incentives (including fiscal incentives) are insufficiently developed in most European countries.

Morever, restoration and maintenance of grassland outside Natura 2000 network is more diffiuclty. It is easier to get financing for grassland in Natura 2000 than outside network. Due to connectivity issues, grasslands conservation outside the network wuld deserve more attention. LIFE funds are available only for restoration of habitats in Natura 2000 sites, and not outside.

7.4 Conclusions and recommendations

- There is a need to guarantee the continuity of appropriate management of 6210 habitat once time-limited funds such as LIFE projects are finished.
- Agricultural support schemes, including agri-environmental measures, could be better used for funding the management of this habitat.
- It is generally relatively easy to develop conservation projects and funding applications for this habitat type - conservation needs are usually clear and the measures required are well known and easy to plan; the partial results after some years are usually visible and reportable. Nevertheless, financing of preparatory actions, as habitat surveys, mapping and assessment, as well as financing of continuous monitoring is more problematic. Surveying and monitoring measures can however be financed as part of short-term projects containing also active conservation.
- There is a need to more precisely track the expenditure of agri-environmental payments and its contribution to the conservation objectives of habitat 6210 both within Natura 2000 and outside the network. Appropriate indicators should be proposed to facilitate such tracking both through the Common Agricultural Policy and through other funds.
- It is important that the required measures for improving the conservation status of this habitat type are included in Member States PAFs for the post 2020 financing period.

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ANNEX

Action plan to maintain and restore to favourable conservation status the habitat type 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchid sites)

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1. Habitat definition

1.1 Definition according to the Interpretation Manual of European Union Habitats

According to the Interpretation Manual of European Union Habitats (EC 2013), the 6210 habitat type includes dry to semi-dry calcareous grasslands assigned to the phytosociological class *Festuco-Brometea*.

The habitat consists of plant communities belonging to two orders within the *Festuco-Brometea* class: the steppic or subcontinental grasslands (*Festucetalia valesiacae* order) and the grasslands of more oceanic and sub-Mediterranean regions (*Brometalia erecti* or *Festuco-Brometalia* order). In the latter, a distinction is made between primary dry grasslands of the *Xerobromion* alliance and secondary (semi-natural) semi-dry grasslands of the *Mesobromion* (or *Bromion*) alliance with *Bromus erectus*. The latter are characterised by their rich orchid flora. Abandonment results in thermophile scrub with an intermediate stage of thermophile fringe vegetation (*Trifolio-Geranietea*).

The vegetation type is considered a priority type if it is an important orchid site. Important orchid sites should be interpreted as sites that are important on the basis of one or more of the following three criteria:

(a) the site hosts a rich suite of orchid species
(b) the site hosts an important population of at least one orchid species considered not very common on the national territory
(c) the site hosts one or several orchid species considered to be rare, very rare or exceptional on the national territory.

The characteristic plant species mentioned in the Interpretation Manual include: *Adonis vernalis, Anthyllis vulneraria, Arabis hirsuta, Brachypodium pinnatum, Bromus erectus, Bromus inermis, Campanula glomerata, Carex caryophyllea, Carlina vulgaris, Centaurea scabiosa, Dianthus carthusianorum, Eryngium campestre, Euphorbia seguierana, Festuca valesiaca, Fumana procumbens, Globularia elongata, Hippocrepis comosa,Koeleria pyramidata, Leontodon hispidus, Medicago sativa ssp. falcata, Ophrys apifera, O. insectifera, Orchis mascula, O. militaris, O. morio, O. purpurea, O. ustulata, Polygala comosa, Primula veris, Sanguisorba minor, Scabiosa columbaria, Silene otites, Stipa capillata, S. joannis, Veronica prostrata, V. teucrium.*

Some invertebrate species are also mentioned in the Interpretation Manual for this habitat type: *Papilio machaon, Iphiclides podalirius* (Lepidoptera); *Libelloides* spp., *Mantis religiosa* (Neuroptera).

1.2 Habitat definition according to the EUNIS

According to the EUNIS (European Nature Information System) habitat classification (Davies et al., 2004, Schaminée et al. 2012), this habitat type (6210) consists of two quite different subtypes, with different distribution, species, conservation and management issues, which makes it hard to treat them in one type. In the Red List of European Habitats (Janssen et al., 2016), they were therefore treated as two different types, both evaluated as valuable:

E1.2a: Semi-dry perennial calcareous grasslands occur **throughout Europe** from the submediterranean to the hemiboreal zone. Characteristic are the semi-dry (meso-xeric) base-rich soils. This habitat is the most species rich plant community of Europe. It accounts for more than 90% of 6210, including most of the orchid-rich types. Due to the imprecise definitions in the Interpretation manual, some very similar types in certain countries have been included in other priority habitats despite floristically-ecologically they belong to E1.2a (as a subtype of 6210). This refers to the mesoxeric, base-rich parts of 6270 (Nordic countries), mesoxeric parts of 6240* (eastern central Europe) and meso-xeric parts of 62A0 (Illyrian region). To avoid inconsistencies between countries, all mesoxeric basiphilous grasslands of Europe should be included in 6210. E1.2a corresponds to the order *Brachypodietalia pinnati* in Mucina et al. (2016) but additionally comprises several alliances not included there, namely *Scorzonerion villosae* and *Brachypodion phoenicoidis* (and some more in Ukraine and Russia).

E1.1i: Perennial rocky calcareous grassland of subatlantic-submediterranean Europe: They occur only in parts of the range of E1.2a, namely in **France, Spain, Belgium, W Italy, W Germany, W Switzerland, and S UK**. The inconsistency arises from the fact that in the rest of Europe, the xeric and/or rocky basiphilous grasslands are not included in 6210, but in other habitat types (6240, 6250, 6190, 62C0, 62A0). E1.1i only consitutes a small fraction of the area of 6210, due to its more extreme site conditions (drier, often steeper) is less species rich, but also less prone to succession and eutrophication. This unit corresponds to the orders *Brachypodietalia phoenicioidis* (excl. *Brachypodion phoenicolidis*) and *Artemisio albae-Brometalia erecti* in Mucina et al. (2016).

1.3 Habitat definition based on the European checklist of vegetation

In a recently published European checklist of vegetation (Mucina et al. 2016), within the *Festuco-Brometea* class several orders with different alliances are recognised. This hierarchical floristic classification of the vegetation of Europe was done based on the compilation and revision of high rank syntaxa, which can be further used for uniform interpretation of habitat types across the EU.

In the table included below an overview of orders and alliances of *Festuco-Brometea* is provided together with their description, based on the European checklist of vegetation (Mucina et al. 2016). The table also identifies the habitat types of the Habitats Directive which are relevant for the alliances included in at least some member states.

Vegetation communities and habitat types included in the *Festuco-Brometea* class, based on the classification of vegetation of Europe by Mucina et al. 2016 for higher plants

***Class: Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947**			
Order	**Alliance**	**Annex I Habitat types**	**Description (copied from Mucina et al. 2016)**
Brachypodietalia pinnati Korneck 1974 nom. conserv. propos.			Meso-xerophytic grassland on deep calcareous soils of Europe
	Bromion erecti Koch 1926	6210/6210*	Meso-xerophytic basiphilous grasslands of Western Europe and subatlantic Central Europe.
	Cirsio-Brachypodion pinnati Hadač et Klika in Klika et Hadač 1944	6210/6210*, 6240* p.p., 6260 p.p	Meso-xerophytic basiphilous grasslands of the subcontinental regions of Central and southeastern Europe.
	Filipendulo vulgaris-Helictotrichion pratensis Dengler et Löobel inDengler et al. 2003	6270 p.p. (dry basiphilous parts), 6210/6210* (in N Germany, Denmark, etc.) 6280* marginally	Meso-xerophilous basiphilous grasslands of alvars of Fennoscandia and the southern seaboards of the Baltic Sea.
	Gentianello amarellae-Helictotrichion pratensis Royer ex Dengler in Mucina et al. 2009	6210/6210*	Meso-xerophytic basiphilous grasslands of northwestern Europe.
	Polygalo mediterraneae-Bromion erecti (Biondi et al. 2005) Di Pietro in Di Pietro et al. 2015	6210/6210*	Dry grasslands on deep clay-rich soils over flysch bedrocks in the colline to lower montane belts of the Apennines.
	Chrysopogono-Danthonion calycinae Kojič 1959	6210/6210*	Dry grasslands on deep soils over siliceous bedrocks in the colline to submontane belts of the Southern and Central Balkans
Festucetalia valesiacae Soo 1947			Steppes and rocky steppic grasslands on deep soils in the steppe and forest-steppe zone of Europe and northwestern Central Asia
	Festucion valesiacae Klika 1931 nom. conserv. propos.	6240*, 6250*, 6210	Steppe fescue grasslands on deep calcareous soils of subcontinental Central Europe, Romania, Bulgaria and northwestern Ukraine
	Koelerio-Phleion phleoidis Korneck 1974	6210/6210*, 6240*, (2330 p.p.), (6120* p.p.)	Steppic silicicolous grasslands of the subatlantic and subcontinental regions of the temperate Europe
	Stipion lessingianae Soó 1947	6240*, 6250*	Dry feather-grass and fescue steppes on deep soils of

			Transsylvania,Moldova and southwestern Ukraine
	Artemisio-Kochion Soó 1964	6250*	Relict tardiglacial xerophytic loess steppes of the Pannonian region
	Stipo-Poion xerophilae Br.-Bl. et Richard 1950	6210, 6240*, 6190	Relict tardiglacial xerophytic fescue and feather steppic rocky grasslands of deep intramontane valleys of the Alps
Stipo pulcherrimae-Festucetalia pallentis Pop 1968 nom. conserv. propos.			Xerophilous open steppic grasslands on shallow rocky calcareous and siliceous substrates of Central and southeastern Europe
	Alysso-Festucion pallentis Moravec in Holub et al. 1967	6190	Xerophilous steppic grasslands on shallow soils over siliceous and ultramafic rocks as well as Silurian limestones of the Hercynicum
	Asplenio-Festucion pallentis Zolyomi 1936 corr. 1966	6190	Xerophilous rocky steppic grasslands on shallow soils over siliceous and ultramafic rocks of the Eastern Alps and northern fringes of the Pannonian Basin
	Bromo pannonici-Festucion csikhegyensis Zolyomi 1966 corr.Mucina in Di Pietro et al. 2015	6190	Xerophilous rocky steppic grasslands on calcareous substrates of the northern fringes of the Pannonian Basin and the Ukrainian Podolya
	Chrysopogono-Festucion dalmaticae Borhidi 1996	6190	Xerophilous rocky steppic grasslands on calcareous substrates of the southern fringes of the Pannonian Basin
	Saturejion montanae Horvat in Horvat et al. 1974	6190 or 62A0	Xerophilous rocky steppic grasslands on calcareous substrates of the Northern Balkans
	Pimpinello-Thymion zygoidi Dihoru et Donita 1970	62C0	Xerophilous rocky steppic dwarf-shrub rich grasslands on steep calcareous slopes of Dobrogea and northeastern Bulgaria
	Diantho lumnitzeri-Seslerion (Soó 1971) Chytrý et Mucina in Mucina et Kolbek 1993	6190	Dealpine relict xerophilous steppic grasslands on calcareous substrates of southeastern Central Europe
	Seslerion rigidae Zolyomi 1936	6190	Dealpine relict xerophilous steppic grasslands on calcareous substrates of the Eastern Carpathians

Brachypodietalia phoenicoidis Br.-Bl. ex Molinier 1934 -			Submediterranean steppic grasslands on deep basic to neutral mesic soils of precipitation-rich regions of southwestern Europe
	Brachypodion phoenicoidis Br.-Bl. ex Molinier 1934	6210/ 6210*	Submediterranean neutro-basiphilous steppic grasslands on deep mesic soils of the Ligurian and Tyrrhenian seaboards
	Artemisio albae-Dichanthion ischaemi X. Font ex Rivas-Mart. et M.L. Lopez in Rivas-Mart. et al.2002	6210/ 6210*	Submediterranean submontane and montane acidophilous steppic grasslands of the piedmonts and intramontane valleys of the Pyrenees
	Diplachnion serotinae Br.-Bl. 1961	6210/ 6210*	Submediterranean submontane acidophilous steppic grasslands of the precipitation-rich Insubrian southern rims of the Alps
Artemisio albae-Brometalia erecti Ubaldi ex Dengler et Mucina in Mucina et al. 2009			Xerophytic basiphilous open grasslands of subatlantic and submediterranean Europe
	Xerobromion erecti (Br.-Bl. et Moor 1938) Zoller 1954	6210/ 6210*	Meso-xerophytic basiphilous open grasslands of southwestern Central Europe and France
	Festuco-Bromion Barbero et Loisel 1972	6210/6210*	Meso-xerophytic basiphilous open grasslands of the submediterranean regions of Provence and Liguria
Scorzoneretalia villosae Kovacevic 1959			Amphiadriatic dry steppic submediterranean pastures of the Prealpine, Illyrian and Dinaric regions
	Chrysopogono grylli-Koelerion splendentis Horvatic 1973	62A0	Illyrian submediterranean rocky grasslands on shallow calcareous soils
	Saturejion subspicatae Tomic-Stankovic 1970	62A0	Dinaric submediterranean calcareous roky grasslands onshallow soils
	Centaurion dichroanthae Pignatti 1952	62A0	Prealpic submediterranean montane calcareous rocky grasslands on shallow soils
	Scorzonerion villosae Horvatic ex Kovacevic 1959	6210/6210*, but probably often classified as 62A0	Prealpic and Illyrian meso-xerothphytic submediterranean grasslands on deep and partly decalcified soils

	Hippocrepido glaucae-Stipion austroitalicae Forte et Terzi in Forte et al. 2005	62A0	Submediterranean xeric pastures on rocky calcareous soils of Apulia (Southern Italy)
Mucina et al. (2016) do not acknowledge Italian endemic alliance, for nomenclatural reasons. It is widely used in the Italian Natura 2000 Network and diagnosis of 6210 habitat is based on the ecological and species characteristic of this alliance			
Order	**Alliance**	**Annex I Habitat types**	**Description (based on Biondi E., Blasi C., 2015)**
Phleo ambigui-Brometalia erecti Biondi et al. in Biondi et al. 2014			
	Phleo ambigui-Bromion erecti Biondi et al. ex Biondi & Galdenzi 2012	6210	Xerophilous to semi-mesophilous, from (sub)Mediterranean to Temperate secondary grasslands of the calcareous Apennines, with optimum in the mesotemperate.

2. Description of related habitats

Other habitat types are associated or in contact with 6210 and can influence its management. Some habitats are related with 6210 in terms of dynamics and ecological succession or forming mosaics. Since the gradient of environmental conditions of dry grasslands is continuous, vegetation of the 6210 habitat is often in transition to other vegetation types, which include the following.

2130 *Fixed coastal dunes with herbaceous vegetation (grey dunes)
There is a transition towards communities of *Mesobromion* in the following cases: old mesophile grasslands of dune slacks and inner dunes (*Anthyllido-Thesietum*), frequently in mosaic with communities of *Salix repens* and particularly developed on the west face of the dunes; grasslands with *Himantoglossum hircinum* of the dunes in the De Haan area (EC 2013).

40A0 *Subcontinental peri-Pannonic scrub.
Occur on both, calcareous and siliceous substrates forming mosaic-like vegetation with steppe grassland (6210) and forest-steppe elements or plants of the rupicolous Pannonic grasslands (6190) often along the fringes of woodlands (EC 2013).

The demarcation between 6210 habitat and *40A0 Subcontinental peri- Pannonic scrub is sometimes unclear. The 40A0 seems to be a stage of expansion of *Prunus fruticosa* after abandonment of grazing on 6210.

5130 Juniperus communis formations on heaths or calcareous grasslands
Formations with *Juniperus communis* of plain to montane levels mainly correspond to phytodynamic succession of the mesophilous or xerophilous calcareous grasslands, grazed or let lie fallow, of the *Festuco-Brometalia* (EC 2013) and or Calluna heath.

In some cases, there are difficulties in differentiating habitat 6210 from habitat 5130 - *Juniperus communis* formations. In fact, habitat 5130 is a habitat whose identification and delineation is not easy because of its close intertwining with habitat 6210 and a vegetation structure that can range from scattered individuals on calcicolous grasslands to dense and impenetrable shrub vegetation. It is importnat to consider this habitat mosaic and ensure an approriate mangement that allows its conservation in adequate consitions.

6110 *Rupiculous calcareous or basophilic grasslands of the *Alysso-Sedion albi*
Open, patchy communities on exposed bedrock or loose rock, dominated by annuals and succulents. They are often located within expanses of other habitat types, mainly 6210. In such instances the habitats should not be mapped as a complex but the examples of this type should be recorded as features within the more extensive habitat[26]. In some regions of Belgium and Germany this habitat is very closely linked with *Xerobromion* and *Mesobromion* associations (EC 2013).

6120 *Xeric sand calcareous grasslands
Dry, frequently open grasslands on more or less calciferous sand fall within type 6120. The sandy-soil types can be considered as type 6120 if the sand is calcareous whereas the moraine type can be considered as type 6210 (Pihl *et al*. 2001) in Denmark.

[26] https://www.bfn.de/en/lrt/natura-2000-code-6110.html

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

In Denmark, on areas where the calcareous content has been wholly or partially washed out (pH 6-7) the community type represents a transitional stage towards type 6230; in such cases, the species composition will determine the appropriate classification (Pihl *et al*. 2001).

6240 *Sub-pannonic steppic grasslands

Steppic grasslands, dominated by tussock-grasses, chamaephytes and perennials of the alliance *Festucion valesiacae* and related syntaxa. These xerothermic communities are developed on southern exposed slopes on rocky substrate and on clay-sandy sedimentation layers enriched with gravels (EC 2013), as well as on loess and deep sandy soils under summer dry climatic conditions. They are partially of natural, partially of anthropogenic origin. They include dry, thermophilous and continental areas, characterised by the influence of entities with Mediterranean–steppic distribution and azonal edaphic and microclimatic occurrences in the Continental and partially other Biogeographic regeions (see Ssymank 2013). The guide species of reference, distinguishing them from other dry grassland types, could be considered to be *Stipa capillata* (Lasen & Wilham 2004).

6270 *Fennoscandian lowland species-rich dry to mesic grasslands

This habitat is comprised of semi-natural grasslands of similar physiognomy but with few or no calcicolous plant species, primarily on nutrient-poor soils on gneiss or granite bedrock in the Nordic countries.

6280* Nordic alvar and precambrian calcareous flatrocks

There is problem between recognition of habitats 6210 and 6280 *Nordic alvar and Precambrian calcareous flatrocks habitats in certain regions, especially in North-Estonia, where calcareous soil is very thin as accurate for 6280*, but productivity and species richness of the grass-layer are corresponding to the 6210. The opposite situation in some West-Estonian areas is also not rare – productivity can be low and some very characteristic species indicate to 6280* but there is no monolitic limestone or very thin soil.

62A0 Eastern sub-mediterranean dry grasslands (*Scorzoneratalia villosae*)

Xeric grasslands of the sub-Mediterranean zones of Trieste, Istria and the Balkan peninsula, where they coexist with steppic grasslands of the Festucetalia valesiacae (6210), developing in areas of lesser continentality than the latter and incorporating a greater Mediterranean element (EC 2013).

6410 Molinia meadows on peaty or clayey-silt-laden soils

Transitions towards the subtype found on neutro-alkaline to calcareous soils may occur on intermittently wet soils. In the Carpathian Mountains, the species rich *Brachypodio pinnati-Molinietum arundinaceae* community is typical by common occurrence of wet diagnostic species of *Molinion* and thermophilous species of the *Festuco-Brometalia* class (Škodová et al. 2014).

6510 Lowland hay meadows (*Alopecurus pratensis. Sanguisorba officinalis*) and 6520 Mountain hay meadows

These are semi-natural habitats whose maintenance depends on human activity. They are nutrient rich, mesic, regularly mowed and manured in a non-intensive manner. Without

manuring and when mowing is carried out more than once a year, certain drier subtypes of this habitat tend to develop towards *Mesobromion* grasslands (habitat 6210) (Lasen & Wilham 2004). The demarcation of 6210 from some forms of 6510 habitat (with the presence of some termophilous species) is often unclear, in particular in northern Poland and Estonia, where the habitat is near the geographical range limit and the list of termophilous species is, due to climatic reasons, naturally limited. In particular, areas of xerothermic grasslands (6210) invaded by *Arrhenatherus elatius* and inappropriately managed by mowing instead of grazing, may be difficult in interpretation.

7230 Alkaline fens

In fresh beach ridge hollows and at the edge of calcareous fens, the 6210 community type may be in transition towards type 7230 (Pihl et al. 2001).

8240*Limestone pavement consists of blocks of limestone bedrock, which can form mosaics with calcareous grasslands. The habitat 6210 can be an integral part of the complex habitat type 8240. It sio impornat to conserve tyis habitats mosaics that form a valuable landscape in some part of the EU.

3. Recent LIFE projects targeted to conservation of dry grasslands

BE	LIFE13 NAT/BE/001067	LIFE Pays Mosan - Connectivity of the Natura 2000 network across the Belgian-Dutch borders in the Meuse basin
CZ	LIFE09/NAT/CZ/000364	Integrated Protection of Rare Butterfly Species of Non-forest Habitats in the Czech Republic and Slovakia
CZ	LIFE09 NAT/CZ/000363	LIFE+ Lounské Středohoří Steppes
CZ	LIFE16 NAT/CZ/000001	CZ-SK SOUTH LIFE - Optimalization of Natura 2000 sites management delivery in the South Bohemia Region and the territory of South Slovakia
DE	LIFE10 NAT/DE/000007	KTKK HX - Dry, calcareous habitats in the cultural landscape of Höxter
DE	LIFE15 NAT/DE/000290	LIFE Rhon grassland birds - Hessische Rhn Mountain grasslands, rough grazing and their birds
DK	LIFE 08NAT/DK/00465	Restoring semi-natural habitat types to at total cover of site Helnæs
IE	LIFE12 NAT/IE/000995	LIFE Aran - The sustainable management of the priority terrestrial Habitats Directive Annex 1 habitats of the Aran Islands
IT	LIFE12 NAT/IT/000818	LIFE Xero-grazing - Semi-natural dry-grassland conservation and restoration in Valle Susa through grazing management
IT	LIFE11/NAT/IT/234	Praterie - Urgent Actions for the conservation of grasslands and pastures in the Gran Sasso and Monti della Laga territory
IT	LIFE13/NAT/IT/000371	SUNLIFE
IT	LIFE11/NAT/IT/000044 and LIFE14 IPE IT 018	GESTIRE and LIFE IP "Gestire 2020"
LT	LIFE10 NAT/LT/000117	Buveinių tvarkymas - Restoration of degrading habitats of Community interest in the protected areas of Lithuania
LU	LIFE13 NAT/LU/000068	LIFE Project 'Conservation and management of species-rich grasslands by local authorities'
LU	LIFE13 NAT/LU/000782	LIFE Orchis: Restoration of calcareous grassland in eastern Luxembourg 2014-2019
LV	LIFE16 NAT/LV/000262	GrassLIFE - Restoring EU priority grasslands and promoting their multiple use
PL	LIFE08 NAT/PL/000513	XericGrasslandsPL - Conservation and restoration of xerothermic grasslands in Poland - theory and practice
PL	LIFE11 NAT/PL/000432	Ochrona obszaru PKOG - Protection of valuable natural non-forest habitats typical of the "Orle Gniazda" Landscape Park
SI	LIFE14 NAT/SI/000005	LIFE to grasslands - conservation and management of dry grasslands in eastern Slovenia
SK	LIFE17 NAT/SK/000589	LIFE SUB-PANNONIC - Conservation of subpannonic dry grassland habitats and species