MANAGING AND RESTORING SEMI-NATURAL HABITATS – A REVIEW OF THE LINKS WITH EXTENSIVE GRAZING SYSTEMS

SUMMARY REPORT OF FINDINGS - FINAL REPORT

Analysis developed by EFNCP and WENR for the European Environment Agency

A summary report edited by EEA & EFNCP staff

Submitted as reference document on the potential use of grazing for the management of habitats on Annex I of the EU Habitats Directive that depend on, or benefit from, grazing by livestock.

Published on the EU Nature Restoration Reference Portal

Version 1, March 2026

European Environment Agency

Acknowledgements:

Jan-Erik Petersen (EEA) – development of analytical approach and main editor

Gwyn Jones (EFNCP), Julia Wiese (EFNCP) – lead experts for thematic analysis and contributions to chapters of the report

Hedwig Bartl (EAA) and Berien Elbersen (WENR) – lead experts for self-standing studies during the initial phase of the analytical project

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List of Abbreviations

ANC	Area of Natural Constraint
BGR	Biogeographical Region
CAP	Common Agricultural Policy
CEEC	Central and Eastern European Countries
CLC	Corine Land Cover
DAD-IS	Domestic Animal Diversity Information System
EEA	European Environment Agency
EFNCP	European Forum on Nature Conservation and Pastoralism
ENVZ	Environmental Zone
ERDF	European Regional Development Fund
ETC-BD	European Topic Centre for Biological Diversity
EUNIS	European Nature Information System
FAO	Food and Agriculture Organisation
HNV	High Nature Value
IACS	Integrated Administration and Control System
IIASA	International Institute for Applied Systems Analysis
JRC	Joint Research Centre
LPIS	Land Parcel Identification System
LU	Livestock Units
MS	Member State
N2000	Natura 2000
UAA	Utilised Agricultural Area
VCS	Voluntary Coupled Support
WENR	Wageningen Environmental Research

List of key terms

This list of key terms provides definitions for technical terms used in the EEA report on extensive grazing and semi-natural habitat management.

Annex I Habitats

Habitat types of Community interest listed in Annex I of the EU Habitats Directive (92/43/EEC); which establishes a framework for the conservation of natural habitats and wild fauna and flora.

Article 17 Reporting

Mandatory reporting by EU Member States every six years on the conservation status of Annex I habitats and Annex II/IV/V species under the Habitats Directive. Primary data source for the estimates of area of habitats in Annex I per Member State.

Biogeographical regions

Large-scale ecological areas defined based on shared characteristics of climate, flora, fauna, and geology, used e.g. in the context of EU Habitats Directive. In Europe, eleven terrestrial biogeographical regions occur: Alpine (ALP), Anatolian (ANT), Arctic (ARC), Atlantic (ATL), Black Sea (BLS), Boreal (BOR), Continental (CON), Macaronesia (MAC), Mediterranean (MED), Pannonian (PAN) and Steppic (STE). For more information please consult: Europe's biodiversity - biogeographical regions and seas | Publications | European Environment Agency (EEA)

CLC (Corine Land Cover)

Europe-wide geo-spatial dataset classifying land cover types. Used in this study to estimate the extent of grazed semi-natural vegetation; see CORINE Land Cover — Copernicus Land Monitoring Service

Environmental Zones

Environmental stratification of Europe (Metzger et al., 2005) used to differentiate grazing estimates by productivity factors such as climate, altitude, and soil characteristics, resulting in 13 environmental zones: Alpine North (ALN), BOR (Boreal), NEM (Nemoral), Atlantic North (ATN), Alpine South (ALS), Continental (CON), Atlantic Central (ATC), Pannonian (PAN), Lusitanian (LUS), Anatolian (ANA), Mediterranean Mountains (MDM), Mediterranean North (MDN), Mediterranean South (MDS).

Halada Grazing Need

Number of livestock (in livestock units) required to maintain semi-natural habitats at appropriate grazing intensity over a single grazing season in a specific geographical area

(EU/country/biogeographical region or a combination thereof). Derived by multiplying habitat area by Halada Stocking Rate.

Halada Habitats

Annex I habitats of the EU Habitats Directive that depend on or benefit from agricultural activities (primarily grazing or mowing). Named after Halada et al. (2011), who first compiled this list. These habitats require continuation of low-intensity farming practices for their conservation.

Halada Stocking Rate

The range of livestock stocking density (expressed in LU/ha) considered optimal for maintaining Halada habitats in favourable conservation status. Derived from expert consultation and expressed as an average value over the grazing season.

Livestock Unit (LU)

Standardised measurement for comparing different livestock types based on feed requirements. For IACS purposes a further standardisation is in place e.g. any adult bovine >24 months = 1 LU; any sheep/goat >1 year old = 0.15 LU.

Representative Stocking Rate

A single stocking rate value derived from expert assessment representing the likely average grazing need of a Halada habitat per Biogeographical Region. Typically set as the median between minimum and maximum estimates, adjusted for regional productivity factors.

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1 Introduction

Both extensive grazing systems and the landscapes and habitats that are associated with them have been declining strongly since the beginning of the 20th century due to fundamental technical, economic and social changes. This decline is closely associated with structural change in European livestock systems, a process that continues at pace and has major implications for the economy of rural areas and European Union (EU) nature conservation objectives (European Commission, 2026). Analysis by the European Environment Agency has shown that those habitats on Annex I of the EU that are connected to extensive farming practices are particularly threatened (European Environment Agency, 2020). The conservation of these habitats and of biodiversity in the wider agricultural landscape has received renewed emphasis via the recent adoption of the EU Nature Restoration Regulation.

The need to preserve the extensive grazing systems that have shaped European biodiversity is underlined by the United Nations declaring 2026 as 'International Year of Rangelands and Pastoralists' (IYRP). This UN initiative aims to recognise the work of shepherds and livestock farmers across the globe. Their role is critical in maintaining the livestock systems for a sustainable use of pastoral landscapes and conserving the threatened European habitats that depend on extensive grazing practices.

This report summarises key results from work that has been developed, on behalf of the European Environment Agency (EEA), to estimate the area under extensive grazing and the livestock numbers required to maintain semi-natural habitats in the European Union (and Europe). This study also reviews the ecological links between livestock grazing and the maintenance of semi-natural habitats in Europe. It was carried out by the European Forum on Nature Conservation and Pastoralism (EFNCP) Wageningen Environmental Research (WENR) for the European Environment Agency (EEA), with some support from the International Institute for Applied Systems Analysis (IIASA), during the period 2020 to 2023. Subsequently, it underwent further expert and Eionet consultation. Given that the study was initiated before Brexit, outcomes and analysis presented in this report cover the EU-27 Member States (MS) and the United Kingdom (UK). The input data used for the analysis presented here relate to the same period, which means that Corine Land Cover (CLC) data from 2018 and data from the 2013 – 2018 reporting period under the EU Habitats Directive were utilised.

Previous work sponsored by the EEA has shown that about one third of all habitats listed in Annex I of the EU Habitats Directive (Council Directive 92/43/EEC) depend on the continuation of extensive agricultural practices, mostly grazing (cf. Halada et al., 2011). The positive role that farmers can play in managing such semi-natural habitats (as well as other farmland biodiversity) is briefly reviewed in a recent EEA briefing (EEA, 2024). However, previous work has not addressed the question of which stocking densities are appropriate for maintaining these habitats in a favourable condition, and estimates for the overall livestock population required for managing the area of semi-natural habitats by grazing are lacking. Furthermore, official statistical data provides insufficient information into the geographic distribution and/or overall herd size of extensive grazing systems (Malek et al., 2024a). The work presented in this report builds on available data (i.e. the CLC data for the reference year 2018, and the most recent Article 17 reporting) at the time of completion of the contract. Some outcomes from this work, i.e. estimated grazing shares per CLC class, have been already published as an academic paper on the geo-spatial modelling of grazing (cf. Malek et al., 2024a).

The work presented in this report combines the five core tasks described below **(Figure 1.1)**:

1) A **literature-based overview** of the relationship between extensive livestock systems and the conservation of semi-natural habitats (and related species), including a review of the **livestock systems** that have particular importance for maintaining such habitats across the EU or in certain European regions (Chapter 2);

2) **Estimates of the potential area of semi-natural vegetation** that is still grazed across Europe, based on the combination of Corine Land Cover (CLC) data and information collected through expert survey (Chapter 3);

3) **Expert-based estimates** for the **suitable stocking density** (expressed as a range of stocking density values) to maintain habitats in Annex I of the Habitat Directive, that are recognized to depend partly or fully on extensive farming practices (principally grazing or mowing). These are called ‘Halada habitats’ in this study (Chapter 4);

4) A **comparison** between the **estimated management needs of the Halada habitats** and the **estimated potential of current extensive grazing capacity** (based on CLC data and expert knowledge); this includes a comparison to national ruminant livestock populations (Chapter 5); and,

5) An **uncertainty analysis** of the estimates presented in this study, and a discussion in the context of implications of this work for targets in the Nature Restoration Regulation (NRR), specifically those related to maintaining and restoring semi-natural habitats (Chapter 6).

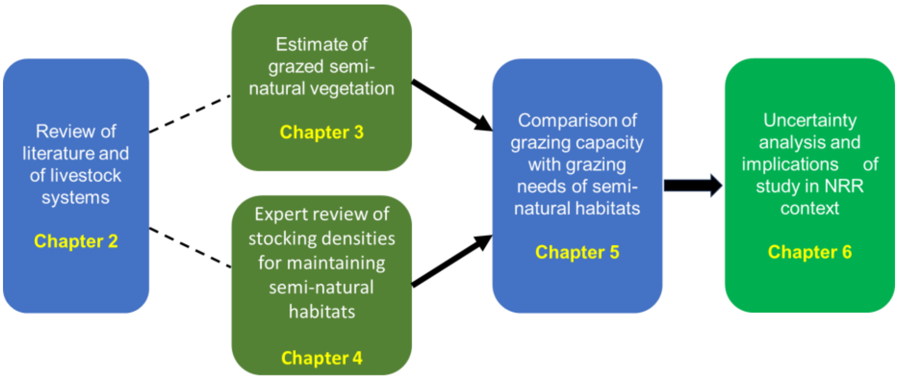

Figure 1.1: Flowchart of the five core tasks of the work presented in this report and their interlinkages.

As shown in **Figure 1.1**, this work included five core tasks, each corresponding to an individual chapter in this report. Chapter 2 describes how extensive grazing practices have shaped different semi-natural vegetation types across Europe over thousands of years and the importance of these habitats for EU conservation targets (section 2.1). It discusses the interaction between different extensive farming systems and semi-natural habitats across Europe, and reviews factors influencing the suitability of different stocking densities for maintaining semi-natural habitats (section 2.2). Section 2.3 provides an overview of the role of grazing in livestock production in a wider environmental context and explores how different animal types and stocking rates can influence nature conservation outcomes. Finally, section 2.4 discusses the relevance of extensive grazing practices for preserving and restoring European semi-natural habitats.

Chapter 3 explores the main approaches for estimating the area of semi-natural vegetation that is grazed across the EU. It explains the rationale for the approach followed in this study (i.e. building an estimate of extensive livestock numbers via spatial data on the likely extent of grazed semi-natural vegetation).

Chapter 4 reviews current expert knowledge on the role of extensive livestock systems in maintaining semi-natural habitats and describes the process for producing quantitative estimates for appropriate stocking densities for grazing-dependent Annex I habitats (section 4.1). Section 4.2 summarises the results of a consultation of botanical specialists or grazing ecologists in countries across Europe to produce an estimate of the grazing needs of high priority semi-natural habitats dependent at least in part on grazing. Section 4.3 presents a crosswalk of the Halada habitat types into related Corine Land Cover (CLC) semi-natural land cover classes. These CLC classes were employed where CLC area estimates were required for gap-filling in countries where reporting under Article 17 of the Habitats Directive was not considered suitable for the analysis presented here.

Chapter 5 describes the analytical approach devised for better understanding grazing management needs for maintaining and restoring semi-natural habitats related to extensive agricultural land use (section 5.1). Section 5.2 presents a comparison between Halada livestock grazing needs and the national grazing livestock herd for EU-27 countries and the UK. Section 5.3 explains the methodological approach for the country-level analysis of the relationship between the estimated grazing needs of Halada habitats and the actual livestock population available to achieve full grazing management per country (section 5.3.1). Section 5.3.2 illustrates the results per country via an example for Austria; while detailed results for all countries covered by this research are available in Annex 4 Comparison of likely grazing capacity with Halada grazing needs per country – a first approximation.

Chapter 6 summarises the uncertainty analysis, considering the data analysis developed by the study team and a series of webinars with the experts consulted (organized and developed in groups of biogeographical regions). The uncertainty analysis comprises the following components: Section 6.2 reviews the range of extent estimates for Article 17 habitats linked to the reporting options that EU Member States have. Section 6.3 presents the impact of the variance in Halada stocking rate estimates on calculating overall livestock grazing needs at EU-level. Section 6.4 explores the results of using 'representative' Halada stocking rate estimates for overall livestock grazing needs at EU-level which are derived from expert review of available data. Section 6.5 discusses priorities for refining certain aspects of this analysis by focusing on the eight habitat types and biogeographical regions that generate most uncertainty.

Finally, Chapter 7 reviews the key outcomes from the current study, while reflecting on potential future work to inform the evidence used for planning nature restoration actions for semi-natural habitats under the EU Nature Restoration Regulation (section 7.1). Section 7.2 summarises key EU-level findings and section 7.3 reviews results and uncertainties associated with the country-level analysis (Chapter 5 and Annex 4 Comparison of likely grazing capacity with Halada grazing needs per country – a first approximation). Section 7.4 (complemented by Annex 5 Review of supporting work and further research questions) proposes next steps to consolidate the analytical conclusions of this study, and to explore additional aspects to take this work further from a habitat management and/or nature restoration perspective.

Some overall comments on how to understand the purpose of this study:

The research presented aims primarily at EU-level insight, to develop an estimate on the grazing needs of a specific group of habitats on Annex I of the EU Habitats Directive (the 'Halada habitats'). In so doing, it had to use EU-wide and country level data and expert input, all of which create significant uncertainty for EU-level and country-specific results. It is the intention to update the analysis presented here as key input data sets are being updated and/or new data become available.

The estimates of suitable stocking rates per Halada habitats have been consolidated through various expert consultation rounds. However, they are not meant as guidance from the EU-level for identifying concrete site level grazing densities.

While the authors consider that the identified stocking rates are well-suited for maintaining habitats that are in a reasonably good conservation status, there are a range of potential situations where other stocking rates will be more appropriate. Such situations include the need for higher grazing pressure when restoring habitats after abandonment or previous intensification as well as reductions in grazing density when droughts substantially reduce vegetation productivity.

This EU-level study is meant to inspire similar analysis to inform national nature restoration planning for grazing-related habitats. However, it is not intended to replace or restrain such national work. It would be relevant to also consider further factors in such national-level work which could not be tackled in this study, such as the actual geographic distribution of potential grazing livestock or the share of hardy livestock breeds among them.

Chapter 2 provides a general discussion of the complex relationship between grazing systems, types of grazing animals and conservation outcomes, with a focus on vegetation types. It should be noted that a very wide range of factors influence the conservation success of different grazing regimes regarding individual components of Europe's nature, whether plant communities, different insect or animal groups, bird populations etc. The full diversity of the interactions between grazing and biological diversity could therefore not be fully addressed in this report.

2 A review of the relationship of Europe's semi-natural habitats with extensive farming practices

2.1 Introduction and overall context

Chapter 2 discusses different aspects of the relationship between low intensity farming systems (particularly grazing systems) and the development of semi-natural habitats across Europe. Section 2.2 reviews the ecological effects of grazing on vegetation and species diversity and presents an approach for identifying farming systems of high nature value. Section 2.3 presents some key factors that influence the conservation success of different grazing regimes, such as grazing systems, livestock types and grazing practices. Section 2.4 explains the importance of semi-natural habitats for European Union conservation targets and concludes with an overview of the key research questions relevant for understanding how to preserve and restore European semi-natural habitats successfully.

There are many factors that influence the impact of grazing on biodiversity. A good understanding of how they intersect and what practical options exist for optimising the conservation outcome of different grazing approaches is critical for achieving nature conservation objectives. This study could not discuss all of them in great depth as it focuses on macro questions related to the total grazing capacity required for the overall extent of semi-natural habitats.

Beyond the impact of grazing on biodiversity there are many interactions between livestock production and a range of environmental resources. This study does not aim to review these; however, a brief summary of the role of livestock systems in the wider environmental context follows below (see Box 2.1).

Box 2.1: Beyond biodiversity: The role of livestock production in a wider environmental context

The type and intensity of agricultural management have consequences not only for biodiversity but also a wide range of other environmental resources. This extends to greenhouse gas emissions, water quality, soil health and climate change induced fire risks, to name some key issues (Bielza et al., 2025; Manzano et al., 2025, 2023). While an extensive review is out of the scope of this report; this section highlights some aspects of environmental sustainability linked to grazing livestock systems.

The high volume of intensive livestock production in the EU, mostly in indoor systems, is a key source of overall EU greenhouse gas (GHG) emissions as well as of water pollution affecting freshwater and marine water bodies (cf. EEA, 2020; Wan et al., 2025). Grazing-based livestock production systems, in particular if they use semi-natural vegetation as a key fodder source, have a more favourable GHG balance than is often assumed in standard life-cycle analysis (Manzano et al., 2025, 2023). That is due to two main factors: a) livestock that use semi-natural vegetation as fodder source in fact replaced the wild herbivores grazing these systems previously (which also were ruminants and thus generated methane emissions themselves) and b) the substantial biomass carbon store that builds up under permanent grasslands.

While livestock production contributes to GHG emissions, grassland ecosystems themselves are affected by a changing climate and concurrent land-use changes. A better comprehension of these pressures and how they combine can help obtain realistic mapping of grazing areas (Stoessel et al., 2022). The changing frequency and intensity of wildfires is one outcome of the changing climate, also affecting grazing resources, especially in Mediterranean landscapes. Traditionally much of the semi-natural vegetation was exploited for sheep, goat and cattle production which contributed to keeping the build-up of flammable biomass low. These systems have declined substantially in area and density of grazing, partly also due to forest management rules. Hence re-expanding the use of these vegetation types for extensive livestock production could contribute to fire risk prevention.

Well-managed grazing systems can serve as powerful tools for ecosystem restoration and enhance biodiversity (Millett et al., 2025; Török et al., 2024). In view of EU goals for a achieving more environmental sustainability it can also be argued that grassland-based livestock systems can support an agroecological transition (Poux and Aubert, 2022). A recent EEA briefing, entitled Solutions for Restoring Europe's Agricultural Ecosystems, briefly discusses the benefits of extensive grazing systems but further work on these questions would be helpful (EEA, 2024).

2.2 Overview of the relationship between grazing and biodiversity

Research shows that grazing by wild herbivores or domestic livestock is a key influence on ecosystems. The gradual transformation of natural ecosystem types into extensive, often grazing-focused farming systems in Europe over thousands of years has created a new habitat diversity and species assemblages, adapted to (and often dependent on) some form of land management (Benthien et al., 2018; Lomba et al., 2020; Malek et al., 2024b; Trepel et al., 2024). Given the reliance of human society on natural productivity to satisfy their alimentary (and many other) needs before the industrial era grazing and/or mowing occurred on nearly all vegetation types and across the entire landscape (even on road verges and in forests, for example). For this reason, Hampicke and Plachter (2010) state that for a long historic period (reaching into the 20th century), 'variety' (read diversity) in nature was a "by-product" of farming.

In the absence of management by livestock or other means, most landscapes in Europe would be mainly covered by different forest ecosystem types, ranging from dense to sparse tree cover due to the influence of natural herbivores and storm, fire and other natural impacts (Pereira and Navarro, 2015; Pillar and Overbeck, 2025; Svenning, 2002). The impact of human use of the land on ecosystem naturalness and species richness is reflected in the main categories of natural, semi-natural and anthropogenic ecosystem types that underpin the Global Biodiversity Framework indicator A.2 'Extent of natural ecosystems'. The EEA (2023) has defined natural, semi-natural and anthropogenic ecosystem types as follows:

- Natural ecosystems (and the habitats they contain) result from natural (including evolutionary) processes over tens of thousands of years without human influence (except limited harvesting of plant and animal biomass by hunting and gathering).
- Semi-natural ecosystems exhibit environmental conditions (e.g. soil characteristics and water cycles) and a species pool similar to those of natural ecosystem types. However, they are dominated by vegetation that results from regular human activity e.g. mowing or livestock grazing. Active management maintains those vegetation types by suppressing (secondary) ecological succession towards the site-specific climax vegetation.
- Anthropogenic ecosystems are characterised by environmental conditions that have been actively changed by human activities (e.g. via large-scale drainage, soil improvement, infrastructure and building development, irrigation, use of chemical fertilisers and pesticides etc.). This means their species pool is actively altered by planting, sowing and/or the active introduction of non-native species and rather limited compared to natural or semi-natural ecosystems.

Considering a gradient of naturalness and complexity where anthropogenic ecosystem types are the most simplified, species richness (per unit of area) can vary substantially across ecosystem types, depending on habitat composition, geographic location, biogeographical region and (other) context-dependent factors. Still, the diversity of species of grazed semi-natural habitats, in particular grasslands, is often at the top end of species richness per habitat type (Dániel-Ferreira et al., 2023; Dengler et al., 2014; Strijker, 2005).

In regions with a long evolutionary history of grazing, such as Eurasia, livestock grazing and browsing, under extensive regimes, is considered an important conservation tool to maintain open vegetation types (Török et al., 2024). In other parts of the globe e.g. Australia, grazing by livestock is often considered detrimental to vegetation, regardless of its intensity, duration or livestock type (Price et al., 2022; Török et al., 2024). Herbivores impact vegetation processes in multiple ways: directly through a direct selective plant biomass removal e.g. (Tälle et al., 2016), by trampling, nutrient addition by dung and urine excretion, and dispersal of seeds or plant nodules via ecto- or endozoochory (Lezama and Paruelo, 2016; Ozinga et al., 2009; Tälle et al., 2016). Indirectly, grazing induces changes on soil compaction and texture (Greenwood and McKenzie, 2001), microclimate (Vaieretti et al., 2018), and competition symmetry or reproductive success (May et al., 2009; Tälle et al., 2016; Wentao et al., 2023).

The contribution of low intensity (i.e. extensive) grazing activities to biological diversity and conservation of semi-natural habitats has been widely described (cf. Beaufoy et al., 1994; Halada et al., 2011; Jakobsson et al., 2024; Maskell et al., 2019; Woodhouse et al., 2005). Grazing practices maintain open types of vegetation where woody species may occur but do not develop fully to their climax stage (IEEP, 2007; Newton et al., 2009; Rupprecht et al., 2016). The maintenance of grazing under low-stocking rates is creating low to medium disturbance levels, and thus supporting the occurrence of open habitats, high species richness and abundance of plants and fauna species (Dumont et al., 2007; Nelson et al., 2025; Pulungan et al., 2019; Török et al., 2016). The general relationship between land use intensity and biodiversity has been described as a hump-backed model, proposed in the 1970's by Grime (Grime, 1973; IEEP, 2007; Pulungan et al., 2019). As shown in **Figure 2.1**, the hump-backed model assumes that species richness is frequently higher in farmlands managed under low-intensity practices when compared with forest ecosystem types, in which the conditions were more uniform and species mostly limited to forest specialists (Pillar and Overbeck, 2025). A shift to extensification of farming practices can again lead to an increase in species number (Humann-Guilleminot et al., 2023; Bunce et al., 2009).

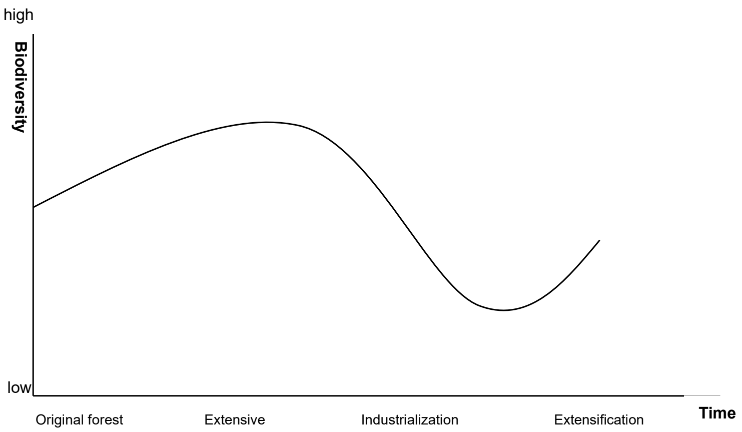

Figure 2.1: Relationship between farm practices over time and number of species (after Grime, 1973; adapted from Bunce et al., 2009).

In Europe, many terrestrial habitats and species of conservation value (as listed in the EU Habitats Directive Annexes I, II and IV), occur predominantly in semi-natural systems, and thus the continuation of low-intensity agricultural practices is paramount for nature conservation (Rodríguez-Rojo et al., 2017; Zalai et al., 2025). Overall, the maintenance of such semi-natural habitats is linked to the continuation of specific low-intensity farming systems, known in Europe as High Nature Value (HNV) farming systems (Fischer et al., 2012; Halada et al., 2011; Lomba et al., 2020; Sutcliffe et al., 2015). Devised in the 1990s, the HNV farmland concept recognizes the importance of low-intensity farming for the maintenance of many habitats and species, some of conservation concern, in Europe (Bignal and McCracken, 1996; IEEP, 2007; Lomba et al., 2014) - see **Box 2.2** for more details on High Nature Value farmlands concept and categories.

***Box 2.2:* Development of the concept of High Nature Value (HNV) farmland**

In the 1990s there was a growing recognition that across Europe many of the habitats and species were declining and that this particularly concerned semi-natural habitats that had been created, and needed to be maintained by, farming practices (Cooper, 2007). This led to the development of the concept of 'High Nature Value (HNV) farmland' which recognised that certain agricultural areas in Europe still retained a very high species richness compared to intensively farmed areas. These areas of HNV farmland were mostly found in the more marginal areas and on poorer land where mostly less intensive farming practices, especially grazing, took place (Baldock et al.,1993; Beaufoy et al., 1994; Bignal and McCracken, 1996). Since around 2000 the concept of HNV farmland was also increasingly taken up by EU policy and a first official definition of the concept was published by the EEA based on a study produced by Andersen et al. (2003).

Building on this study Paracchini et al. (2008) defined HNV farmland as:

"*Those areas in Europe where agriculture is a major (usually the dominant) land use and where that agriculture supports, or is associated with, either a high species and habitat diversity or the presence of species of European conservation concern, or both*."

There are three main types of HNV farmland:

Type 1: Farmland with a high proportion of semi-natural vegetation

Type 2: Farmland with a mosaic of low intensity agriculture and natural and structural elements, such as field margins, hedgerows, stone walls, patches of woodland or scrub, small rivers etc.

Type 3: Farmland supporting rare species or a high proportion of European or World populations

HNV farmland type 1 is the one most closely associated with the grazed (or mown) semi-natural habitats in Annex I of the EU Habitats Directive that are identified in this study as 'Halada habitats' (see section 2.5). Related work that supports the identification of HNV farmland areas in Europe based on CORINE land cover (CLC) data is discussed in section 3.2.

2.3 Effects of grazing systems, livestock types and management on biological diversity

2.3.1 Introduction

As described in previous sections, grazing contributes to increased structural diversity enabling a wider number of species to perform life functions (e.g. Ford et al., 2012; Reif and Hanzelka, 2016; Trepel et al., 2024), if carried out at suitable stocking density and during suitable vegetation periods. This was confirmed for insect diversity (Lázaro et al., 2016; Wallis De Vries et al., 2007), but also for bird species (Báldi et al., 2005; Reif and Hanzelka, 2016; Zalai et al., 2025). For example, Kotsonas et al. (2021) reported the need to maintain mosaics with grazed and ungrazed areas to sustain diverse bird communities of high conservation value in pseudo-alpine grasslands. Reif & Hanzelka (2016) reported an expected decline of farmland birds associated with open habitats (e.g. grassland) under a scenario of agricultural abandonment followed by landscape transition towards successional habitats/forests.

While the impacts of grazing vary with management intensity and environmental conditions across biogeographical regions, positive impacts from low-intensity, extensive grazing or mowing, have been reported for several dimensions of biodiversity (i.e. habitats and several taxonomic groups) (Niu et al., 2025; Török et al., 2024), when optimized regarding the dominant herbivore, timing, intensity, pattern and extent (Benthien et al., 2018; Mavromihalis et al., 2013; Okick et al., 2025). Optimization needs to consider several dimensions e.g. the intensity of grazing (or stocking rate), considering that the type of grazer or the balance of different grazing species are also relevant (Török et al., 2024; Tóth et al., 2018).

Overall, a wide range of factors influence the conservation success of different grazing regimes regarding individual components of Europe's nature, whether plant communities, different insect or animal groups, bird populations etc. The full diversity of the interactions between grazing and biological diversity could therefore not be fully addressed in this report. This section briefly discusses different grazing systems, livestock types and grazing management on biological diversity.

2.3.2 Review of grazing systems

This section sets out a brief review of key grazing systems of particular conservation relevance in Europe that can still be found, even if they are declining. It does not cover the more intensive grazing approaches linked to most conventional systems (where grazing is still used in modern intensive approaches.

Readers need to be aware that livestock farming practices have changed substantially during historical times, not only during the still fairly short period of livestock specialisation and intensification that began with the introduction of modern transport systems in the 19th century and created massive structural change and intensification from 1950 onwards. These changes also affected the combination of grazing and mowing in one livestock system or on individual fields. For a long time, grazing was the pre-dominant way of feeding livestock, even in winter; with harvesting of tree branches or heather brush and similar supplementing feed from grazing and/or serving as bedding. With the wider availability of sharp iron tools (and other changes in farming) the mowing of grassland (meadows) for hay as winter fodder became more widespread in the last centuries. However, in most cases even meadows were grazed at least in the autumn (once the main hay crop had been harvested). There are some exceptions where small properties or husbandry practices (year-round stabling of cattle) led to a pre-dominance of meadow use even in historic times.

Table 2.1 gives an overview of the types of agricultural, conservation and recreational systems linked to low input grazing activities, under which biodiversity can be maintained in semi-natural habitats. Such systems comprise mainly the farming systems that were identified in comprehensive studies of the characteristics of High Nature Value (HNV) farmland (Beaufoy et al., 1994; IEEP, 2007; Oppermann et al., 2012). It also includes conservation grazing activities set-up by nature conservation organisations to 'mimic' the grazing practices by wild large herbivores or the traditional farming systems in the HNV typology.

Table 2.1: Low-intensity (extensive) farming systems that have an important (conservation) grazing component, based on High Nature Value (HNV) farmland typology (based on Cooper et al., 2007; IEEP, 2007 and own elaboration).

Focus	System group	System and key characteristics	Geographical distribution: BGRs* or countries
Agronomic	Cattle (bovine) systems	**Extensive Systems using Semi-Natural Pastures** Mostly involves grazing on semi-natural pastures. Grazing is seasonal (at least summer grazing) but depending on location the grazing season can cover large part or whole year. Covers dairying systems, beef and can involve transhumance. Most common in HNV farmlands Type 1.	Occurs in practically all BGRs. Dairying: Alpine zone Beef: Alpine, Atlantic, Continental, Mediterranean and Pannonian zones
		Extensive grass-based or extensive grass and arable systems During grazing season (covers at least spring, summer and part of autumn) stock grazes in improved or semi-improved grassland and semi-natural grasslands (mostly young cattle and dry cows). Outside the grazing season the cattle are held inside. Grass and arable combination involves systems that keep the cattle year-round inside and feed on on-farm produced feed and forage. This covers most non-HNV farming systems, but some systems may have remained in HNV class because of low intensity management and use of unimproved often semi-natural vegetation. Most common in HNV farmland types 2 and 3.	Dairy systems: In Alpine and Atlantic zones but becoming increasingly rare. Beef: still common in almost all BGRs, but HNV system in this sector is becoming increasingly rare and usually involves very small subsistence and/or non-commercial farms. The grass and arable HNV system is very much declining and rare, but still more common in Continental, Pannonian and Mediterranean zones.

Focus	System group	System and key characteristics	Geographical distribution: BGRs* or countries
	Sheep & goat systems	**Sedentary low-intensity systems on semi-natural grassland** Stock grazes on fenced semi-natural grazing lands which is sometimes combined with local shepherding of other pastures. Stocking densities are usually between low (0.15 LU/ha) to medium (0.6 LU/ha), but use of higher stocking densities (potentially leading to overgrazing?) is also possible.	Seen in all BGRs (except in Alpine North and Boreal) mostly in marginal areas (ANCs). These systems are most common in UK, west Ireland, and Iberian Peninsula.
		Herded systems on semi-natural vegetation Stock grazes primarily on poor, semi-natural forage such as semi-natural grasslands, scrub and woodland and often mixed use of these habitats. The system is most common in uplands and mountains. The most traditional systems in this group involve herding with or without transhumance. In 'modernised' systems stock are taken to different types of (fenced) pasture and then visited daily or weekly but not closely herded.	Most common in the Mediterranean but also common in CEEC in Continental and Pannonian BGRs.
		Pastoral on stubble and fallows Stock grazes on unfenced stubbles and fallows and is moved around accompanied by a shepherd that is usually not owning the land but has grazing rights obtained from landowners. The stubble and fallow lands can also be part of an HNV arable systems and can also be agroforestry areas.	Still typical in Mediterranean and in part of Continental and Pannonian zones.
	Pigs and poultry systems	**Low-intensity pannage pig systems** For at least some part of the year pigs forage freely and at low densities in woodland and agroforestry areas (e.g. Dehesa in Spain and Montado system in Alentejo in Portugal).	Historically seen in all BGRs, but in present times most common in Iberian Peninsula, in CEEC and Sardinia where semi-wild pig production systems exist.
Conservation/ recreational	**Horses**	**Grazing by horses** The majority of the horses are held by private owners for recreation purposes, with some small amount of breeding for meat and, in some areas a more or less formal system where horses are kept in low input systems on semi-natural vegetation for sale when the market is good; these systems are very similar in impact to those described in the next section, but their rationale is quite different. There are still	Still exists in certain regions, usually in association with other livestock types. Minor importance except locally.

Focus	System group	System and key characteristics	Geographical distribution: BGRs* or countries
		pastoral horse systems in central and Eastern Europe, and small farms oriented towards horse breeding with semi-natural grazing.	
	Semi-wild or wild herbivores	Restoration conservation grazing with large herbivores (e.g. horses Exmoor ponies, Przewalski horses) and hardy bovine cattle breeds (Galloway, Heck, Highland cattle) has increased in many European nature protection areas where in former times both domestic and wild grazers lived in half open landscapes (e.g. meadows and pastures, riverside flood meadows, coastal and floodplain marshes, heathlands, fens, marshes and swamps). For restoration and conservation purposes some form of grazing is needed to support and bring back plant and animal species of conservation concern (Hampicke and Plachter, 2011).	Most common in Northwestern Europe (Atlantic and Continental zones) where some N2000 areas are no longer managed by farmers but by nature conservation organisations using grazing as a management tool for conservation and restoration of habitats. Overall, covers a small % of semi-natural areas.

*For information on biogeographical regions (BGR) and their location see: Europe's biodiversity - biogeographical regions and seas | Publications | European Environment Agency (EEA)

Maintaining or re-creating extensive grazing practices is a strategic instrument for the management of species-rich semi-natural habitats. Many of these habitats were created or supported by grazing of domestic livestock raised in shepherded, transhumance or fenced systems (Hampicke and Plachter, 2010; Vera, 2000). As re-creating traditional extensive grazing systems is difficult for socio-economic reasons, increasing attention is given to the concept of rewilding, which aims to restore biodiversity through (re-)introducing wild large herbivores (or hardy domestic livestock breeds as a substitute) and the disturbance regimes associated with these animals (Lomba et al., 2020). While definitions and suitable applications for rewilding practices requires further scrutiny (Du Toit and Pettorelli, 2019; Perino et al., 2019), scientific studies are suggesting it can be a suitable conservation strategy to promote plant biodiversity (Hart et al., 2023; Svenning et al., 2024). The extent to which the rewilding concept *sensu strictu* can be implemented in practice and its interaction with other more established conservation approaches requires further research, topics that are not tackled in the context of this study for reasons of resources and scope.

2.3.3 The influence of livestock type and grazing patterns on grazing outcome

As mentioned in previous sections, the dominant herbivore, timing, intensity, pattern and extent are key factors for the impacts of grazing on vegetation, habitats and species composition (Benthien et al., 2018; Mavromihalis et al., 2013; Nelson et al., 2025; Okick et al., 2025; Tóth et al., 2018; Trepel et al., 2024). Table 2.1 illustrated that there is a wide range of livestock types and other large herbivores that graze semi-natural habitats (and more intensive grasslands). To better understand the role of grazing in shaping vegetation structure and plant species composition, this section briefly reviews how the type of animal and their specific grazing patterns influence the impact of livestock on semi-natural habitats.

Defining a suitable grazing regime to promote biodiversity and habitat conservation depends very much on the type of habitat, the type of grazing animals used, length and intensity of grazing intervals and the seasonal variation in grazing (Millett et al., 2025; Tóth et al., 2018). Different animals cause different grazing impacts because of the variation in dietary preferences and their weight as explained by Chapman, 2007 and Benthien et al., 2018. For example, goats are a browser species well adapted to feed on shrubby vegetation, while sheep prefer grazing herbaceous vegetation (Jáuregui et al., 2009). Sheep prefer shorter swards and are therefore less effective in habitats which have abundant biomass growth and/or many woody species. Overall, smaller herbivores select high-quality food due to high energy demand in relation to gut capacity, while larger animals with bigger guts have the ability to eat higher quantities of lower-quality food (Stanley et al., 2024).

In practical terms this means that cattle are less selective than sheep and eat large and coarse vegetation that grows abundantly in more nutrient rich habitats or in areas that have been abandoned for some years. Horses are more active than ruminants and have higher food intake compared to ruminants of the same size. They have two sets of teeth and can tackle extremely coarse vegetation, e.g. thorny shrubs. They are also able to digest more low-quality, high-fibre grasses and they can graze closer to the ground (Fleurance et al., 2016; Søndergaard et al., 2025). Cattle and horses are heavier and have large hooves and are therefore more likely to damage fragile vegetation on wet soils. Grazing patterns are also influenced by season and biomass availability (Fleurance et al., 2016; Søndergaard et al., 2025). On this topic, prolonging the grazing season is gaining increasing attention as a driver of plant diversity. For example, year-round grazing can be argued to add additional components to herbivore-plant interactions, resulting in further inhibition of single-species dominance and the promotion of forbs (Søndergaard et al., 2025). Nevertheless, length of grazing season must always be considered in relation to winter fodder availability and the risk of damage to vegetation due to wet soils and associated poaching effects.

An effective use of grazing for conservation purposes needs to consider how different grazing animals and grazing techniques influence different habitat types and structural diversity. Style of historic grazing practices (from before 1950) and livestock type are important variables in that regard. Mobile sheep and goat grazing was particularly important in southern Europe and some upland regions whereas cattle played a dominant role in other European regions. As mobile grazing systems are often no longer practiced it needs to be considered how livestock interact with vegetation in stationary and/or year-round grazing systems. In this context, coarse grazers, such as cattle and horses, are generally a better choice in a conservation perspective. Nevertheless, well targeted grazing with sheep or goats still has an important role in habitat management, especially where traditional shepherded practices can be emulated.

This report cannot discuss the full range of factors that influence conservation success in different locations and vegetation types properly. Conservation grazing strategies need to be developed for individual sites considering the factors discussed in the literature (see this chapter for an initial review), local factors and advice from livestock managers and conservation experts.

The suitable stocking density for conservation purposes will depend on the variety of factors shaping different grazing regimes (Chapman, 2024, 2007; Stanley et al., 2024; Török et al., 2024). Nonetheless, the natural productivity of the land, which is an outcome of the soil and climate, is a central component. The higher this natural productivity the higher the potential stocking density (see **Figure 2.2**). Productivity, expressed in vegetation biomass, varies over location and season and dictates the overall stocking density and the stocking density over the year. Areas with high biomass production can support higher stocking densities to maintain the optimal species diversity in a habitat than nutrient poor habitats with low biomass production (Borer and Risch, 2024; Tóth et al., 2018).

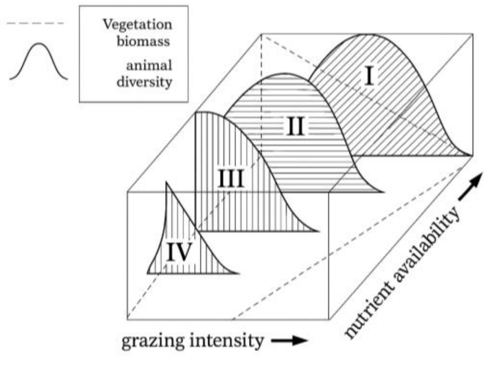

Figure 2.2: Relationship between grazing intensity and species distribution in habitats ranging from nutrient poor to nutrient rich (after (Grime, 1973).

High stocking densities can lead to local nutrient overload (in particular with supplementary feeding) and can also induce more trampling of vegetation and damage to soil structure. If the density is very high the vegetation is completely eaten and there will be loss in structural diversity. In both too low and too high stocking density situations there will be loss of biodiversity. The careful tuning of the stocking density over location and time and the choice of the grazing animal is a delicate process (Borer and Risch, 2024; Millett et al., 2025; Millett and Edmondson, 2015).

Guidelines for stocking densities were for example given by Chapman (2007, 2017, 2024) for semi-natural grazing land in Scotland (see **Table 2.2**). This illustrates that in semi-natural habitats stocking densities will remain low compared to improved grasslands and range between 0.2 LU/ha to 1 LU/ha. The reason that semi-natural habitats need these lower stocking densities is mostly related to the fact that the higher productive semi-natural habitats have already largely been taken over into arable (and nowadays also intensive grassland) – what is left is either uneconomic to intensify or subject to other factors which have prevented intensification (e.g. where there are no means to invest, such as on Romanian smallholdings). However, where biophysical factors have prevented this intensification or conversion into arable lands, highly productive semi-natural habitats can still be found. Alluvial meadows (habitat 6440) are one example – they produce '10-30 tonnes of biomass per ha' 'thus they belong to the most productive ecosystems in the world' (Šeffer et al., 2008).

Table 2.2: Recommendations for stocking densities per type of habitat in Scotland (based on Chapman, 2024, 2017).

Type of grazing vegetation/habitat	Typical herbaceous vegetation types	Recommended stocking density (LU/ha)
Nutrient poor fen	Sedges and reeds	0.05-0.25
Blanket and Raised Bog	Heather, crowberry and bilberry, bog mosses	<0.05*
Wet heath	Heather, cotton grasses, sedges	0.05-0.10
Dry heath	Heather, gorse	0.10-0.15
Poor/low productive semi-natural grassland	Molinia/Nardus	0.2 -0.4
Medium productive semi-natural grassland	Sheep's fescue/Common bent	0.4-0.7
High productive semi-natural grasslands	Red Fescue/Crested dog's-tail	0.7-1.4)
Semi-improved grasslands	Rye-grass/Crested Dog's-tail	0.8-1.0

*<0.02 LU/ha recommended where restoration has taken place (Chapman, 2024).

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Because of the diversity in semi-natural habitats and the complexity in determining the right stocking density and use of animals, there are no simple rules to estimate how many animals are needed to maintain and conserve biodiversity in semi-natural habitats. However, understanding the suitable livestock densities for grazing these habitats and the total livestock population size required to maintain them would be very informative for policy targeting. The work presented in this study aims to shed light on these questions and to provide initial quantitative estimates for suitable stocking ranges per habitat type as well as the overall livestock grazing capacity required to maintain EU priority semi-natural habitats.

2.4 The importance of grazed semi-natural habitats for achieving EU biodiversity conservation targets

Many semi-natural habitats in Europe depend on the continuation of low-intensity agricultural management for conservation. The key issue in semi-natural habitats is that, despite the local significance of fires, flooding or the grazing of wild herbivores, to a large extent, the processes that prevent succession are those associated with agricultural management, in particular grazing and mowing (Benthien et al., 2018; Davidson et al., 2017; Ford et al., 2012; Hampicke and Plachter, 2010; Vera, 2000). Grassland habitats are a key example for the need for extensive grazing (or mowing) in Europe to achieve the conservation of many species of conservation importance. As illustration, 92% of the butterfly species included in Annex II of the EU Habitats Directive depend on extensively managed grasslands. Furthermore, meadow birds under legal protection dependent on permanent grassland habitats make up a high proportion of all protected birds listed in Annex I of the EU Birds Directive. Finally, European semi-natural habitats support a high fraction of the continent's endemic species - 18.1% of endemic vascular plants are found in grassland ecosystems and 15.5% in heaths and shrub habitats (Habel et al., 2013).

In this context, work sponsored by the European Environment Agency (Halada et al., 2011) produced an overview of ***63 habitat types*** listed in Annex I of the EU Habitats Directive that depend on or which can profit from agricultural activities[1] (building on initial work by (Ostermann, 1998) Experts from many European countries were involved in the selection of semi-natural habitats meeting one of the following criteria: (1) their existence depends on the continuation of agricultural activities; (2) their existence is maintained or fostered by agricultural activities that block or reduce secondary succession; or, (3) the habitat type contains both natural and semi-natural expressions, the last requiring agricultural management for maintenance (Halada et al., 2011). The list below gives an overview of how many and what type of habitats fall into these three categories:

A) *Habitats fully dependent on agricultural management* (D), corresponding mainly to semi-natural habitat types established under regular, low-intensity, agricultural management. Overall, this group of habitats includes mainly meadows and pastures (16 habitat types),

[1] According to Halada et al. (2011), agricultural activities related to the continuation of semi-natural habitats are mainly grazing and mowing, as other agricultural practices e.g. tilling are not so often applied or represent higher disturbance levels.

besides some types of heaths (4 types: 4010, 4020, 4030, 4040), forests (1 type: 9070) and sand dunes (2 habitat types: 21A0, 2340).

B) *Habitats partially dependent on agricultural management* (P); this refers to a group of habitats that profit from agricultural management as they contribute to the maintenance of the habitat or they contribute to increase the area of the habitat distribution, by blocking or reducing secondary succession. This group includes 40 types of habitats, where the potential benefit of farming use is dependent on site-specific soil type or climatic conditions.

C) *Habitats for which the relationship with farming practices only applies to some sub-types or for part of the distribution of the habitat* (M) – these habitats were generally not selected for analysis in this report as their relationship with farming is too variable or uncertain.

The habitats described above are called 'Halada habitats' in this study. Annex 1 presents the published Halada habitat selection and the classification (i.e. as D, P or M) of each habitat in relation to its dependence on agricultural management (Halada et al., 2011). Further additions to the list may occur in the future as the main author and other experts consider that certain habitats are still missing in the 2011 Halada list (Halada pers. comm.). As an illustration, during the expert consultation on identifying grazing needs per habitat for this study Greek experts pointed out some non-Annex I semi-natural habitats requiring grazing. Some habitats suggested as missing in the 2011 list are: (i) 5110 Stable xerothermophilous formations with *Buxus sempervirens* on rocky slopes (Berberidion p.); (ii) 9250 *Quercus trojana* woods; and, (iii) 9560* Endemic forests with *Juniperus* spp.

The decline of semi-natural habitats due to the disappearance of extensive agricultural practices and due to agricultural intensification across Europe is evident from reporting by EU Member States on priority habitats under the EU habitats directive (EEA, 2020). **Figure 2.3** shows the conservation status for EU priority habitats during for the reporting period 2013 to 2019, disclosing those that are fully, partially or not dependent on extensive agricultural management[2]. As shown by the numbers presented in Figure 2.3, the habitats fully dependent on extensive grazing (in nearly all cases) have the worst current conservation status and trend.

[2] Trends on the conservation of species and habitats of Community Interest, i.e. listed in the scope of the Habitat Directive annexes, considered strongly linked to the occurrence and maintenance of specific agricultural management practices, are the scope of CAP Indicator I.20 *Enhancing biodiversity protection*. The list of species and habitats per Member State was built on previous studies, namely by Halada et al. (2011); but also Roscher et al. (2015) and the Guidance 'Farming and Natura 2000' (European Commission, 2014), and validated by Member States. While the list considered within CAP Indicator I.20 overlaps, in general, with Halada habitats list, it reflects a recent process of consultation at the MS level, and thus some differences can be observed. Still, the identification and discussion of such differences were not in the scope of the work developed in this study.

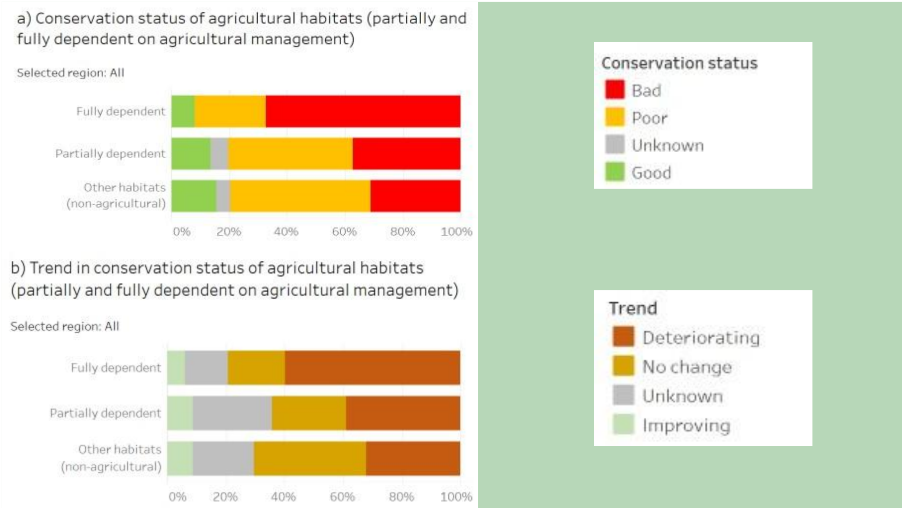

Figure 2.3: Conservation status for habitats dependent on agricultural management, based on the 2013 – 2018 reporting period (European Environment Agency, 2024).

The goals of the EU Birds and Habitats Directives have been incorporated in the Nature Restoration Regulation (NRR). The Nature Restoration Regulation refers to the role of extensive farming systems in various recitals of its preamble and underpins the need for putting in place adequate measures towards the restoration of terrestrial and coastal ecosystems (including habitat types listed in Annex I), reinforcing the Birds and Habitats Directive goals via e.g. its Article 4. Overall, EU policy targets provide the context of the work presented here, which aims at better understanding our ability to maintain grazed semi-natural vegetation and hence the associated EU priority habitats and species. Thus, this report tackles the following questions (Q):

Q1. How much of the remaining semi-natural vegetation is currently grazed? [Chapter 3];

Q2. What is a suitable stocking density for maintaining the semi-natural habitats in Annex I of the Habitats Directive (the 'Halada habitats') by grazing? [Chapter 4];

Q3. How does the current estimated grazing capacity per country compare to the grazing needs for maintaining (or restoring) semi-natural Annex I habitats? [Chapter 5 and Annex 4]; and,

Q4. What are the current data uncertainties and options for improving the accuracy of this analysis in the future? Which implications follow for the estimate of overall extensive livestock grazing needs for maintaining Halada habitats? [Chapter 6]

3 Estimating the current extent of grazed semi-natural vegetation

3.1 Overview and approach

Two main approaches can be considered for estimating the area of semi-natural vegetation being grazed: the first one relies on available agricultural statistics on livestock (grazing) systems, and the second is based on spatially explicit data on the extent of semi-natural vegetation that is likely being grazed. While the first approach can provide a better estimate of the number of grazing livestock, if the available data adequately differentiate extensive grazing systems in statistical datasets, the second approach has the advantage of disclosing the spatial distribution and overall area extent of (grazed) semi-natural vegetation. To decide on the best approach to develop this study, an initial step focused on compiling national datasets and statistics from all EU Member States as far as available. While statistical offices and Eurostat usually provide data on total number of livestock heads, Member States are not obliged to make detailed data on the share of grazing animals available. Furthermore, the definition of grazing animals differs among Member States, and they graze all types of grassland (and sometimes cropland) of which semi-natural vegetation may only be a small part. Only some Member States provide data on livestock grazing on common land (e.g. Bulgaria, France and Italy) or mountain pastures (Austria). However, while these areas are mostly composed of semi-natural vegetation, they represent only a part of the total semi-natural grazing land or of all livestock grazing such land. Furthermore, no Member State provides spatially explicit information on grazing livestock.

Data from the Integrated Administration and Control System (IACS) and respective LPIS (Land Parcel Identification System) would provide spatial data and information on grazing land, depending on the data gathered in each Member State, but it is only publicly accessible in some EU Member States. Therefore, available statistical data at national or EU-level do rarely provide insights on the spatial distribution of extensive grazing systems, or even of the share of livestock in relation to the national total that is part of extensive grazing systems. Considering outcomes from this initial step, the methodological approach implemented in this study builds on an expert survey that allowed to estimate the potential grazing share per semi-natural classes of the Corine Land Cover (CLC) dataset, used to calculate the share and total area of grazed semi-natural vegetation per country.

3.2 Estimation of grazing share and livestock density on Corine Land Cover classes

As discussed in Section 3.1, available livestock statistics do not allow estimating the share of the different livestock types that are part of extensive grazing systems, and thus the methodological approach followed in this study built on an estimation of the potential grazing share per semi-natural classes of the Corine Land Cover dataset. Corine Land Cover (CLC) constitutes the only Europe-wide geo-spatial data set that allows an interpretation of likely land use (EEA, 2020), and there is relevant previous experience in interpreting CLC information for the potential occurrence of extensive farming systems, developed during the substantial studies that led to the first EEA/JRC High Nature Value (HNV) farmland estimate (Paracchini et al., 2008).

Figure 3.1 provides an overview of the approach taken in the work on High Nature Value farmland for interpreting Corine Land Cover classes (Paracchini et al., 2008), to estimate the total agricultural reference area, beyond the core agricultural classes (2XX; Figure 3.1). To take account of potential grazing on semi-natural vegetation these include semi-natural classes, e.g. moors and heathland (i.e. the extended agricultural area in Figure 3.1).

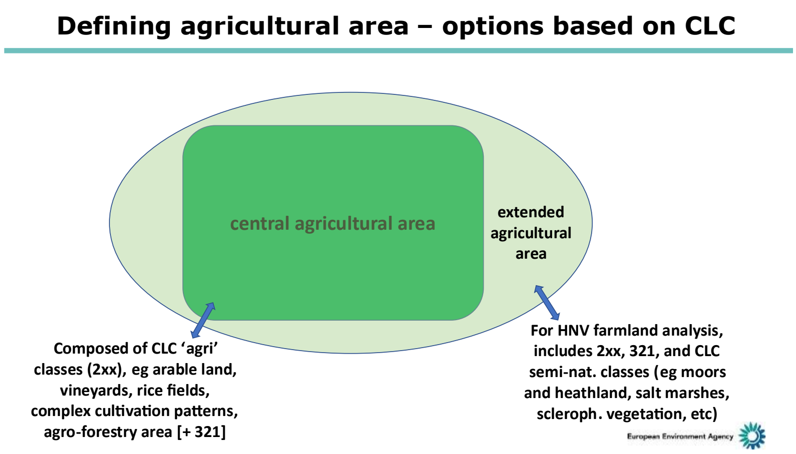

Figure 3.1: Approach developed by (Paracchini et al., 2008) for estimating the total farmed area (including extensive grazing, based on Corine Land Cover (CLC) classes.

As indicated, the development of the HNV farmland estimate included an expert-based interpretation of which additional CLC classes (that are not part of the core CLC agricultural classes; see Figure 3.1) are likely under extensive agricultural use (in particular grazing). Semi-natural CLC classes considered as grazed in HNV farmland work are marked by a green highlight in **Table 3.1**.

Table 3.1: Semi-natural Corine Land Cover Classes considered to be potentially grazed. Adapted from Paracchini et al. (2008).

3. Forest and semi-natural areas	3.1 Forests	3.1.1 Broad-leaved forest
		3.1.2 Coniferous forest
		3.1.3 Mixed forest
	3.2 Scrub and/or herbaceous vegetation associations	3.2.1 (Semi-)Natural grassland
		3.2.2 Moors and heathland
		3.2.3 Sclerophyllous vegetation
		3.2.4 Transitional woodland-scrub
	3.3 Open spaces with little or no vegetation	3.3.1 Beaches, dunes, sands
		3.3.2 Bare rocks
		3.3.3 Sparsely vegetated areas
		3.3.4 Burnt areas
		3.3.5 Glaciers and perpetual snow
4. Wetlands	4.1 Inland wetlands	4.1.1 Inland marshes
		4.1.2 Peat bogs
	4.2 Coastal Wetlands	4.2.1 Salt marshes
		4.2.2 Salines
		4.2.3 Intertidal flats

Work developed to support updating the EEA/JRC study on estimating HNV farmland refined the original approach for estimating the likely area of semi-natural vegetation that is still grazed across Europe, by combining the selection of CLC classes identified as grazed by livestock in different parts of Europe with an additional country expert survey to identify which share of each CLC is still grazed per country.

Grazing at low stocking densities can also occur on the following CLC classes: 2.4.2 (Complex cultivation patterns), 2.4.3 (Land principally occupied by agriculture), and 2.4.4 (Agro-forestry areas). However, while these classes were relevant for the updated HNV farmland estimate, they are not generally considered to be part of "semi-natural CLC classes", which focuses on vegetation principally shaped by grazing or mowing practices. Excluding these CLC classes enabled this analysis to focus on grazed area and avoid potential overestimates.

To enable a more targeted analysis of the potential share and density of grazing per CLC class, this study employed a differentiation by environmental zones for all countries involved. This helped the consulted experts to take account of productivity factors (such as climate, altitude and soil characteristics) in their estimates of likely occurrence of grazing, particularly relevant in case of larger European countries covering various environmental zones, e.g. France or Spain. The climatic stratification of Europe (Metzger et al., 2005) was used to delineate environmental zones in the EU-27 and other countries considered in this study (see **Figure 3.2**)[3].

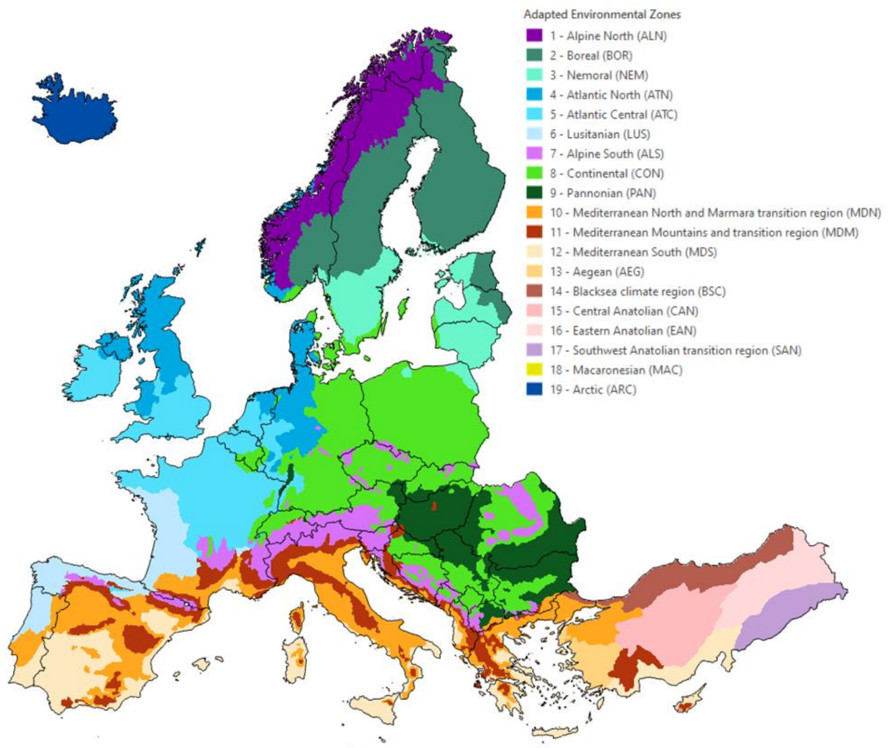

Figure 3.2: Distribution of Environmental Zones across Europe defined by (Metzger et al., 2005).

Outcomes from this work include a database with the first estimated grazing share and stocking density per semi-natural CLC class in the different environmental zones of each country considered. Detailed information on this database is available in (Malek et al., 2024b), and a summary of the main results is provided as Annex 3 of this report. **Table 3.2** gives an example of the results obtained for Austria and illustrate insights gained and the type of data obtained that was used in later phases of this work.

[3] Environmental Zones, as defined by Metzger et al. (2005) were used for the geo-spatial analysis of likely distribution of grazing on semi-natural CLC classes, as published in Malek et al. 2024. However, given the familiarity of nature specialists with the biogeographical regions provided by EEA (EEA, 2016; https://www.eea.europa.eu/en/analysis/maps-and-charts/biogeographical-regions-in-europe-2), this zonation was used for illustration during the consultation with ecological experts on suitable stocking densities per Halada habitat type. In practice, there is a very high geo-spatial overlap between both delineations.

Table 3.2: Results of the survey on grazing of semi-natural CLC classes and estimated average stocking densities per class and environmental zone, as estimated for Austria.

AUSTRIA				
CLC code	CLC name	Estimated grazing share	Estimated LU/ha	
			Total bovine	Total ovine
		Alpine		
321	Natural grassland	**65%**	0.80	0.04
322	Moors and heathlands	**10%**	0.10	0.02
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**10%**	0.10	0.02
333	Sparsely vegetated areas	**15%**	0.10	0.02
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-
		Mediterranean Mountains		
321	Natural grassland	**65%**	0.80	0.04
322	Moors and heathlands	**10%**	0.10	0.02
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**10%**	0.10	0.02
333	Sparsely vegetated areas	**15%**	0.10	0.02
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-
		Continental		
321	Natural grassland	**65%**	0.80	0.04
322	Moors and heathlands	**0%**	0.10	0.02
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**0%**	0.10	0.02
333	Sparsely vegetated areas	**0%**	0.10	0.02
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-
		Pannonian		
321	Natural grassland	**65%**	0.80	0.04
322	Moors and heathlands	**0%**	0.10	0.02
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**0%**	0.10	0.02
333	Sparsely vegetated areas	**0%**	0.10	0.02
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-

Note: Outcomes presented for countries included in the survey are presented by all Environmental Zones, even if they cover only very small geographic areas, e.g. the zone ***Mediterranean Mountains*** occurs only in a small area in the south-east of the Austrian territory.

4 Estimating grazing needs of priority semi-natural habitats

4.1 Overview and approach

As described in section 2.2, European semi-natural habitats require low-intensity agricultural management for their conservation. Semi-natural vegetation is defined in this study as vegetation subjected to human intervention while retaining ecological functions and composition of habitats and species, that can also be found in natural vegetation (Cooper, 2007). Section 2.4 described the work of Halada et al. (2011) that identified 63 habitat types in Annex I of the EU Habitats Directive that depend on, or can profit from, low-intensity agricultural activities, namely grazing and mowing. **Figure 4.1** illustrates how grazing relates to major land use types and the connection between Annex I habitat types and grazing.

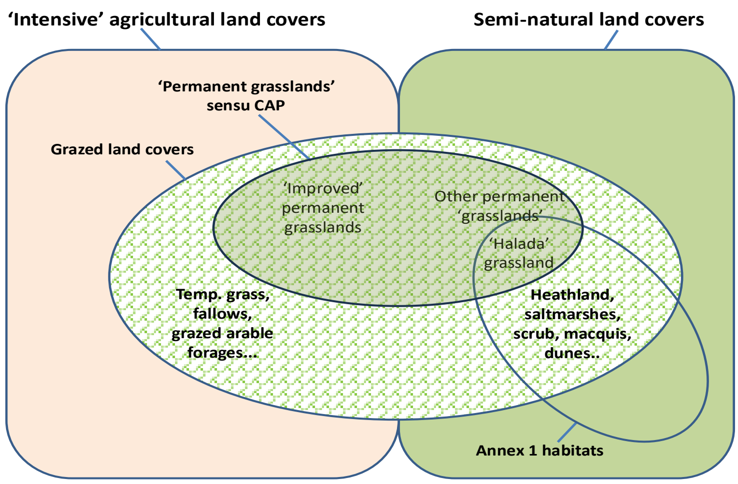

Figure 4.1: Diagram showing the relation between Halada habitats in relation to land cover and grazing use. European Environment Agency, 2025.

This chapter reports current expert knowledge on the role of extensive livestock systems in maintaining semi-natural habitats i.e. Halada habitats per country. It describes the methodological approach followed to estimate suitable stocking densities and overall livestock grazing needs for the so-called Halada habitats. Section 4.2 summarises the results of the consultation of specialists in semi-natural habitats and/or grazing in countries across Europe, which provided estimates of stocking density needs for all Halada habitats. This section includes also a discussion of methodological details relevant for the interpretation of the results of the surveys conducted in the context of this study. In section 4.3, a crosswalk of the Halada habitats into Corine Land Cover (CLC) semi-natural classes, is presented. This crosswalk was applied where area estimates for these CLC classes were required for gap-filling, in countries where reporting under Article 17 of the Habitats Directive was not suitable for the analysis developed in this study. This crosswalk also supports the analysis of the potential semi-natural grazing needs per country, presented in Annex 4.

4.2 Gathering information on grazing needs per Halada habitats

Two main sources of information were used: (1) a review of published available recommendations; and (2) a consultation carried out with vegetation specialists and/or grazing ecologists in countries covering all biogeographical regions in Europe. These were employed to develop an estimate of the grazing needs of Halada habitats. This resulted in an estimation of the stocking density needs for all Halada habitats across sub-national (BGR, biogeographical regions), national and EU levels.

A survey was distributed across renowned experts and a request for assistance circulated also through the Eurasian Dry Grassland Group (a sub-group of International Association of Vegetation Science), which proved very constructive and informative. Overall, interactions were carried out with experts in the following countries:

- Austria
- Belgium
- Bosnia-Hercegovina
- Czech Republic
- Estonia
- Germany
- Greece
- Hungary
- Ireland
- Italy (Alpine zone)
- Latvia
- Netherlands
- Portugal
- Romania
- Slovakia
- Slovenia
- Spain
- Sweden
- Switzerland
- Ukraine
- United Kingdom

The survey built on mainly two questions to experts: (1) what density of livestock do the various Halada habitats require to be brought to and be maintained under a favourable conservation status; and, (2) how, in terms of percentage of LU, should that suitable stocking density be composed in terms of cattle, sheep, goats and equines? Experts were asked to provide specific responses for each biogeographical regions occurring in their countries. Additional guidance to experts was provided for question (1) given the potential difficulties posed by mobile pastoral systems and by the possibility (if not exact equivalence) of a range of management approaches. Depending on the livestock system in question, the use of traditional or modern grazing practices and the physical accessibility of pasture area, the grazing approach employed can range from high stocking densities over a short time to low stocking over a long time. We asked the experts to focus on what area of habitat could be maintained by 100 cattle or 1000 sheep over a normal grazing season (whatever that might be for any biogeographical region and habitat), and to work backwards from that figure.

Both the study on the grazing of semi-natural Corine Land Cover classes and the work on the grazing needs of Halada habitats depended to a large degree on expert knowledge. The source of data and type of expertise available per country are presented in **Table 4.1**.

Table 4.1: Approach used for estimating suitable Halada habitats stocking rates per country.

Country	Source of national input	Source of estimate in absence of national input
Austria	-	CH, IT
Belgium	Plant ecologist	n/a
Bulgaria	-	RO, GR, AT, summary
Croatia	-	AT, HU, GR, summary
Cyprus	Environmental NGO	GR, summary
Czechia	Environmental scientist	DE, AT, summary
Denmark	-	DE, summary
Estonia	Environmental activist and farmer	n/a
Finland	-	EE, SE
France	-	ES, DE
Germany	Ecologists and grazing specialists	n/a
Greece	Plant ecologists; grazing specialists	n/a
Hungary	Paper on grassland communities[4] (Molnár et al., 2008)	n/a
Ireland	Report author (Gwyn Jones)	n/a
Italy	Grazing specialist, South Tyrol only	Areas: Alpine zone directly, rest via Corine; densities extrapolated from GR, ES
Latvia	Report on Annex I grasslands[5] (Rūsiņa, 2017)	n/a
Lithuania	-	LV, EE
Luxembourg	-	BE, DE, summary
Malta	-	GR
Netherlands	Report author	n/a
Poland	-	SK, DE, summary
Portugal	-	ES
Romania	Plant ecologist; local NGO staff	n/a
Slovakia	Plant ecologist	HU, AT, summary
Slovenia	Agriculture Ministry staff ecologist	AT, GR, summary
Spain	Extensive grazing expert	n/a
Sweden	Environmental Board staff member	n/a
EU-27	n/a	n/a
United Kingdom	Report author, plant ecologist	n/a

[4] Molnár, M, Biró, M, Bölöni, J, Horváth, F (2008) Distribution of the (semi-)natural habitats in Hungary I. Marshes and grasslands. Acta Botanica Hungarica 50 (Suppl.1), pp. 59–105. doi: 10.1556/ABot.50.2008.Suppl.5.
[5] Rūsiņa, S (Ed.) 2017. Protected Habitat Management Guidelines for Latvia. Volume 3. Semi-natural grasslands. Nature Conservation Agency, Sigulda.

Regarding the information required for the development of this work, even in the case of Halada habitats (listed in Annex I of the Habitats Directive), where the conservation status of the habitats is a matter of legal obligations, the information sought was usually not readily available, a limitation particularly evident for grazing of semi-natural CLC classes. A further observation was that the more such grazing systems had declined in different countries, the more difficult experts seemed to find providing an estimation for suitable grazing pressure per Halada habitat or current grazing practices. In such situations, experts more frequently referred how extremely variable grazing needs were, which may reflect the shifting of such questions into the 'conservation grazing' mental box. In the CLC work, the emphasis was mainly on the knowledge of the actual situation on the ground. In some cases, experts also had sufficient knowledge (or access to such knowledge) and thus they were also well suited for providing input to the Halada exercise. Thus, for that purpose, experts with specialist ecological knowledge were also sought. Nevertheless, for some Member States it proved not possible in the available time to find experts willing to engage with the project (see **Table 4.1**). In such cases, data had to be extrapolated from the most similar countries, a methodological approach that potentially added additional uncertainty, as estimates from source countries could have an error range impacting estimates in other areas of the continent.

Initial estimates and proposals for gap-filling were brought together for a final check at the biogeographical region level through a set of multi-country webinars. These proved to be a constructive and useful strategy for reviewing optimal stocking density ranges and the potential share of grazing for semi-natural CLC classes and thus led to some amendments of the data used and presented in the current report. **Table 4.2** presents the results of the expert consultation regarding suitable stocking rates for Halada habitats per biogeographical region expressed as averages over the grazing season. Note that many of the estimates are given in the form of a range, reflecting not only possible uncertainty on the part of the experts, but also a real variation between the grazing needs of different sub-communities within the overall habitat as their productivity varies across their geographic distribution.

However, for further stages of this work, in particular for estimating overall Halada grazing needs per country, it was most practical to use just one stocking rate value for calculations. This stocking rate is called the 'representative' stocking rate and aims to express the likely average productivity of the given habitat per biogeographical region. In most cases this 'representative value' is set as the median between the minimum and maximum stocking rate estimates for a given habitat in a specific biogeographical region. In other cases, the representative value could be set somewhat lower if the median stocking rate estimates in adjacent biogeographical regions were consistently lower and no specific productivity advantage could be assumed for the biogeographical region in question. In some cases, the authors' judgement was used, e.g. when the prevalent expression of a habitat in a biogeographical region is considered to be of low productivity. The values for this representative stocking rate are presented in Annex 2 Summary table of 'representative' stocking rates for Halada habitats expressed as averages over the grazing season.

The methodological approach for developing the estimate for suitable stocking rates per Halada habitat is summarised in **Figure 4.2**.

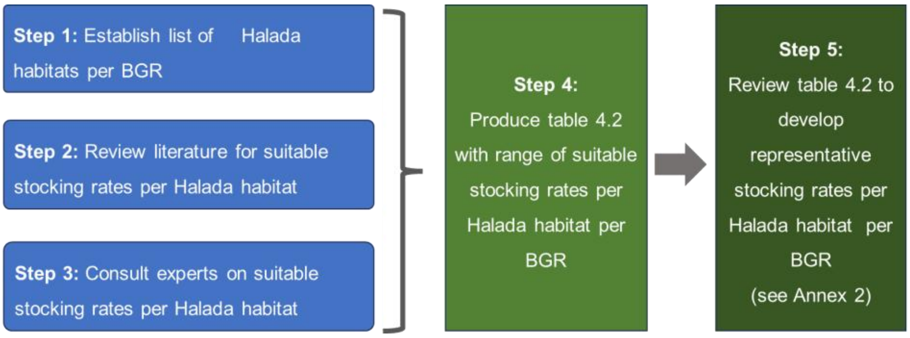

Figure 4.2: Methodological approach for developing estimates of suitable stocking rates per Halada habitat. European Environment Agency, 2025.

Table 4.2: Summary table of suitable stocking rates for Halada habitats expressed as averages over the grazing season

Notes: a) Blue values are extrapolations by the study team; red values indicate that the value was adjusted by the EEA team after the final expert consultation for reasons of coherence and/or conservation concern.

b) A grey cell indicates that the habitat was not declared in that biogeographic region (BGR) in the Article 17 report from any EU Member State; a dark orange cell indicates that the habitat's maintenance is considered to be best achieved via mowing in the given BGR; a light orange cell indicates that the respective habitat only benefits from grazing in part of its range in that BGR.

Code	Habitat name	Atl	Cont	Bor	Pan	Alp	Black S	Step	Mac	Med
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	0.4 - 0.8	0.4 - 0.8	0.8 - 1.2						0.8
1340	Inland salt meadows	0.3 - 0.6	0.05 - 0.6		0.3 - 0.5	0.6	0.3			
1530	Pannonic salt steppes and salt marshes		0.01 - 0.3		0 - 0.8		0.3	0.3		
1630	Boreal Baltic coastal meadows		0.8	0.5 - 1.2						
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)	0.05 - 0.1	0.05 - 0.15	0.1			0.05		0.05	0.05
2140	Decalcified fixed dunes with Empetrum nigrum	0.15	0.15	0.1						
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	0.15 - 0.2	0.15							0.15
2160	Dunes with Hippophae rhamnoides	0.05 - 0.15	0.05 - 0.15				0.0			
2170	Dunes with Salix repens ssp. argentea (Salicion arenariae)	0.05 - 0.15	0.05 - 0.15	0.1			0.0			
2190	Humid dune slacks	0.15 - 0.3	0.15	0.3			0.15			0.0 - 0.2
2250	Coastal dunes with Juniperus spp.	0.1	0.1							0.0 - 0.15
2310	Dry sandy heaths with Calluna and Genista	0.05 - 0.15	0.05 - 0.15							
2320	Dry sandy heaths with Calluna and Empetrum nigrum	0.0 - 0.15	0.15 - 1.2	0.2						
2330	Inland dunes with open Corynephorus and Agrostis grasslands	0.1 - 0.15	0.1 - 0.2	0.3	0.15	0.1 - 0.15				0.15
2340	Pannonic inland dunes		0.2		0.2					
4010	Northern Atlantic wet heaths with Erica tetralix	0.05 - 0.2	0.1 - 0.2	0.1 - 0.2						0.1 - 0.2
4020	Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix	0.5 - 0.8	0.8			0.5 - 0.7				0.3 - 0.45
4030	European dry heaths	0.1 - 0.6	0.3 - 0.5	0.3	0.2	0.05 - 0.4	0.2			0.2 - 0.5
4040	Dry Atlantic coastal heaths with Erica vagans	0.6 - 0.8								

Code	Habitat name	Atl	Cont	Bor	Pan	Alp	Black S	Step	Mac	Med
4060	Alpine and Boreal heaths	0.2 - 0.3	0.3	0.3		0.05 - 0.3	0.3		0.30	0.3 - 0.5
4090	Endemic oro-Mediterranean heaths with gorse	0.5 - 0.6	0.3			0.0 - 0.6	0.3		0.40	0.2 - 0.4
5120	Mountain Cytisus purgans formations	0.6 - 0.8	0.7			0.6 - 0.7				0.4 - 0.65
5130	Juniperus communis formations on heaths or calcareous grasslands	0.05 - 0.3	0.05 - 0.3	0.2 - 0.8	0.3 - 0.5	0.3 - 0.6				0.3 - 0.4
5210	Arborescent matorral with Juniperus spp.	0.4 - 0.5	0.3			0.3 - 0.4	0.3			0.2 - 0.3
5330	Thermo-Mediterranean and pre-desert scrub		0.15						0.1	0.1 - 0.2
5420	Sarcopoterium spinosum phryganas									0.05 - 0.1
5430	Endemic phryganas of the Euphorbio-Verbascion									0.05 - 0.1
6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi	0.01	0.01 - 0.15	0.1	0.1	0.1 - 0.15	0.1			0.1
6120	Xeric sand calcareous grasslands	0.1 - 0.2	0.1 - 0.2	0.1 - 0.2	0.1 - 0.2		0.1 - 0.2	0.1		0.1
6140	Siliceous Pyrenean Festuca eskia grasslands					0.3 - 0.6				
6150	Siliceous alpine and boreal grasslands		0.25 - 0.6	0.4	0.4	0.2 - 0.4				0.15
6160	Oro-Iberian Festuca indigesta grasslands	0.4 - 0.6								0.2 - 0.4
6170	Alpine and subalpine calcareous grasslands	0.2 - 0.6	0.2 - 0.4			0.2 - 0.6				0.1 - 0.4
6180	Macaronesian mesophile grasslands								0.2	
6190	Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis)		0.1 - 0.2		0.1 - 0.2	0.1 - 0.2				
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)	0.3 - 0.6	0.3 - 0.8	0.1 - 0.5	0.4 - 0.6	0.3 - 0.6	0.4	0.4		0.2 - 0.4
6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	0.2 - 0.3	0.3			0.2 - 0.3	0.4	0.3		0.05 - 0.2
6230	Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in continental Europe)	0.2 - 0.8	0.5 - 0.75	0.1 - 0.3	0.3	0.3 - 0.75				0.3 - 0.7
6240	Sub-pannonic steppic grassland	0.6	0.2 - 0.6		0.3	0.05 - 0.6	0.3			
6250	Pannonic loess steppic grasslands		0.2		0.4	0.3				
6260	Pannonic sand steppes		0.2		0.2					0.05
6270	Fennoscandian lowland species-rich dry to mesic grasslands		2.0	0.1 - 1		1.0				
6280	Nordic alvar and precambrian calcareous flatrocks		0.1	0.2						
6310	Dehesas with evergreen Quercus spp.									0.3 - 0.6

Code	Habitat name	Atl	Cont	Bor	Pan	Alp	Black S	Step	Mac	Med
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	0.0 - 0.4		0.0 - 1.2	0.0 - 0.4	0.0 - 0.3				0.15 - 0.3
6420	Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion	0.3 - 0.6	0.3			0.3 - 0.6	0.1		0.15	0.15 - 0.7
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	0.0 - 0.7	0.0 - 0.3	0.3	0.0 - 0.2	0.0 - 0.7	0.01	0.01		0.5 - 0.6
6440	Alluvial meadows of river valleys of the Cnidion dubii				0.0 - 1.6					
6450	Northern boreal alluvial meadows			0.0 - 1.2						
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	0.0 - 1.5		0.0 – 1.5	0.0 - 1.6	0.0 – 1.0				0.0 - 0.6
6520	Mountain hay meadows				0.0 - 0.3					
6530	Fennoscandian wooded meadows			0.2 - 0.8						
6540	Sub-Mediterranean grasslands of the Molinio-Hordeion secalini									0.4- 0.8
7140	Transition mires and quaking bogs	0.0 - 0.1	0.0 - 0.1	0.0 - 0.1	0.0	0.0 - 0.1		0.05	0.05	0.0 - 0.1
7150	Depressions on peat substrates of the Rhynchosporion	0.0 - 0.3	0.0 - 0.05	0.0 - 0.1		0.0 - 0.05				0.05 - 0.1
7210	Calcareous fens with Cladium mariscus and species of the Caricion davallianae	0.0 - 0.3	0.0 - 0.3	0.0 - 0.3	0.0 - 0.2	0.0 - 0.2				0.05 - 0.25
7230	Alkaline fens	0.0 - 0.3	0.05 - 0.5	0.3 - 0.5	0.0 - 0.2	0 .0 - 0.2				0.05 - 0.25
8230	Siliceous rock with pioneer vegetation of the Sedo-Scleranthion or of the Sedo albi-Veronicion dillenii	0.05	0.0 - 0.3	0.05	0.0 – 0.05	0.0 - 0.1	0.0 – 0.05	0.0 – 0.05	0.0 – 0.05	0.0 – 0.05
8240	Limestone pavements	0.2	0.0 - 0.1	0.05 - 0.1		0.0 – 0.05				0.0 – 0.05
9070	Fennoscandian wooded pastures		1.2	0.2 - 1.1		1.0				
21A0	Machairs	0.5								
62A0	Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae)		0.4			0.4	0.4			0.2 - 0.3
62C0	Ponto-Sarmatic steppes		0.2				0.1	0.1		
62D0	Oro-Moesian acidophilous grasslands		0.7			0.7				0.7

4.3 Relationship between CLC semi-natural classes and Halada habitats

Section 4.3 presents a crosswalk between Halada habitats and related CLC semi-natural land cover classes. This approach was implemented where area estimates for these CLC classes were required for gap-filling, specifically for countries where data from the reporting under Article 17 of the Habitats Directive was not adequate for the analysis developed and presented here. Such information was also developed to support the analysis of potential semi-natural grazing needs per country (which is presented in Annex 4) that also required CLC-based estimates. The list of Halada habitats was clustered to the CLC classification (based on existing crosswalks developed by ETC/BD and the EEA) - **Table 4.3** , with some amendments by the study team:

Fennoscandian wooded pastures (9070) and Fennoscandian wooded meadows (6530) were originally mapped as 2.3.1 Pastures. For pragmatic reasons, in this exercise, they were included within 3.2.1 (Semi-) Natural Grasslands while they would seem to belong with 2.4.4 Agroforestry areas.

Limestone pavement (8240) and Nordic alvar and Precambrian calcareous flat rocks (6280) are very similar, but the former is mapped as 3.3.2 Bare Rock while the latter is mapped as 3.2.1 (Semi-)Natural Grassland. Thus, for this exercise, they were both considered within 3.3.3 Sparsely vegetated Areas.

Machairs (21A0), originally mapped as 2.3.1 Pastures, were included them in 3.2.1 (Semi-) Natural Grasslands.

It should be noted that habitat type 1630 Baltic Boreal coastal meadows is lumped in with 4.2.1 Saltmarshes whereas CLC class 3.2.1 (Semi-) Natural Grasslands might be a better match for this habitat type.

Table 4.3 shows the relation of CLC classes and Halada habitats. Overall, CLC classes with the highest number of habitats that are classified as dependent (D) of low-intensity agricultural management and therefore most strongly rely on extensive grazing are (semi-)natural grassland (321) and agroforestry (244), the latter class fully overlapping with the habitat Dehesas with evergreen Quercus spp. (6310). Regarding the CLC class Moors and heathlands (322), only European dry heath (4030) and Dry Atlantic coastal heath with Erica vagans (4040) depend on grazing, while the other habitats in this CLC class have a lower or more patchy dependence on agricultural management. For Corine Land Cover classes Salt marshes (4.2.1), Inland marshes (4.1.1), Beaches dunes and sand plains (3.3.1), Sparsely vegetated areas (3.3.3), Sclerophyllous vegetation (3.2.3) and Bare rock (3.3.2), the habitats scored by

Halada et al. (2011) as partially dependent (P) or the relation with agricultural management holds true for only some sub-habitat types (M).

Table 4.3: Crosswalk of Annex 1 Halada habitats to CLC classes (updated from Halada et al. (2011) in the context of this study).

Code	Habitats name	CLC code	CLC name
6310	Dehesas with evergreen Quercus spp.	2.4.4	Agro-forestry area
1530	Pannonic salt steppes and salt marshes	3.2.1	(Semi-)Natural grassland
21A0	Machairs	3.2.1	(Semi-)Natural grassland
6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi	3.2.1	(Semi-)Natural grassland
6120	Xeric sand calcareous grasslands	3.2.1	(Semi-)Natural grassland
6140	Siliceous Pyrenean Festuca eskia grasslands	3.2.1	(Semi-)Natural grassland
6150	Siliceous alpine and boreal grasslands	3.2.1	(Semi-)Natural grassland
6160	Oro-Iberian Festuca indigesta grasslands	3.2.1	(Semi-)Natural grassland
6170	Alpine and subalpine calcareous grasslands	3.2.1	(Semi-)Natural grassland
6180	Macaronesian mesophile grasslands	3.2.1	(Semi-)Natural grassland
6190	Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis)	3.2.1	(Semi-)Natural grassland
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)	3.2.1	(Semi-)Natural grassland
6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	3.2.1	(Semi-)Natural grassland
6230	Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in continental Europe)	3.2.1	(Semi-)Natural grassland
6240	Sub-pannonic steppic grassland	3.2.1	(Semi-)Natural grassland
6250	Pannonic loess steppic grasslands	3.2.1	(Semi-)Natural grassland
6260	Pannonic sand steppes	3.2.1	(Semi-)Natural grassland
6270	Fennoscandian lowland species-rich dry to mesic grasslands	3.2.1	(Semi-)Natural grassland
62A0	Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae)	3.2.1	(Semi-)Natural grassland
62C0	Ponto-Sarmatic steppes	3.2.1	(Semi-)Natural grassland
62D0	Oro-Moesian acidophilous grasslands	3.2.1	(Semi-)Natural grassland
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	3.2.1	(Semi-)Natural grassland
6420	Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion	3.2.1	(Semi-)Natural grassland
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	3.2.1	(Semi-)Natural grassland
6440	Alluvial meadows of river valleys of the Cnidion dubii	3.2.1	(Semi-)Natural grassland
6450	Northern boreal alluvial meadows	3.2.1	(Semi-)Natural grassland
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	3.2.1	(Semi-)Natural grassland
6520	Mountain hay meadows	3.2.1	(Semi-)Natural grassland
6530	Fennoscandian wooded meadows	3.2.1	(Semi-)Natural grassland
6540	Sub-Mediterranean grasslands of the Molinio-Hordeion secalini	3.2.1	(Semi-)Natural grassland
9070	Fennoscandian wooded pastures	3.2.1	(Semi-)Natural grassland
2140	Decalcified fixed dunes with Empetrum nigrum	3.2.2	Moors and heathland
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	3.2.2	Moors and heathland
2160	Dunes with Hippophae rhamnoides	3.2.2	Moors and heathland
2170	Dunes with Salix repens ssp. argentea (Salicion arenariae)	3.2.2	Moors and heathland

Code	Habitats name	CLC code	CLC name
2250	Coastal dunes with Juniperus spp.	3.2.2	Moors and heathland
2310	Dry sandy heaths with Calluna and Genista	3.2.2	Moors and heathland
2320	Dry sandy heaths with Calluna and Empetrum nigrum	3.2.2	Moors and heathland
4010	Northern Atlantic wet heaths with Erica tetralix	3.2.2	Moors and heathland
4020	Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix	3.2.2	Moors and heathland
4030	European dry heaths	3.2.2	Moors and heathland
4040	Dry Atlantic coastal heaths with Erica vagans	3.2.2	Moors and heathland
4060	Alpine and Boreal heaths	3.2.2	Moors and heathland
5120	Mountain Cytisus purgans formations	3.2.2	Moors and heathland
5130	Juniperus communis formations on heaths or calcareous grasslands	3.2.2	Moors and heathland
4090	Endemic oro-Mediterranean heaths with gorse	3.2.3	Sclerophyllous vegetation
5210	Arborescent matorral with Juniperus spp.	3.2.3	Sclerophyllous vegetation
5330	Thermo-Mediterranean and pre-desert scrub	3.2.3	Sclerophyllous vegetation
5420	Sarcopoterium spinosum phryganas	3.2.3	Sclerophyllous vegetation
5430	Endemic phryganas of the Euphorbio-Verbascion	3.2.3	Sclerophyllous vegetation
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)	3.3.1	Beaches, dunes, and sand plain
2190	Humid dune slacks	3.3.1	Beaches, dunes, and sand plain
2330	Inland dunes with open Corynephorus and Agrostis grasslands	3.3.1	Beaches, dunes, and sand plain
2340	Pannonic inland dunes	3.3.1	Beaches, dunes, and sand plain
6280	Nordic alvar and precambrian calcareous flatrocks	3.3.3	Sparsely vegetated areas
8240	Limestone pavements	3.3.3	Sparsely vegetated areas
8230	Siliceous rock with pioneer vegetation of the Sedo-Scleranthion or of the Sedo albi-Veronicion dillenii	3.3.3	Sparsely vegetated areas
1340	Inland salt meadows	4.1.1	Inland marshes
7140	Transition mires and quaking bogs	4.1.1	Inland marshes
7150	Depressions on peat substrates of the Rhynchosporion	4.1.1	Inland marshes
7210	Calcareous fens with Cladium mariscus and species of the Caricion davallianae	4.1.1	Inland marshes
7230	Alkaline fens	4.1.1	Inland marshes
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	4.2.1	Salt marshes
1630	Boreal Baltic coastal meadows	4.2.1	Salt marshes

5 Distribution and area of grazing in semi-natural areas in relation to grazing needs in a conservation perspective

5.1 Overview and approach

Chapter 5 combines the evidence presented in previous chapters to develop a first estimate for the livestock grazing capacity needs for maintaining semi-natural habitats related to extensive agricultural land use. The aim is to develop an initial assessment whether the current ruminant livestock population per country is well-positioned for maintaining semi-natural habitats in a good conservation status (with a focus on the EU Habitats Directive Annex I 'Halada habitats'). This is done in two steps: first a comparison with the national ruminant livestock population (section 5.2) and secondly a comparison with the proportion of the national livestock herd that is likely to be currently grazing on semi-natural vegetation types (section 5.3).

The analysis combines five components developed by, or compiled for, this study:

a) The range of livestock stocking density considered suitable for maintaining the Habitats Directive Annex I habitats that depend on grazing (the 'Halada stocking rate'), derived from an expert survey (see Section 4 as well as Table 4.2 and Annex 2 Summary table of 'representative' stocking rates for Halada habitats expressed as averages over the grazing season);

b) The area extent (in ha) for these Annex I habitat types per country, derived from reporting under Article 17 of the EU Habitats Directive (see section 5.2 and chapter 6);

c) The total national ruminant livestock population (cattle, sheep and goats), derived from the Eurostat Farm Structure Survey (FSS) 2020;

d) The share of semi-natural CLC classes that is estimated to be grazed per country – that allowed to calculate the area likely grazed per semi-natural CLC class in each country (see chapter 3);

e) The estimated average stocking density for the grazed area of these semi-natural CLC classes in the environmental zones in each country (the estimated 'CLC stocking density') (see chapter 3), with detailed information in Annex 3).

These knowledge components allowed the study team to investigate different analytical questions. An initial outcome of the work was the development of estimates of overall livestock grazing needs for Halada habitats per country (called 'Halada grazing needs'). This estimation was developed by combining the estimated suitable grazing densities for different Halada habitats [called the 'Halada stocking rate', variable a)] with an estimation of the area occupied by each habitat per country derived from reporting by EU Member States under Article 17 of the EU Habitats Directive [variable b)]. This is likely the first time an analysis estimating Halada grazing needs is attempted.

Future work could combine Halada grazing needs with an estimation of the additional area per such habitat type that needs to be restored to achieve the targets of good conservation status under the EU Habitats Directive and of Article 4 of the EU Nature Restoration Regulation. This was not feasible within the resources and timeframe available for this study.

Halada grazing needs can be analysed against two different estimates of available livestock grazing capacity. The first comparison is with total potential grazing capacity of ruminant agricultural livestock (i.e. cattle, sheep and goats, variable c) per country. This comparison is presented in **Section 5.2** However, as many agricultural livestock are either not suitable for grazing on semi-natural vegetation (e.g. modern dairy cows) and/or are not geographically close to areas with habitats requiring grazing (e.g. most of the modern dairy production is located on productive farmland where hardly any semi-natural vegetation is left) this study produced a second analysis.

This second analysis compared the Halada grazing needs in a more targeted way with the livestock grazing capacity that is adapted to semi-natural vegetation. This 'extensive' livestock grazing capacity was calculated by combining the area of grazed semi-natural CLC classes [variable d)] with estimated average stocking density on the grazed area of these CLC classes per country [variable e)]. This CLC-based extensive grazing capacity only includes cattle, sheep and goat numbers in the total livestock estimate per country and was compared to the Halada grazing needs per country derived from [variables a) and b)]. **Section 5.3** provides a detailed description of the analytical approach employed in this comparison and how to interpret it. In addition, Annex 4 Comparison of likely grazing capacity with Halada grazing needs per country – a first approximation presents the outcome of this comparison in a range of tables, a figure and interpretive text for each country in this study.

Before studying the analytical work presented in the following sections it is important to be aware what information can be drawn from the 'Halada' grazing figures and what not. In short, the work on Halada grazing needs in this study:

- Does not describe actual use of Halada habitats, but rather the expert estimates of what those habitats require; the comparison of those needs with an estimated actual use of semi-natural habitats is further discussed in Section 5.3;

- Does not describe the optimal total grazing livestock stock of High Nature Value (HNV) farming systems which use Halada habitats – those systems will often use also other semi-natural vegetation and/or other land to satisfy total herd feed requirements over the year.
- Does not, following on from the previous point, indicate the number of LU maintained solely by the Halada habitats, many of which have a very short grazing period during spring or summer only.
- Does not assume grazing needs for the maintenance of meadow habitats (6410, 6440, 6450, 6510, 6520, 6530), unless extensive grazing practices were specified as a suitable management method by the country experts surveyed. It should be noted that these habitat types are among the most productive Halada habitats, many capable of supporting >1 LU/ha. Hay from these meadows was traditionally used as winter fodder in extensive grazing systems and historically many of these areas were grazed after an initial hay cut.

Finally, it needs to be acknowledged that the analysis presented uses some input data that are a proxy for the input variable they represent (for lack of direct measurement) and that the results obtained therefore remain first estimates only. Furthermore, not all input data sets are fully comparable, for example the relationship between *CLC grazed area and Halada grazing needs* estimates needs to be further verified. For this reason, **chapter 6** discusses potential uncertainties associated with the results presented for a range of variables.

5.2 Comparing conservation grazing needs to total grazing livestock population per country

5.2.1 Overall approach

This section presents a comparison of total potential grazing capacity of ruminant agricultural livestock (i.e. cattle, sheep and goats) with Halada grazing needs per country. The latter estimate is derived from variables a) and b) as set out in section 5.1 whereas total potential livestock grazing capacity is derived from the Eurostat farm structure survey 2020 (variable c).

The purpose of this analysis is to understand to what degree the national ruminant livestock population (i.e. cattle, sheep and goats) matches the calculated seasonal grazing requirement of Halada habitats (in terms of livestock units). This is a first step to estimate the grazing capacity available for maintaining these EU priority habitats. It needs to be said that the geographical distribution of grazing livestock does not necessarily match the distribution of Halada habitats across the country. Furthermore, not all ruminant livestock are held in systems that include an outdoor grazing period, in particular dairy cows and intensive beef systems.

However, reliable data on these variables was not available for the analysis presented in this study.

Figure 5.1 illustrates the input data and analytical steps that were combined to develop the results presented in Table 5.1.

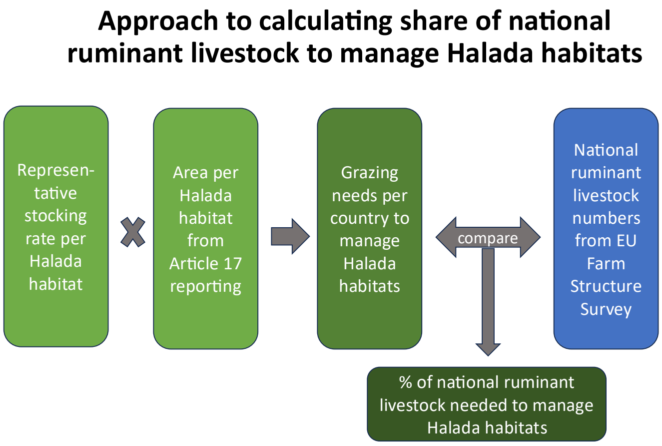

Figure 5.1: Methodological approach for developing estimates of suitable stocking rates per Halada habitat. European Environment Agency, 2025.

5.2.2 Discussion of input data sets

Chapter 4 has described how the estimates for suitable stocking rates per Halada habitat type were developed. These estimates were exposed to several expert feedback rounds and are considered fairly robust in terms of the stocking rate range per habitat type presented in Error! Reference source not found.. However, for estimating overall Halada grazing needs per country, it was most practical to use a specific stocking rate value per habitat for calculations. This stocking rate is called the 'representative stocking rate' and aims to express the likely average productivity of the given habitat per biogeographical region. See section 4.2 for further detail on how this representative rate was derived and the table in Annex 2 for the actual representative stocking rate values used for calculations in this chapter.

Some further methodological notes are also helpful for understanding the potential uncertainty associated with deriving Halada grazing needs by combining variable a) [i.e. the 'Halada stocking rate'] with variable b) [i.e. the area of Halada habitats derived from Article 17 reporting]. Member States can report maximum and minimum area estimates or 'best' estimates of habitat extent. Some Member States use both approaches for reporting on some or all habitat types. The results presented in Table 5.1 below are based on 'best' estimates of habitat area for all cases where it was provided. Where no 'best' value was given, this analysis employed the minimum value (this combination of values is denoted as 'Min/best' in subsequent analysis).

Figure 5.2 shows a summary of the Halada habitat area by country, combined into different habitat groups, based on Article 17 reporting for the 2013-18 period and using the 'minimum' or 'best' values given by Member States.

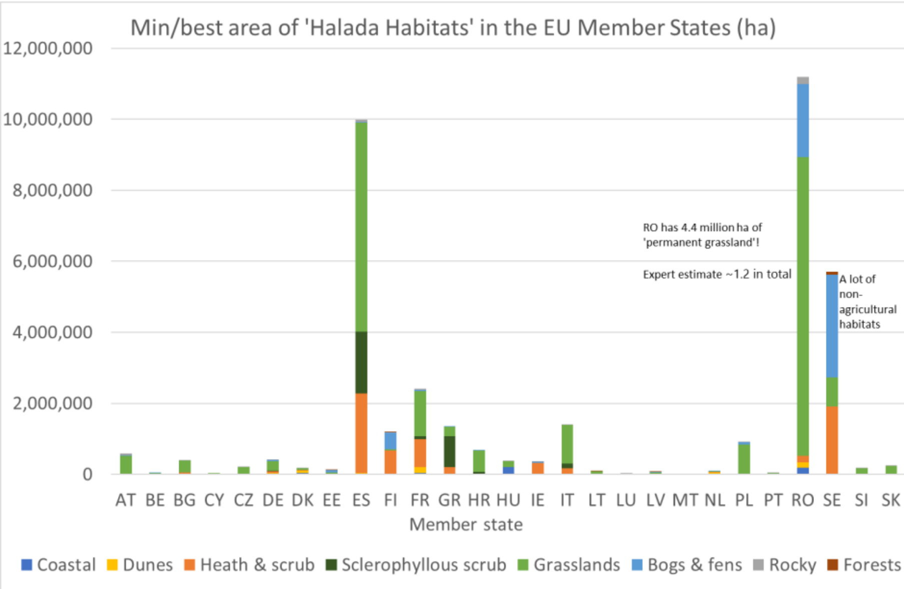

Figure 5.2: Overview of Halada habitat area per country (for the 2013-18 reporting period). European Environment Agency, 2025

Data gaps and limitations, well-known to EU Habitats Directive experts, have become apparent in the case of data reported under the Habitats directive, for the following countries (please note this refers to data reported in the 2013 – 2018 reporting period):

France: large differences between minimum and maximum estimates for some habitats, including some of the largest ones in terms of reported maximum hectarage.

Italy: the Mediterranean biogeographical region has wide variation between minimum and maximum area estimates for many habitats.

Portugal: many habitats reported but with no values given; precise estimates for the Macaronesian biogeographical region were provided, but rarely elsewhere.

Romania: no minimum and maximum estimates were provided, but ‘best’ estimate totals that are most likely unreliable (together they account for 120% of the land area of the country, according to EEA).

Given the data uncertainty associated with reporting under Article 17 of the Habitats Directive for some countries, this study used Corine Land Cover semi-natural grazing estimates as one input to reviewing national Halada livestock grazing need estimates. Knowledge of the agronomic and ecological characteristics of each country also contributed to the uncertainty assessment shown in the comment column of Table 5.1.

Table 5.1 presents the results of the comparison of national livestock herds and the calculated seasonal grazing requirement of Halada habitats (in LU). Please note that for the calculations presented in Table 5.1 the study team used the so-called ‘representative stocking rate’ (see section 4.2 and Annex 2).

EEA analysis suggests that the total grazing livestock needed for maintaining Halada habitats is significant in absolute numbers (ca 7.9 million livestock units (LU) for the EU-27). This represents about a 12.6% share of total EU-27 ruminant livestock in 2020 (~8 million LU compared to a ~63 million LU in total). The EEA study team estimates that about 10 – 15 % of total EU-27 ruminant livestock would be sufficient for managing the area of grazing dependent Annex I habitats, if spatially distributed in an appropriate manner. There is wide variation in the required share of livestock between countries, as presented in **Table 5.1**.

Table 5.1: A comparison of national ruminant livestock herds (cattle, sheep, goats) and the calculated seasonal grazing requirement of Halada habitats (in livestock units - LU).

Note: Use of purple font indicates high uncertainty in the estimate presented.

Country	Total LU 2020 (Eurostat)*	Total Halada grazing LU need	Halada needs as % of total national LU	Comments / alternative data
Austria	1,367,220	184,769	13.5%	
Belgium	1,668,750	8,964	0.5%	
Bulgaria	659,680	148,456	22.5%	
Croatia	381,750	196,124	51.4%	
Cyprus	119,960	2,220	1.9%	
Czechia	1,027,080	17,324	1.7%	
Denmark	1,104,170	55,203	5.0%	
Estonia	199,630	40,930	20.5%	
Finland	609,100	153,435	*25.2%*	On high end, to be reviewed
France	13,351,310	682,200	5.1%	Grazing use & extent of 6210, 6510, 6520 to be reviewed
Germany	8,398,740	83,790	*1.0%*	Appears low; use of 6510, 6520?
Greece	1,536,280	203,993	13.3%	
Hungary	781,440	150,410	19.2%	
Ireland	5,779,520	74,045	1.3%	
Italy	5,303,340	340,817	6.4%	Appears low for Mediterranean region
Latvia	319,790	24,459	7.6%	
Lithuania	509,960	46,177	9.1%	
Luxembourg	142,220	147	0.1%	
Malta	12,950	155	1.2%	
Netherlands	2,847,560	20,811	0.7%	
Poland	4,685,490	33,848	0.7%	
Portugal	1,371,830	8,474	*0.6%*	A CLC-based proxy estimate gives a Halada need of ~900,000 LU
Romania	2,628,940	1,754,155	*66.7%*	Probably too high, due to Art. 17 reporting approach
Slovakia	353,600	110,800	31.3%	
Slovenia	343,620	38,083	11.1%	
Spain	6,368,890	2,807,528	44.1%	
Sweden	1,058,500	725,047	*68.5%*	Probably too high, influenced by habitats used mainly by reindeer?
EU-27	62,931,260	7,912,362	12.6%	
United Kingdom	10,198,320	1,022,422	10.0%	

*Source: Eurostat; Main livestock indicators by NUTS2 region for 2020; data extracted 21 March 2025.

As Table 5.1 shows, the share of total national grazing capacity that is required to manage Halada habitats varies widely between countries. This is due to their different share of semi-natural vegetation and the characteristics of their livestock sector.

There is a group of eight countries with large areas of semi-natural vegetation where a large share of total ruminant livestock (20 – 40% or even >40%) would be required to manage the estimated Halada habitat area in the country. This group includes mainly Mediterranean countries and countries with a large share of mountainous and remote areas. At the other end sits a group of ten EU-27 countries where grazing needs are at or below 5% of total ruminant livestock. This group comprises Malta and Cyprus and countries in central and northwestern Europe. A further nine countries sit in two groups that require 5 – 10 % or 10 – 20 % of available livestock for the management of grazing-dependent Annex I habitats. These have mixed characteristics, but all contain substantial areas of semi-natural habitats to manage. **Table 5.2** groups the EU-27 countries into the five main categories discussed above.

Table 5.2: A comparison of national livestock herds (cattle, sheep, goats) and the calculated seasonal grazing requirement of Halada habitats (in livestock units - LU)

Share of national ruminant livestock needed for Annex I habitat management (in %)	EU-27 countries in this group
0 – 5 %	Belgium, Cyprus, Czechia, Denmark, Germany, Ireland, Luxembourg, Malta, Netherlands, Poland
5 – 10 %	France, Italy, Latvia, Lithuania
10 – 20 %	Austria, Estonia, Greece, Hungary, Slovenia
20 – 40 %	Bulgaria, Finland*, Slovakia
> 40 %	Croatia, (*Portugal*)#, Romania, Spain, Sweden*

Notes: * indicates that the grazing need estimates for this country may be too high

Portugal is placed in this group based on land cover data rather than Article 17 reporting

It should be considered that the EU-27 grazing need estimate and the country level shares presented in the table above are a first estimate and carry significant uncertainty. The share of ruminant livestock that is likely required for managing grazing-dependent Annex I habitats is both driven by the estimated extent of these habitat types and the overall size of the national ruminant livestock population.

Countries can have a large area of grazing-dependent habitats to manage and a large ruminant livestock population – this would result in a similar ‘livestock requirement’ in percentage terms as in countries with both a small Annex I habitat area and a low ruminant livestock population. Germany and Malta are examples for these two different situations.

Lastly, these grazing need estimates relate to the existing area of Annex I habitats only and do not take into account the additional grazing needs that could arise from setting national nature restoration goals under the EU Nature Restoration Regulation.

In Chapter 6 the uncertainty associated with this estimate is assessed, by repeating the described analysis with area estimates for Article 17 habitats per country and the range of estimates for Halada stocking rates. Overall, the uncertainty analysis aimed to estimate the effect of the ranges of both area data and grazing density estimates. For analytical clarity, only one factor was allowed to vary each time: initially the maximum and minimum area estimates were multiplied by a 'representative' Halada stocking rate (documented in Annex 2 Summary table of 'representative' stocking rates for Halada habitats expressed as averages over the grazing season); then the maximum and minimum stocking rate estimates were multiplied by the more conservative lower estimate for habitat area (comprised of the 'best' values (if provided), and the 'minimum' values if not – what is referred to as 'best+min' in the tables).

5.3 Comparing grazing needs of Halada habitats to the CLC semi-natural grazing estimates per country

This section presents the approach to a more detailed country-level analysis of the relationship between the estimated grazing needs of Halada habitats and the actual livestock available to achieve such management per country. As set out in **Chapter 2**, low intensity, extensive grazing practices are an important factor in achieving favourable conservation status for those habitats that are fully or partially dependent on extensive agricultural practices. The role of grazing is therefore an important issue to address the goals of the EU Biodiversity Strategy, the Nature Restoration Regulation (NRR) and for the conservation of species and habitats listed as priority in the Birds and Habitats Directives in particular.

5.3.1 How to understand the data presented

For each country, estimates of grazing pressures/needs are presented (see Tables 5.2, 5.3, and 5.4 and Figure 5.3). The first ("green") table compares Halada grazing needs with Corine Land Cover (CLC) grazing use (e.g. Table 5.2), expressed as a percentage. More detailed data underlying these totals is set out in the respective ("blue") tables below (e.g. Tables 5.3 and 5.4). Section 5.3.2 shows results for Austria as an illustration of the presentation of results per country, while details for all countries covered are available in Annex 4.

Overall, Halada habitat area data was derived, whenever possible, from the publicly available Article 17 reports for each Member State, while the total area mapped under each CLC class is also publicly available. As described above, the original Article 17 reporting may contain a maximum, a best and/or a minimum estimate. In most cases the maximum estimate was used – unless the other options already gave a very large share for Halada habitat area, such as in Romania. This is likely to bring in a certain degree of over-estimation in relation to the current extent of these habitats. However, as the EU Biodiversity Strategy to 2030 and the NRR set out significant nature restoration objectives, the use of the higher estimate seemed appropriate. Livestock densities (LU) were calculated by combining the publicly available area data with expert-based estimates. Where experts were not found (i.e. countries where experts were not available during the completion of this study), the most adequate data was selected by the authors from neighbouring countries or biogeographical regions with similar characteristics. Where experts gave a range, the authors used their discretion to choose a value to use, taking into account the views of experts in other Member States. For CLC the resulting densities give an average grazing density over the grazing season of different livestock types. In case of the Halada habitats, the densities are for estimates of the average maintenance grazing needs ('Halada stocking rate') over the grazing season.

A simplistic reading of the green comparison table (e.g. Table 5.2) might lead one to conclude that a large disparity in percentage area indicates mis-mapping, while disparities in the grazing estimates would indicate under-grazing or overgrazing in relation to the livestock herd required for an optimal grazing of Halada habitats. While these may indeed be valid explanations, in reality they are just some of many – the tables are meant to raise questions rather than answer them definitively. In addition to the possibility of incorrect estimates on the part of the experts (and the lack of useable data in some countries, relating in particular to the lack of precision of Article 17 reports), there are a number of issues which appear and reappear in more than one country. To save repetition, the authors identified the following issues, noting them in the final column of the comparison table:

- **Mosaic (landscape)**: due to the minimal mapping unit rules of CLC small areas of the non-dominant land covers can be "lost" within the dominant class (CLC polygons are assigned the land cover type which has the largest area within them). Across entire countries or larger regions (such as NUTS2) this balances out between different CLC classes but it could be a significant effect where those land covers of interest occur mostly in such mosaic landscapes. The study team considers this relevant for the remaining patches of semi-natural grasslands of meadows and enclosed pastures in particular.
- **Non-Halada significant**: In some CLC classes, the majority of the vegetation types making up the mapped area are unlikely to be on the Halada list, as they do not require any grazing or they are not in Annex I. This issue usually causes the Halada area to be much smaller than the corresponding CLC area and mostly occurs in CLC classes 4.1.1 Inland Marshes (Phragmites beds do not need grazing, for example) and 3.3.3 Sparsely Vegetated Areas (most rocky Annex I habitats are not on the Halada list) and to some extent 3.2.2 Scleropyhllous vegetation.
- **Mowing**: Habitats are not considered to need grazing by local experts, as they are usually mown. Experts in many countries recorded a zero-grazing need for habitats 6410, 6510 and 6520 (Molinia, upland and lowland meadows). It is clear from experience and perusal of satellite images of Natura sites with large areas declared as these habitats, however,

that significant proportions of their total extent is found in areas which are not mown, or even cannot be mown, such as on military ranges. The issue is so widespread that it is worth considering whether it has a wider significance. In this report's tables, the issue would manifest as an apparent overgrazing of those habitats.

- **Abandonment/overgrazing**: Article 17 reporting concerns itself not only with habitats in good condition but with areas considered to be degraded examples of those habitats. That can often include areas which could be mapped by CLC as another land cover altogether. For example, semi-natural grassland habitats might be identified as scrub or woodland in CLC due to land abandonment or undergrazing. Similarly acid grassland might be regarded in Article 17 as degraded heathland. This issue mostly occurs in areas and classes that are not as productive, are remote or in border areas, as well as in countries that have undergone recent wars, land abandonment or heavy grazing pressure.
- **Pasture**: Due to local mapping rules and available satellite imagery some significant semi-natural grassland areas that are under extensive grazing are at least partly mapped as CLC class 2.3.1 Pasture (e.g. on the island of Öland) and are thus not included in the semi-natural CLC areas, as defined in this report.

5.3.2 Austria as an example for the country level analysis

The tables, figure and text below review the grazing of semi-natural vegetation in Austria and serve as an example of the information this study has aimed to gather for each county covered. By combining the different data sets gathered or developed in one comparative analysis with additional information about grazing practices and vegetation characteristics per country and its regions, quite a detailed analysis is feasible. This study includes results for all countries (incl. Austria), that are presented in Annex 4.

Table 5.3: Austria - Comparison of grazing estimates.

AUSTRIA – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	101%	152%	37%	Pasture
3.2.2	*Moors and heathland*	153%	1623%	1353%	Mosaic, Abandonment
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	18%	123%	2%	Mosaic
4.1.1	*Inland marshes*	56%	-	-	
4.2.1	*Salt marshes*	-	-	-	
	total	87%	210%	45%	

The most significant share of grazing on semi-natural areas in Austria occurs on mountain pastures in the alpine region, which is well documented. The CLC grazing area estimates are based on an overlap of INVEKOS (LPIS, Land Parcel Identification System) data and the CLC classes. The estimates can thus be considered reliable. However, due to the minimal mapping unit rules of CLC, small-structured areas are not sufficiently mapped. Smaller mountain pastures, essentially semi-natural grasslands, are thus often “lost” amongst larger areas of 3.2.2 Moors and heathland and 3.2.3 Sclerophyllous vegetation. Also, available mountain pasture data usually includes areas larger than the actual “grazing areas”, for example in some cases including the area that is passed when driving up the animals to the pastures. Further, due to dense settlement in the lowlands grazed semi-natural settlements are generally mapped as 2.3.1 Pastures. There was no Halada habitat expert available for Austria. Instead estimates from Switzerland and Italy (Südtirol) were used. Their ‘needs’ estimates for the major Halada habitats in Austria (6150, 6170) were broadly consistent with each other and were therefore used in the Austrian case.

The dominant grazed CLC land cover class in Austria is 3.2.1 (Semi-)Natural Grassland. Looking at the global figures, this seems at first sight to be just slightly ‘overgrazed’. But national data and LPIS mapping indicate that only around two thirds of the total is in fact grazed. Class 3.2.2. Moors and heathlands are, according to the experts and national data, also substantially under-grazed, with less than 10% grazed at all.

The overall picture therefore is that the total ‘overstocking’ shown by the national totals is roughly 100%. These livestock are largely concentrated on about one third of the Halada/CLC resource, with large areas significantly under-grazed or ungrazed. Grazed semi-natural grasslands have an estimated livestock density of around 0.55 LU/ha; though national grazing data and LPIS gives an even higher value of 0.68 LU/ha.

Table 5.4: Austria CLC grazing estimates.

AUSTRIA – CLC grazing estimates								
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural grassland*	615 300	407 160	66%	342 014	0.8	Reliable, mostly mountain pastures
3.2.2	*Moors and heathland*	196 300	18 510	9%	2 221	0.1	Areas surrounding mountain pastures
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	305 700	44 220	14%	5 306	0.1	Areas surrounding mountain pastures
4.1.1	*Inland marshes*	19 200	-	-	-	-	Not grazed
4.2.1	*Salt marshes*	-	-	-	-	-	
	total	1 136 500	469 890	41%	349 542	0.7	

Table 5.5: Austria – Halada grazing expert estimates.

AUSTRIA – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1.	*(Semi-)Natural grassland*	619 930	127 481	0.2	Mostly 6150 (siliceous alpine and boreal grasslands), 6170 (alpine and subalpine calcareous grasslands)
3.2.2.	*Moors and heathland*	300 409	30 063	0.1	4060 (Alpine and boreal heaths)
3.2.3.	*Sclerophyllous vegetation*	-	-	-	
3.3.3.	*Sparsely vegetated areas*	54 500	100	0	8240 (Limestone pavements)
4.1.1.	*Inland marshes*	10 810	720	0.1	7230 (Alkaline fens)
4.2.1.	*Salt marshes*	-	-	-	
	total	985 649	158 364	0.2	

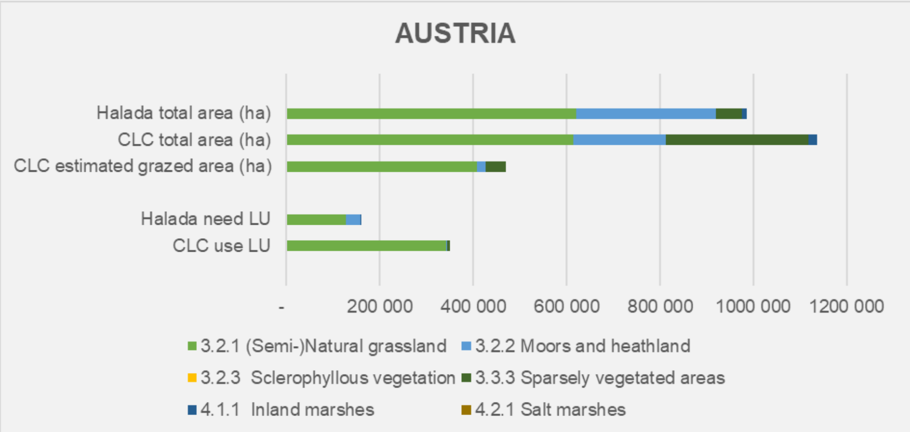

Figure 5.3: Austria - comparison of Halada grazing needs with grazed semi-natural area estimated via CLC

5.3.3 Reflections on interpreting the country results shown in Annex 4

This chapter brings together data sets developed in different domains for a comparison of livestock grazing capacity with conservation grazing needs for Halada habitats in a triangulation exercise. In looking through the country results in Annex 4 the following considerations are worth bearing in mind:

- The input data sets were not designed to be comparable (but are the only ones currently available) – for example, the CLC land cover classes define vegetation types differently than the Annex I habitat type descriptions.

- There were substantial uncertainties in estimating the area of Annex I habitat types where no reliable country area estimates under Article 17 or substitute expert estimates were available.
- There is a substantial variability in the productivity of Annex I habitats, frequently leading to a substantial range in the Halada stocking rate estimates.
- Grazing by horses and other equines was not considered in this analysis as official statistical data are generally not available and the geographic distribution of hobby horses is skewed towards stables around urban centres. However, robust horse and pony breeds are employed for conservation grazing in quite a number of protected areas.

The two main input data sets provide estimates for very different things: The CLC grazing share estimates the actual livestock use of all of the non-forest semi-natural CLC classes (and note that forest area can still be a significant grazing resource in some countries), without knowledge whether current grazing use represents an optimal stocking rate or should be considered overgrazing or under-grazing. The Halada stocking rate estimates are of the optimal livestock use of just a sub-set of the various vegetation types. In an ideal situation, the Halada grazing need total should therefore be less than the CLC total, but different arithmetic relationships can still arise when there is over- or under-use of the Halada habitats.

All the above means that even with perfect expert knowledge, one must be careful in drawing general inferences from situations where the estimated CLC total grazing use is higher than the estimated grazing needs of the Halada habitats it contains. This is because the CLC semi-natural classes may contain significant areas of non-Halada habitats. It would certainly raise the possibility of overgrazing of Halada habitat types, but nothing more. The same is true to some extent for the opposite case where CLC class use is lower than the estimated needs of the Halada habitats it contains. However, here the issue is likely to be rather clearer, at least at national scale, as under-grazing is highly unlikely to be limited to non-Halada habitats. In all cases, caution needs to be exercised when the absolute and relative discrepancies are large.

While there are some exceptions across Europe, the work strongly suggests that the primary issue now seems to be the under-grazing of Halada habitats. This was the clear message from many of the experts interviewed. Furthermore, in those countries where the landscape characteristics allow for clear alignment of Halada habitats with CLC classes (Spain is the outstanding example), this seems to be borne out by the data. The issue of under-grazing gets more significant, the less productive the habitat, e.g. it is more the case in general for sclerophyllous vegetation than for heaths and more for heaths than for grasslands. These under-grazing patterns correspond well to what is known about the geographic distribution of land abandonment which occurs above all in areas of low productivity, such as marginal lands in the Mediterranean. The combination of the resulting large biomass fuel loads with changing climate conditions then leads to a substantially increased wildfire risk.

A review of the results of the comparative analysis per country (as shown in Table A4 in Annex 4) indicates certain patterns, which are summarised in **Table 5.5:**

Table 5.5: Grouping countries by main analytical conclusions or data limitations.

1) Average size of grazed habitats not large enough to be visible at the scale of CLC data	(FI), LU, MT
2) Large uncertainties (and/or no expertise available to study team) to enable firm conclusions to be drawn	CY, DE, FR, HU, IT, LT, PL, PT, RO, SK
3) Livestock stocking density suitable overall (maybe even too high) but with some variation within CLC types	BE, IE, UK
4) Livestock densities on grasslands apparently suitable overall, but with significant areas under- or unmanaged; other Halada habitats likely significantly undermanaged	AT, BU, DK, EE, ES, NL
5) Clear evidence of substantial under-grazing on all habitat groups	HR
6) Expert message of significant under-grazing across habitat types, but evidence from current work remains uncertain	CZ, FI, GR, LV, SE

Three main country groupings can be identified in Table 5.5:

- A large group of 13 countries where data uncertainties are considered too big for firm conclusions to be drawn [groups 1) and 2)]
- A group of 3 countries where sufficient grazing capacity is available, with potential for overgrazing [group 3)]
- A large group of 12 countries where significant undergrazing of (some) Halada habitats is suspected or confirmed [groups 4), 5) and 6)]
- The large group of countries with significant data uncertainties shows the need for further investment in monitoring the area, conservation status and (grazing) management of Annex I Halada habitats.

For most countries there is apparently a significant to large grazing deficit for Halada habitats. This grazing deficit has important ramifications for the ability of reaching habitat protection and restoration targets under the EU Biodiversity Strategy and the NRR. The next chapter reviews the uncertainties in the available input data sets further and explores how results could vary with utilising different input data sets.

6 Review of data at European level and uncertainty analysis

6.1 Introduction and overview

Given the nature of the data available for this analysis, the study team conducted a thorough review of the data sets used and how their uncertainty range could influence overall results. This builds on data analysis by the study team itself and a series of final webinars with the experts consulted (arranged by groups of biogeographical regions) for a discussion of the estimates of stocking density for optimal grazing of the Halada habitats. This allowed identifying the main sources of uncertainty for the analysis presented in the previous chapter and it provides a foundation for reflecting on future analytical work.

This chapter presents the results of this work in the following order:

Section 6.2 reviews the range of area estimates for Article 17 habitats linked to the reporting options that EU Member States have.

Section 6.3 presents the impact of the variance in Halada stocking rate estimates on calculating overall livestock grazing needs at EU-level.

Section 6.4 explores the relative impact of the range of area estimates for Annex I habitats versus the effect of variation in Halada stocking rate estimates on calculating overall livestock grazing needs per Member State.

Section 6.5 discusses priorities for refining certain aspects of this analysis based on expert feedback.

6.2 Review of the uncertainty related to Article 17 reporting

This section focuses mainly on uncertainties arising from reporting on the area of Annex I habitats under Article 17 of the EU Habitats Directive. The reporting of Member States under this directive is based on the biogeographical regions of Europe (BGR).

The analysis presented below is structured into three parts:

a) Comparison of range of area estimates for Halada habitats per BGR and per habitat type

b) Analysis which Article 17 habitat types have the largest absolute variation in area

c) Relative influence of individual habitat types on national grazing needs estimates expressed in livestock units (LU)

6.2.1 Comparison of range of area estimates for Halada habitats per BGR and per habitat type

As reported in previous chapters, there are some examples of large discrepancies between minimum and maximum estimates of the extent of Habitats Directive Annex I Habitats. In looking again at the range of values reported by Member States, the main finding is that at the level of Biogeographic Regions (BGR) there is mostly a rather modest variation arising from the difference between the minimum and maximum habitat area estimates from the Article 17 reports (2013 – 2018), for the countries where no best value was given.

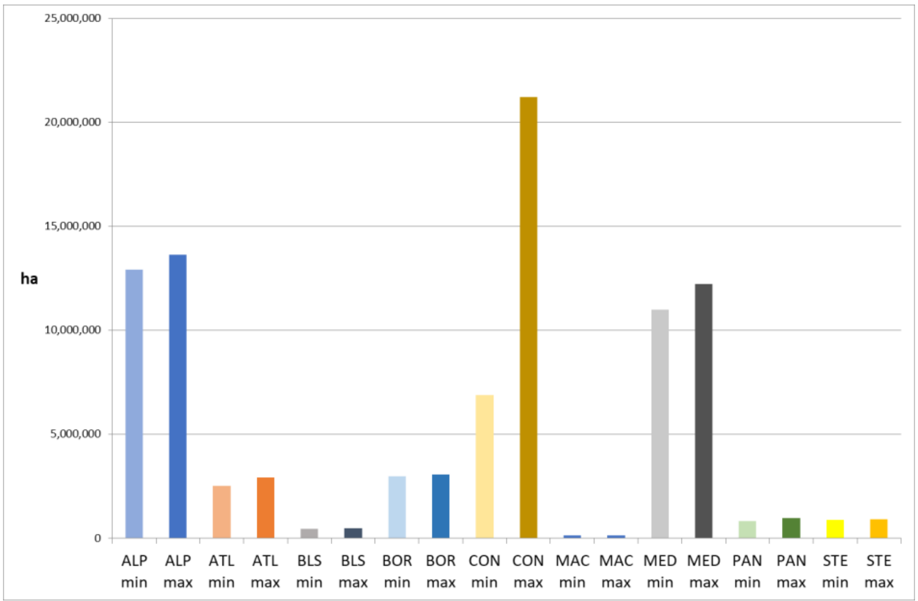

Figure 6.1: Variation in total extent of Halada habitats by BGR according to Article 17 reports (2013-2018 reporting period)

Note: Best values used where given; variation results from the difference between minimum and maximum estimates of the habitat extent, where no best value was given by the Member State.

As shown in **Figure 6.1**, the largest variation is found in the Continental BGR, with the next biggest found in the Mediterranean BGR. However, if summed up across all BGR, the overall gap between the 'best + minimum' and the 'best + maximum' total is over 17 million hectares (ca. 38 million vs. ca. 55 million ha), most of which arises from the variation in the Continental BGR. This illustrates the substantial uncertainty in the area estimates for some large Annex I habitat types provided by (some) EU Member States. As a comparison, Eurostat (FSS 2020) records a total of over 156 million ha of Utilised Agricultural Area, but less than 49 million ha of permanent grassland.

6.2.2 Analysis of relative variation in area per habitat type and country

The Article 17 reporting for 2013 - 2018 can be analysed by Halada habitat type (see **Figure 6.2**). Most of the total uncertainty arises from two habitats – predominantly from 6510 Lowland hay meadows (ca. 71% of total uncertainty) and then from 6520 Upland hay meadows (ca. 12% of total uncertainty).

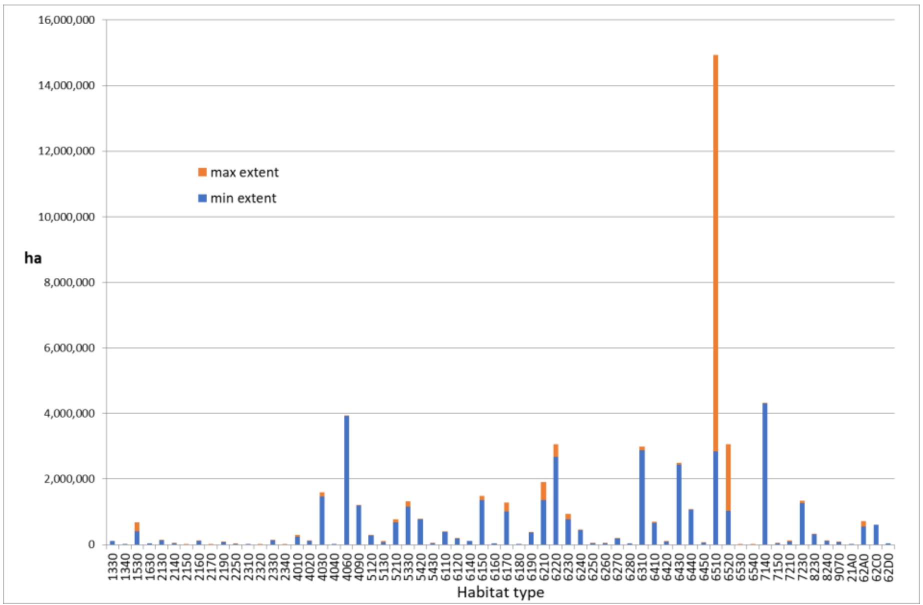

Figure 6.2: Area value at EU-27 level from Article 17 reporting (2013 – 2018) per Halada habitat.

Note: Best values used where given; variation results from the minimum and maximum estimates of the habitat data, where no best value was provided by the Member State.

Closer analysis reveals that only 12 habitats have an uncertainty of over 100,000 ha at the EU level (**Table 6.1**). Additionally, most of the uncertainty in those cases arises from just one country – France – and only two other countries (Italy and Croatia) have over 100,000 ha of variation in their country reports on individual habitats (see **Table 6.2**).

Table 6.1: List of Halada habitats with over 100,000 ha of difference between Article 17 maximum and minimum extent estimates, at the EU level (2013 – 2018, where no best value was available)

Habitat	Name	Min area (ha)	Max area (ha)	Difference (ha)
1530	Pannonic salt steppes and salt marshes	410,544	680,544	270,000
4030	Dry heaths	1,459,559	1,597,554	137,995
5330	Thermo-Mediterranean and pre-steppe scrub	1,160,870	1,322,686	161,816
6150	Siliceous alpine and boreal grasslands	1,356,579	1,479,077	122,498
6170	Alpine and subalpine calcareous grasslands	1,014,065	1,287,849	273,784
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates	1,349,494	1,904,715	555,221
6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	2,682,045	3,053,631	371,586
6230	Species-rich Nardus grasslands	774,437	931,157	156,720
62A0	Eastern sub-mediterranean dry grasslands	550,055	709,003	158,948
6310	Dehesas with evergreen Quercus spp.	2,884,747	2,988,297	103,550
6510	Lowland hay meadows	2,837,551	14,940,556	12,103,005
6520	Mountain hay meadows	1,024,415	3,065,517	2,041,102
	Total area of the habitats listed in this table	17,093,817	33,960,586	16,456,225

Table 6.2: List of Halada habitats with over 100,000 ha of difference between Article 17 maximum and minimum extent estimates (where no best value was available), at Member State level

Country	Habitat	Name	Min area (ha)	Max area (ha)	Difference (ha)
Croatia	62A0	Eastern sub-Mediterranean dry grasslands	434,000	550,000	116,000
France	4030	Dry heaths	106,200	237,600	131,400
	6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates	126,358	298,800	172,442
	6230	Species-rich Nardus grasslands	52,700	182,000	129,300
	6510	Lowland hay meadows	451,100	12,504,600	12,053,500
	6520	Mountain hay meadows	16,000	2,011,200	1,995,200
Italy	5330	Thermo-Mediterranean and pre-steppe scrub	88,217	249,933	161,716
	6170	Alpine and subalpine calcareous grasslands	164,268	298,053	133,784
	6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates	277,833	640,693	362,860
	6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	127,899	468,699	340,800
	6310	Dehesas with evergreen Quercus spp.	10,494	114044	103,550
		Total area of the habitats listed above	1,855,069	17,005,622	15,700,552

The analysis presented in the figures above enables a better understanding which habitats contribute most to the uncertainty of the results presented in this study and vegetation type they represent. Grassland habitats feature very strongly in the lists above, and hay meadow habitat types (i.e. 6510 and 6520) clearly show the greatest variation in potential area. The large range in minimum and maximum area estimates for meadow habitats for the 2013 – 2018 reporting period stems mostly from reporting by France, whereas the range of area estimates in the reporting by Italy contributes strongly the variance in other grassland habitat types.

6.2.3 Influence of habitat area uncertainty on EU-27 grazing need estimates

The main aim of this study is to understand the size of the ruminant livestock herd needed for an adequate management of the habitats studied, i.e. their grazing needs. To achieve that the uncertainty in area of Halada habitats needs to be combined with the estimated suitable stocking density (the Halada stocking rate). This was done for the analysis in this sub-section by choosing the representative Halada stocking rate (presented in Annex 2), which allowed a focus on the influence of Article 17 area range on Halada grazing needs.

The representative Halada stocking rate per habitat type in each BGR was multiplied by the total (max and min) area figures from Article 17 reporting. The resulting maximum and minimum livestock grazing needs estimates in terms of overall livestock units (LU) per habitat type are shown in **Figure 6.3**.

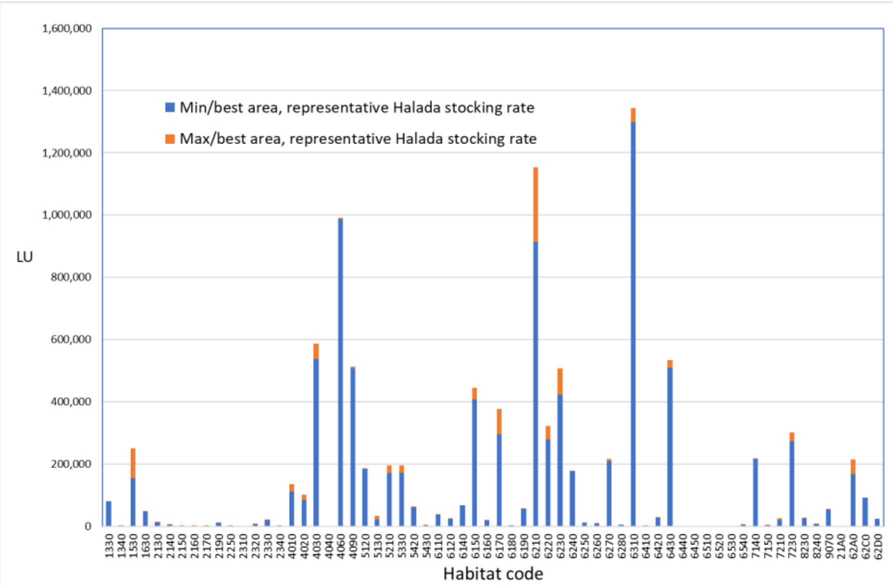

Figure 6.3: Habitat area range: minimum and maximum total livestock need estimates for the Halada habitats.

Note: Best values for extent used where given; variation results from the minimum and maximum estimates of the habitat data, where no best value was given by the Member State.

When this uncertainty range is plotted separately per habitat type (see **Figure 6.4**), it can be seen clearly that the potential impact of Article 17 habitat extent estimates on overall Halada grazing needs stems from only seven habitats (1530, 4030, 6170, 6210, 6230, 6310, 62A0). Each of these habitat accounts for over 5% of the total variation individually, with another one coming in just below that threshold (6220). Only one habitat brings an uncertainty of over 100,000 LU to the total – 6210 (ca 26% of total uncertainty). The total uncertainty is modest at just over 900,000 LU compared to a calculated EU-27 grazing needs estimate of almost 8 million LU (and a total EU complement of ruminant livestock (cattle, sheep and goats) of almost 63 million LU). As seen in the diagrams for each BGR, none stand out as needing particular attention.

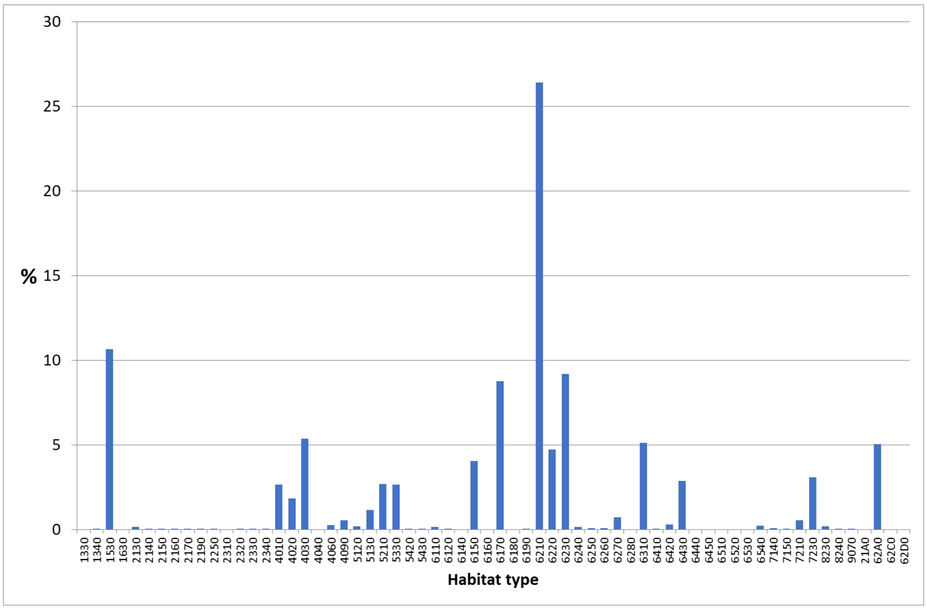

Figure 6.4: The contribution of each grazed Halada habitat to the uncertainty in overall livestock needs at the EU level for their grazing, based on the range in the extent of those habitats.

The conclusion from the analysis presented above is that improvement of habitat mapping in the future should focus first and foremost on those seven habitats that account for most of the uncertainty. Improving the input data for these habitats will have the most impact on EU level livestock needs estimates. Those efforts should be particularly focussed on experts with knowledge about French, Italian and Croatian habitat types and grazing practices.

The consensus assumption amongst the experts for important biogeographical regions (CON, ALP, BOR, BLS) is that the 'meadow' habitats 6510 and 6520 (along with other 'meadow' habitats) do not require grazing but rather rely on mowing for their maintenance. Based on this, one could thus assume that the largest 'problematic' habitats have no impact on grazing needs estimates. However, a significant share of these habitats is likely to have been grazed in the past (at least after a first cut). Furthermore, under current agronomic and conservation management practices, grazing is often considered a more likely/feasible use of these habitats than mowing (for labour and cost reasons). Practical experience in large-scale conservation grazing projects in Germany shows that the botanic species range of habitat type 6510 can be achieved via an extensive grazing regime, with positive side benefits for the insect communities associated with grassland vegetation types (Nickel, pers. comm., 2024). Finally, as discussed in chapter 4, the use of hay harvested from meadow habitats fits best with extensive livestock systems as its nutritional value is not sufficient for dairy production or intensive beef cattle fattening systems.

As a thought experiment, the study team therefore tested what number of livestock could be associated with the use of hay from Annex I meadow habitats for feeding livestock over winter. Given that hay loses some nutritional value compared to fresh grass and that some of this hay would be consumed by extensive livestock that already feed on other Annex I habitat types during summer (and thus are already accounted for), only 50 % of the resulting livestock units were included in the uncertainty analysis. The results in Table 6.3 indicate a similar amount of potential additional livestock numbers needed for maintaining Annex I meadow habitat types as for the grazed Annex I habitats presented above.

Table 6.3: Estimate of livestock units needed for maintaining Annex I meadow habitats.

Habitat code	Livestock units resulting from identified grazing needs (representative value)	Livestock units resulting from grazing value plus hay from meadow habitats (50% use assumed for hay)	Additional livestock units arising from assumed 50% use of hay from meadows
6410	52,716	87,729	35,013
6440	1	305,097	305,096
6450	24,410	25,160	750
6510	582,671	1,025,738	443,067
6520	600	102,741	102,141
6530	3	2,313	2,310
Total LU	***660,400***	***1,548,778***	***888,378***

6.3 Uncertainties arising from the Halada stocking rate (LU/ha) estimates for each habitat

This section presents an assessment of the impact of the full variation of suitable stocking rates estimated per Halada habitat on overall livestock grazing needs. This aims to capture the maximum range in estimated livestock grazing needs when focusing on the full range of suitable stocking rates per Halada habitat. The results using the best extent numbers (where available) and the minimum in their absence are shown graphically in Figure 6.5. The uncertainty due to variation in Halada stocking rate needs (LU/ha) estimates seems much greater than that arising from the uncertainty linked Article 17 reporting – over 10 million LU compared to the less than 1 million LU related to the uncertainty in habitat area. While only one habitat brought over 100,000 LU of uncertainty in the case of variation in area (6210), this time 16 habitats do so (see **Figure 6.5**). **Table 6.4** lists these 16 Annex I habitats.

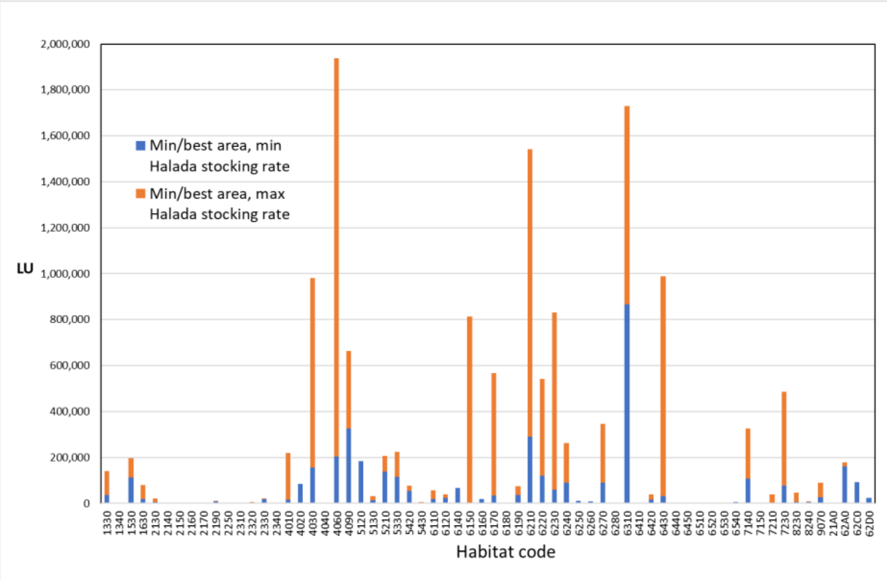

Figure 6.5: Minimum and maximum estimates for total livestock grazing requirements for the Halada habitats dependent on grazing.

Note: based on the stocking density range provided by experts using single EU-wide habitat area value (min+best) and varying the LU/ha needs estimate

Table 6.4: Habitats with >100,000 LU of uncertainty when extent and Halada stocking rate values respectively are varied in the calculation.

EXTENT	GRAZING NEED ESTIMATE			
6210	1330	4010	4030	4060
	4090	5330	6150	6170
	6210	6220	6230	6240
	6310	6430	7140	7230

Figure 6.6 shows that only 8 habitats dominate the uncertainty: they account individually for more than 5% of total uncertainty (4030, 4060, 6150, 6170, 6210, 6230, 6310, 6430).

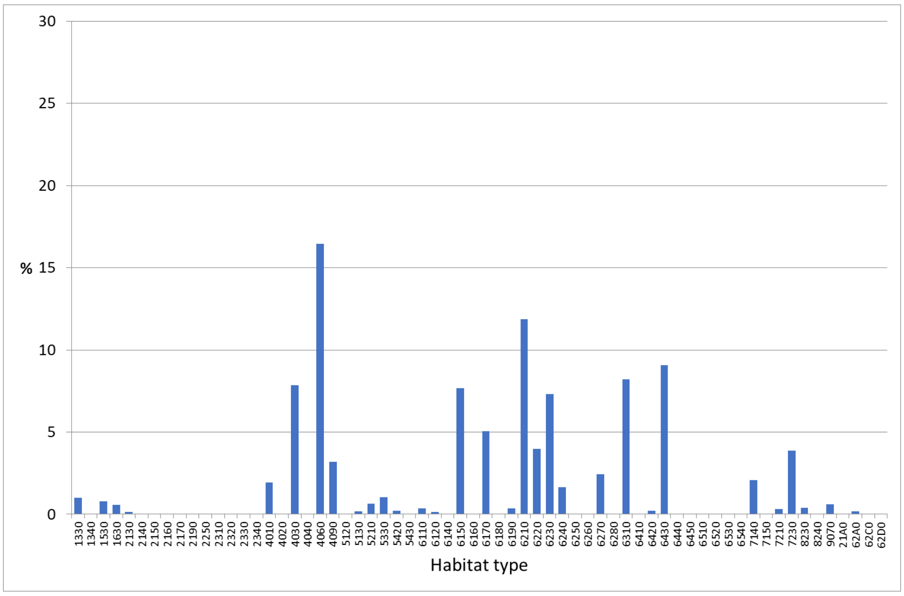

Figure 6.6: The contribution of each grazed Halada habitat to the uncertainty in overall livestock grazing need at EU level

Note: based on the range of estimated Halada stocking rates using a single EU-wide habitat area value (min+best) and varying the LU/ha needs estimate

When the estimates are shown separately by biogeographical region (BGR) it becomes apparent that further work to limit data uncertainty would ideally focus on the following habitats in five BGR with an impact on LU estimates of over 100,000 LU at the BGR level (Table 6.5):

Table 6.5: Review of habitats with high impact on grazing need estimates per BGR

BGR	Heath & scrub	Sclerophyllous scrub	Grasslands	Bogs, mires, fens
ALP	4060		6150, 6170, 6210, 6230, 6430	7140, 7230
ATL	4030			
BOR			6270	
CON	4010, 4030		6210, 6230, 6240, 6430	7230
MED	4030, 4090	5330	6220, 6310	

The following biogeographical regions have such a minor impact on overall EU estimates that no further work is deemed necessary with regard to stocking rate estimates in an EU-level perspective: Black Sea (BLS), Macaronesia (MAC), Pannonian (PAN), and Steppic (STE).

6.4 Further review of uncertainty factors influencing the overall grazing need estimates

6.4.1 Introduction

The results presented in Section 6.3 built on an analysis of the variation in grazing need estimates when the full range of suitable Halada stocking rates is applied. This section explores the outcome of such calculations when different approaches are used for selecting suitable Halada stocking rate estimates for deriving overall livestock grazing needs at EU-level. Just as section 6.3, this builds on the improvements in Halada stocking rate estimates achieved in the final expert review phase. This final interaction included bilateral exchanges but benefitted most from two rounds of web-based workshops with experts grouped by biogeographical regions.

The workshops did not always lead to a consensus between country experts on individual Halada rate stocking numbers. However, the interchange and chance to discuss the precise question (e.g. stress on grazing need in the context of the maintenance of favourable status rather than maintenance of agronomic potential) often led to a convergence on a range of values between countries. In many cases this was lower than had been generated in the previous round of predominantly individual, often email-based, contact. In general, there was a reduction in the number of high maximum values, but considerable relative variation remains, particularly (though not only) where the absolute values are small (for example, 0.2 is 100% greater than 0.1).

The final interactive rounds of exchange with experts were particularly useful for achieving higher confidence in the ‘representative’ values (based on an initial proposal by the study team). Representative values are the results of a study team assessment of which stocking rate estimate best represents the average grazing need (expressed as stocking rate per ha) of each Halada habitat per country or biogeographical region – see Annex 2 for a full documentation of these consolidated stocking rate estimates. When there were still some differences between country estimates located in the same BGR, the team chose a value informed not only by the per-country values but also by the relative area of the habitat in each country. However, the fact that the representative values at country level were obtained from the experts brings much better reliability to those estimates. Building on the consolidated expert feedback, the subsequent uncertainty assessment contains numbers calculated for the EU level and at individual country level, where the quality of both expert data and Article 17 reports allow (see section 6.2 above).

The review of the uncertainty range associated with using Halada stocking rate estimates proceeds in the following steps:

- Comparing total Halada grazing needs per Member State using representative Halada stocking rates per BGR and [best+min] and [best+max] area estimates (Figure 6.7);
- Comparison of the estimated total Halada grazing needs per Member State to the national population of bovines + sheep + goats (Figure 6.8); and,
- Comparing four estimates of total Halada grazing needs for a selection of Member States (Figure 6.9).

6.4.2 Estimating the relative size of Halada grazing needs at Member State level

Using the representative stocking rate estimates per BGR (see Annex 2), it is possible to multiply these with Article 17 data to estimate the total Halada livestock grazing needs for the whole EU and for individual Member States. Using these representative stocking rate values, the estimated total Halada livestock grazing need per Member State is as shown in **Figure 6.7.**

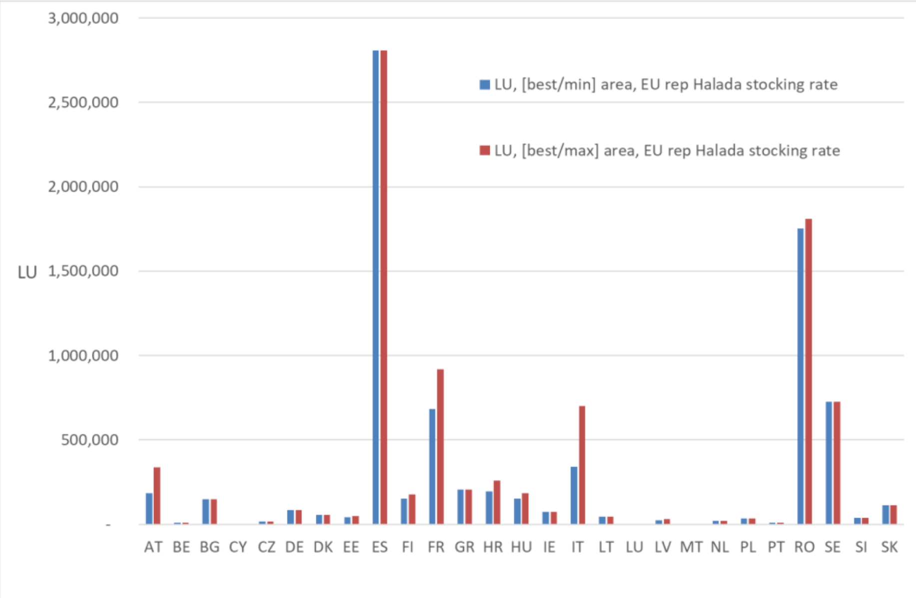

Figure 6.7: Halada livestock grazing needs per country for representative Halada stocking rates per BGR and [best+min] and [best+max] extent estimates.

While there are known issues (over- estimated habitat area in Romania; likely incomplete area estimates in Portugal; habitats maintained by grazing of Reindeer and deer in Sweden and Finland; etc.), a clear broad pattern emerges. Countries with a larger territory and/or a substantial area for grazing dependent Annex I habitats need a larger livestock population for maintaining Halada habitats. This total livestock grazing requirement does not vary much between the two habitat area estimates - apart from for a few already known countries.

An equally interesting but subtly different picture emerges when the totals generated are compared to the national livestock populations (Error! Reference source not found.). Croatia, R omania, Spain and Sweden have a Halada grazing need that lies between 40% and 70% of their national ruminant livestock population (if these estimates are correct). A further five countries have a Halada grazing need that is equivalent to about 20% of their national ruminant livestock population (Bulgaria, Estonia, Finland, Hungary and Slovakia), on the basis of the figures estimated in this study.

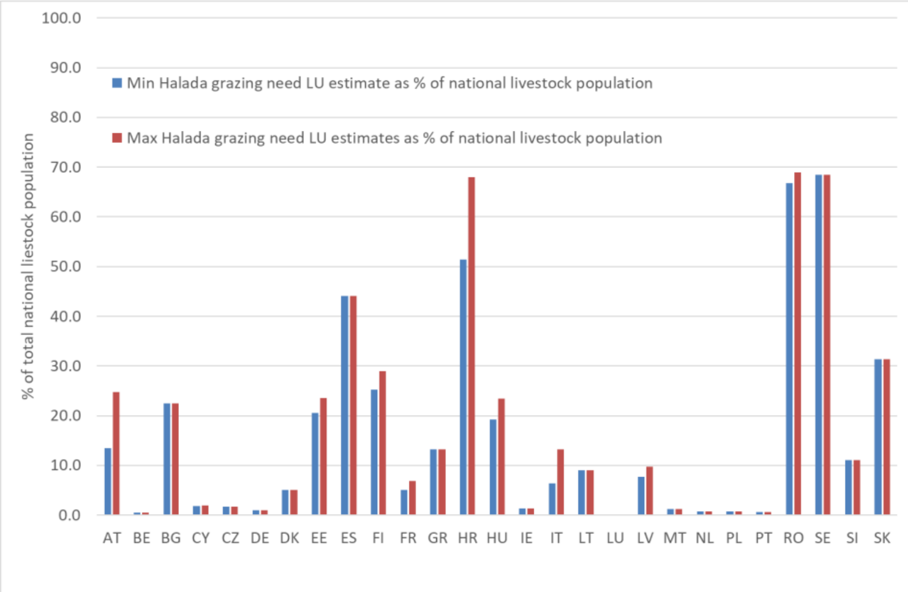

Figure 6.8: Comparison of estimated total Halada livestock grazing need per Member State to the national population of bovines + sheep + goats

Note: the figure is intended to give a scale to the grazing population needed to maintain the Halada habitats; it should not be taken to imply that an adequate number of livestock is grazing these habitats in reality.

Figure 6.9 presents a similar analysis for 13 selected countries to compare the outcome of estimating the relative share of Halada grazing requirements in total national ruminant livestock population when different input values are used. These countries were chosen as they represent a wide range of situation, and the analysis utilises country-specific values for the grazing needs estimates per BGR. To test the impact of variation in both input variables both high and low habitat area estimates as well as upper and lower estimates for country-specific Halada stocking rates were employed. Even for countries with substantial variation in input data estimates the outcome of the different data combinations as share of Halada grazing requirements in total national ruminant livestock population is roughly similar in most cases. The exceptions are the Czech Republic and Hungary where the Article 17 habitat area estimates vary substantially between minimum and maximum values.

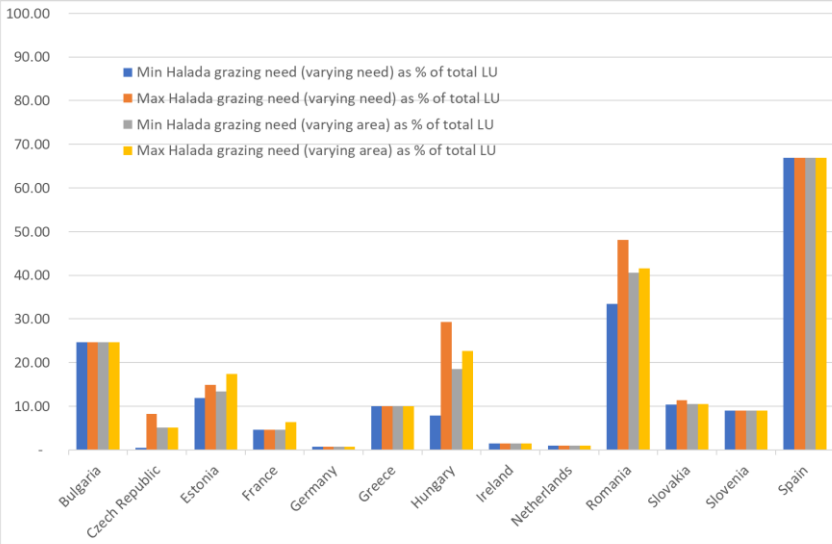

Figure 6.9: Four estimates of Halada total livestock requirement for a selection of Member States.

Note: *this analysis is based on country-specific values for the grazing needs estimates per BGR, shown relative to the current (2020 Eurostat data) total population of bovines, sheep and goats. Note that the graph is not an indication whether the appropriate number of livestock are in fact grazing these habitats.*

6.5 Summary of key outcomes of uncertainty assessment

6.5.1 Review of key factors influencing overall results

The uncertainty analysis presented in this section reviews three main factors influencing overall results:

1. Section 6.2: Which Halada habitat types have the biggest influence on total Halada habitat extent per country?
2. Section 6.3: How does the range in potential Halada stocking rates per habitat influence the calculation of total grazing needs?
3. Section 6.4: Is it possible to narrow down the likely uncertainty value associated with stocking rate estimates and what influences the estimates for share of total ruminant livestock per country that is needed for managing Halada habitats?

The analysis in section 6.2 showed that the uncertainty of total Halada habitat extent per country arises mainly from eight of these habitats and this uncertainty has a limited influence on the overall Halada livestock grazing need relative to national livestock populations.

Section 6.3 explored the effect of utilizing the full variation between lower and upper estimates for Halada stocking rate estimates in calculating total grazing needs. This results in an uncertainty range about 10 times larger than for habitat extent. However, it is again only eight habitat types that generate most of this uncertainty. And it should be noted that

Section 6.4 narrowed down this analysis by using representative Halada stocking rate estimates, which were derived by the study team in interaction with national experts. The use of 'representative' values strongly reduces the overall uncertainty in this analysis.

Analysis associated with figures 6.8 and 6.9 showed that estimates for Halada livestock grazing need as a share of total national ruminant livestock are affected by two independent variables: the relative size of Halada habitats area compared to the country's overall territory, and the size of the total livestock population.

For most countries, including most countries which have a large impact on the EU meat markets, the proportion of national ruminant livestock which would need to be targeted on Halada habitats, if these are to be managed appropriately, is relatively modest, with minimal impacts on the overall livestock market. However, Spain stands out – it has a very large area of the EU's semi-natural habitats, and of Halada habitats in particular.

6.5.2 Assessment of confidence in key data sources and expert estimates

This sub-section reviews the main uncertainties associated with the data sources or expert estimates utilized in this study. It complements the analysis presented in sub-section 6.5.1 which looked at key factors influencing study results. There are often no ground truth data and the data sets developed are not the outcome of a certain sampling design the uncertainty range of data used. The qualitative assessment of uncertainty range of data sets used / generated therefore presents an assessment by the study team itself of confidence in data used or generated.

There are several data sets generated for or during this study, nearly all of which rely on expert assessment. Substantial efforts were made to consult a wide range of experts with good geographic representation (see Annex 3 and Malek et al., 2024b) but expert-based assessments always remain qualitative to a certain degree. The study team suggests the following uncertainty ranking for the different data sets:

High confidence in:

- Assessment of which semi-natural CLC classes are grazed across Europe

Substantial confidence in but further expert review welcome:

- Share of grazing per semi-natural CLC class and environmental zone

- Estimate of current stocking rates for grazed share of semi-natural CLC classes across Europe

- Suitable stocking rates for maintaining grazing-dependent Annex I habitats

Substantial data uncertainty:

- Article 17 estimates for area of Annex I Halada habitats per country

The qualitative assessment of the different data sets above shows that the biggest uncertainty is associated with estimates for the area of Annex I habitats submitted under Article 17 of the Habitats Directive. In many ways this is not surprising as a precise estimate for the extent of these habitats would require the availability geo-spatial data from habitat mapping surveys which are not available in many countries. The expert estimates related to the occurrence of grazing on semi-natural vegetation and associated stocking rates as well as optimal stocking rates for maintaining grazing-dependent Halada habitats have their own limitations. For many of the experts consulted it was the first time that they reflected closely about the questions raised in the expert survey for this study. Several thought that further follow-up work at national level would be useful. Nevertheless, in most cases it is uncertainties in the area estimates per habitat that have the bigger impact. Differences in estimates of optimal stocking rates have a limited impact – 0.2 LU/ha is indeed twice as large as 0.1 LU/ha, but when multiplied by only a modest area of a habitat, both give rise to small number of livestock.

It should be noted that grazing by horses and other equines was not considered in this analysis, which creates one additional source of data uncertainty. However, official statistical data on equines are not available consistently across EU-27 Member States. Furthermore, the geographic distribution of hobby horses is skewed towards stables around urban centres and high attention is paid to the quality of fodder for most riding horses. This means that most horses in European Union countries are not available for, or exposed to, grazing on semi-natural vegetation. On the other hand, robust horse and pony breeds are used for conservation grazing in a significant number of protected areas and/or conservation projects in many European countries. The overall size of the equine herd that is contributing to the grazing of Halada habitats is difficult to estimate, however. For this reason, the potential benefit from the grazing of horses and ponies on for the management of Halada habitats was not further analysed in this study; neither was it included in the uncertainty analysis.

6.5.3 Potential future work for reducing uncertainty of results

This section lists some key aspects to tackle for reducing the uncertainty of results in the future. This is grouped in two main themes: a) a proposed priority ranking for Annex I habitat types in terms of developing better data on habitat extent or knowledge on the suitable stocking rates; and b) the question of the potential suitability of grazing on what are considered ‘meadow’ habitats.

1) Based on insights presented in previous sections, several priorities emerge for a potential engagement with country agencies and experts to better understand Halada habitat livestock grazing needs and available grazing capacity. This does not mean that other habitats would not also deserve further attention, even though their influence on overall total livestock grazing need is less significant. The following priority topics are proposed:

a) Improving area estimates for habitats in the following order of priority:

- 6210
- 1530, 4030, 6170, 6220, 6230
- 6150, 6310, 62A0
- With a particular focus on Croatia, France and Italy as per Table 6.2.

b) Reflecting on all of the values listed in Table 4.2 (and Annex 2), but giving priority to:

- Habitats listed in Table 6.4

- Values (shown in red type) which were extrapolated by the team without expert assistance
- Giving particular attention to certain habitats in specific biogeographical regions:

  Alpine (ALP): 4060, 6150, 6170, 6210, 6230, 6430, 7140, 7230;

  Atlantic (ATL): 4030;

  Boreal (BOR): 6270;

  Continental (CON): 4010, 4030, 6210, 6230, 6240, 6430, 7230;

  Mediterranean (MED): 4030, 4090, 5330, 6220, 6310.

2) The suitability of grazing as a management tool for maintaining ‘meadow’ habitats (in particular 6510 and 6520) was considered differently in different biogeographical regions. This means that the potential of ‘grazing only’ management would ideally need to be reviewed. Insofar as grazing management is appropriate, the large uncertainties in 6510 and 6520 area data will become significant and the prospects of refining the estimate would need to be discussed with experts from all countries concerned.

Among the various expert communities that are concerned with the preservation of species-rich grassland habitats there is a very diverse range of expert opinion on the ‘right’ way to manage Annex I habitat types 6510 and 6520. The views range from ‘they should not be grazed, only mown’ through to ‘they should actually only be mown where necessary, otherwise grazing is preferable’. It is perhaps notable that the experts consulted in this study (who needed to understand livestock grazing practices in relation to habitat productivity and dependence on grazing) generally expressed grazing-tolerant or pro-grazing views. Other expert communities (such as botanists) or staff in conservation agencies who need to observe administrative decisions and standards (even if adopted as a measure of precaution) are reported to hold views that are less favourable, or even opposed, to grazing on these two habitat types.

As reported in section 6.2.3, the study team therefore tested what number of livestock could be associated with the use of hay from Annex I meadow habitats for feeding livestock over winter. Applying a 50% use estimate for the hay harvested from the area recommended to be mown for six Annex I meadow habitats gave a potential extra 900,000 LU that could be using these habitat types. This is about 11% of the calculated EU-27 grazing needs estimate of almost 8 million ruminant livestock units.

6.6 Summary of uncertainty analysis

The analysis in section 6.2 showed that the uncertainty of total Halada habitat extent per country arises mainly from eight of these habitats and this uncertainty has a limited influence on the overall Halada livestock grazing need relative to national livestock populations.

Section 6.3 explored the effect of utilizing the full variation between lower and upper estimates for Halada stocking rate estimates in calculating total grazing needs. This results in an uncertainty range about 10 times larger than for habitat extent. However, it is again only eight habitat types that generate most of this uncertainty.

Section 6.4 narrowed down this analysis by using EU wide estimates for optimal Halada stocking rate; initially employing upper and lower stocking rate estimates and then using ‘representative’ values which reflect median habitat productivity and were derived by the study team in interaction with national experts. The use of ‘representative’ values strongly reduces the overall uncertainty in this analysis.

Further analysis shows that estimates for Halada livestock grazing need as a share of total national ruminant livestock are affected by two independent variables: the significance of semi-natural Halada habitats in the country’s area, and the size of the total livestock population. Each country has a different combination.

Section 6.5 discussed priorities for refining certain aspects of this analysis by focusing on the eight habitat types and biogeographical regions that generate most uncertainty. The expert estimates for optimal Halada stocking rates are worth re-visiting but are likely not the factor that is most difficult to improve in the analysis presented. However, the suitability of grazing as a management tool for maintaining ‘meadow’ habitats (in particular 6510 and 6520) is an aspect to be further explored by biogeographical region and could impact overall grazing needs in some countries significantly.

7 Review of key results and potential next steps

7.1 Introduction

This chapter reviews the key findings summarised in this report, which are the result of work carried out between 2020 and 2023. The prime focus of the study was to shed light on the conservation grazing needs of the terrestrial Annex I habitats of the EU Habitats Directive that depend on, or benefit from, grazing. This report reviewed the following questions in previous chapters:

Chapter 2: What is the link between (historic) extensive grazing systems and Europe's biodiversity, in particular for habitats on Annex I of the EU Habitats Directive?

Chapter 3: How much of the remaining semi-natural vegetation is currently being grazed?

Chapter 4: What is the best range of stocking density for maintaining semi-natural habitats in Annex I of the Habitats Directive (the 'Halada habitats') by grazing?

Chapter 5 (and Annex 4): How does the current estimated grazing capacity per country compare to the grazing needs for maintaining Halada Annex I habitats?

Chapter 6: What are the current uncertainties related to input data and options for improving the accuracy of this analysis in the future?

This chapter is structured as follows: Section 7.2 summarises key EU-level findings whereas section 7.3 reviews additional factors that need to be considered in optimising the use of grazing for nature conservation purposes. Section 7.4 proposes several next steps that could be taken to consolidate the analytical conclusions in this study or to explore additional aspects to take this work further in a habitat management or nature restoration perspective.

7.2 Key findings per analytical step

Chapter 2 documents that extensive grazing practices have created many different semi-natural vegetation types across Europe over thousands of years and confirms the importance of these habitats for European Union conservation targets by introducing the so-called 'Halada habitats' (Halada et al., 2011). It also discusses the interaction between different extensive farming systems and semi-natural habitats across Europe. Factors influencing the suitability of different livestock types and stocking densities for maintaining semi-natural habitats are reviewed.

Chapter 3 briefly summarises already published work for estimating the likely grazing share per semi-natural Corine Land Cover (CLC) class. This work yielded a database with the first complete results for estimated grazing share and stocking density per semi-natural CLC class in the different environmental zones of each country. Detailed information is available in Malek et al., 2024, with a summary of the main results presented in Annex 3 of this report.

Chapter 4 summarises key results of this study obtained via a consultation of botanical specialists or grazing ecologists across Europe to produce an estimate of the grazing needs of the Halada habitats. Table 4.2 presents the estimated suitable stocking rates for each of these habitats as averages over the grazing season (called 'Halada stocking rates'). This is the first time such estimates have been compiled to help in considering the national livestock herd that is needed for maintaining these habitats successfully. Section 4.3 presents a crosswalk of the Halada habitat types into related CLC semi-natural land cover classes. This was developed for this study and was employed where area estimates for these CLC classes were required for gap-filling in some countries where reporting under Article 17 of the Habitats Directive did not seem suitable for the analysis presented here.

Chapter 5 combines analytical results presented and/or developed in previous chapters for reviewing the grazing management needs for maintaining and/or restoring semi-natural habitats related to extensive grazing systems. This allowed a comparison between the estimated grazing needs of Halada semi-natural habitats and current ruminant livestock populations for the EU-27, its Member States and the UK (see Table 5.1). This analysis suggests that the total grazing livestock needed for maintaining Halada habitats is significant in absolute numbers (ca 8 million livestock units for the EU-27). This represents about a 12.6% share of total EU-27 ruminant livestock (~8 million livestock units (LU) compared to a ~63 million LU in total).

There is a group of eight countries with large areas of semi-natural vegetation where a large share of total ruminant livestock (20 – 40% or even >40%) would be required to manage the estimated Halada habitat area in the country. This group includes mainly Mediterranean countries and countries with a large share of mountainous and remote areas. At the other end sits a group of ten EU-27 countries where grazing needs are at or below 5% of total ruminant livestock. This group comprises Malta and Cyprus and countries in central and northwestern Europe. A further nine countries sit in two groups that require 5 – 10 % or 10 – 20 % of available livestock for the management of Annex I Halada habitats. These have mixed characteristics, but all contain substantial areas of semi-natural habitats to manage.

Chapter 6 summarises the outcome of a review of the data sets used and how their uncertainty range could influence overall results. This builds on data analysis by the study team itself and a series of final webinars with the experts consulted (arranged by groups of biogeographical regions) for a discussion of the estimates of stocking density for optimal grazing of the Halada habitats.

7.3 Review of additional factors that influence the success of grazing by livestock for maintaining semi-natural habitats and associated species richness

This study addresses very relevant first order questions that need to be understood if one wants to use grazing by livestock for maintaining or improving the conservation status of Annex I habitats that depend on, or benefit from, grazing. However, as already discussed in chapter 2, there are various additional factors that influence the potential success of livestock grazing on semi-natural habitats and their associated species richness.

It needs to be recognised therefore, that overall livestock grazing capacity is only one factor in determining the success of grazing as a tool for nature management. The following four components of grazing management are also important to consider:

- type of livestock used (e.g. cattle, sheep, goats or horses, wild herbivores, alone or in combination),
- grazing period (spring, summer, autumn, winter),
- grazing regime applied (e.g. permanent or rotational grazing), and
- stocking density in relation to habitat productivity and weather conditions.

Grazing by domestic livestock can be an important nature conservation tool. However, different habitat types react differently to the same grazing practices, and finding the optimal grazing regime for each habitat type requires careful consideration, in dialogue between grazing experts, farmers and ecologists. The literature review in chapter 2 reviews relevant insights from the academic literature and national experience. Overall, careful planning and an appropriate knowledge and capacity to manage livestock is needed to ensure livestock grazing effectively supports nature conservation targets, within and outside of Natura 2000 areas. A recent study by Butterfly Conservation International provides a useful overview of how grazing (and other management techniques) can be applied to favour grassland butterfly species in Europe by 'Bending the curve' : https://bc-europe.eu/documents/69a964b3a2f6d.pdf

7.4 Potential next steps to improve the knowledge base

The work presented in this report has provided useful insights into the links between European biodiversity and extensive livestock systems and developed concrete evidence for maintaining or restoring semi-natural EU priority habitats (such as suitable stocking rates for grazing Annex I Halada habitats). However, as discussed, several uncertainties remain and various aspects related to the link between extensive grazing systems and biodiversity protection could be further explored. The paragraphs below provide several suggestions for potential improvement in monitoring or further research in this regard, without aiming to be comprehensive. These are complemented by more detailed additional reflections in Annex 5 (which also reviews related non-published work).

The first area for potential follow-up work would be to develop more informed analysis about likely grazing rates of semi-natural vegetation and optimal stocking rates in a conservation perspective. An important step in doing so would be to combine the current expert-based estimates of grazing rates on semi-natural vegetation with actual field surveys or other suitable monitoring methods. Only by developing ground-truth data, e.g. on actual stocking rates on Halada habitats in good conservation status, can the current expert estimates be improved. The study teams considers that the following variables should be the priority for further research, monitoring and/or expert review:

- Estimates of suitable stocking rates for maintaining grazing-dependent habitats
- Share of grazing per semi-natural CLC class and environmental zone
- Estimate of current stocking rates per grazed semi-natural vegetation across Europe

A second area of further work could be a future update of the current quantitative analysis of overall livestock grazing needs for maintaining Halada habitats when underpinning data sets are refreshed. This includes CLC land cover data and the Article 17 estimates of area of Annex I habitat types, in particular. Future work on the quantitative analysis could also include a review of other land cover or statistical data sources that could improve on the area estimates for semi-natural vegetation, currently derived from CLC land cover. The EU Copernicus program for satellite-based monitoring or administrative data sets for implementation of the EU Common Agricultural Policy in EU Member States seem particularly important in this regard.

From this initial analysis, it appears important to secure substantial further investment in data on the distribution of habitats and the monitoring of grazing and grassland area. Combined with an analysis of the grazing practices of different farm types this is required to develop a solid data foundation for properly understanding current extensive grazing systems and their role in achieving EU nature conservation and restoration goals. A combination of such spatial data sets is required to be able to direct effort for Natura 2000 site management and targeted nature restoration planning. Together such data and knowledge can help maintain or restore grazing where it delivers the greatest environmental benefits.

There are further links between extensive livestock systems, the grazing of semi-natural grasslands and other ecosystem types and the provision of ecosystem services that have not been discussed here. Such links include carbon storage and sequestration, adaptation to climate change, recreation, fire risk management or water flow regulation, to name but a few.

It is hoped that the data foundation established via this study can support further work to explore such connections.

Finally, it needs to be underlined that the work of shepherds and livestock farmers is critical in maintaining grazing and managing livestock for conserving threatened European habitats. This deserves full recognition by society as well as market and policy support for improving the economic viability of extensive livestock systems. Further research on the socio-economic viability of different extensive farming systems is therefore important. This would ideally focus on different habitat types and compare the efficiency of different types of policy support (both income and more targeted agri-environmental support) in compliance with the density required. Box 7.1 provides some reflections in that regard.

Box 7.1 Reflections on the economic future of extensive livestock systems

The socio-economic prospects for extensive livestock systems are very challenging (EC, 2026a). The trend to larger and more specialised livestock farms and more intensive livestock systems is driven by several structural factors These include economic pressure to increase productivity, labour constraints in extensive systems, changing market structures, lack of profitability and the abandonment of farming in marginal areas. Nori & Farinella (2020) provide a detailed analysis of such trends in the Mediterranean region, which is a very illustrative example.

The economic pressures on low intensity production systems have contributed to the decline of traditional grazing systems across many regions of Europe. Analysis by DG Agriculture shows that between 2005 and 2020 the number of EU farms fell by 37% (from 14.4 to 9.1 million across the EU-27), with livestock specialists and mixed farms most affected (Eurostat, 2025). If one looks at extensive and mixed livestock farms only this decline is even sharper – their number fell by over 70% between 2010 and 2020 (EC, 2026).

The decline in low-intensity livestock systems has not only socio-economic consequences in rural areas, but also strongly affects the rural environment, in terms of habitat management, cultural heritage and wildfire risk mitigation. Their viability can be improved if public policies adequately reward their contribution to such public goods. The potential synergies between the re-introduction of grazing for conservation reasons and managing wild-fire risk is worthy of further practice-oriented research. Grazing as a tool for reducing wild fire risk is listed as a strategic component and as one land management practice promoted in the recent EC Communication on integrated wildfire risk management (EC, 2026b).

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Annex 1 Updated Halada et al. (2011) habitats totally or partially dependent on farming activities.

Table A1. 1: Halada et al. (2011) 63 semi-natural habitats which are totally or partially dependent on farming activities (mostly grazing). Besides including habitats listed in (Halada et al., 2011), habitats fully dependent (D), partially dependent (P) or those for which the relationship is not clear, only true for some sub-types or for part of their distribution (M), are highlighted. Crosswalks between Annex I Habitats, EUNIS Code and Name, CLC (Corine Land Cover) code and name are also presented.

Code	Habitats name	D	P	M	EUNIS code	EUNIS name	CLC code	CLC name
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)		1	1	A2.5	Coastal saltmarshes and saline reedbeds	4.2.1	Salt marshes
1340	Inland salt meadows		1		D6	Inland saline and brackish marshes and reedbeds	4.1.1	Inland marshes
1530	Pannonic salt steppes and salt marshes		1	1	E6.2	Continental inland salt steppes	3.2.1	Natural grassland
1630	Boreal Baltic coastal meadows		1		A2.5	Coastal saltmarshes and saline reedbeds	4.2.1	Salt marshes
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)		1	1	B1.4	Coastal stable dune grassland (grey dunes)	3.3.1	Beaches, dunes, and sand plain
2140	Decalcified fixed dunes with Empetrum nigrum		1	1	B1.5	Coastal dune heaths	3.2.2	Moors and heathland
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)		1	1	B1.5	Coastal dune heaths	3.2.2	Moors and heathland
2160	Dunes with Hippophae rhamnoides		1	1	B1.6	Coastal dune scrub	3.2.2	Moors and heathland
2170	Dunes with Salix repens ssp. argentea (Salicion arenariae)		1	1	B1.6	Coastal dune scrub	3.2.2	Moors and heathland
2190	Humid dune slacks		1		B1.8	Moist and wet dune slacks	3.3.1	Beaches, dunes, and sand plain
21A0	Machairs	1			B1.9	Machair	3.2.1	Pasture
2250	Coastal dunes with Juniperus spp.		1		B1.6	Coastal dune scrub	3.2.2	Moors and heathland
2310	Dry sandy heaths with Calluna and Genista		1	1	F4.2	Dry heaths	3.2.2	Moors and heathland
2320	Dry sandy heaths with Calluna and Empetrum nigrum		1	1	F4.2	Dry heaths	3.2.2	Moors and heathland
2330	Inland dunes with open Corynephorus and Agrostis grasslands		1	1	E1.9	Non-Mediterranean dry acid and neutral open grassland, including inland dune grassland	3.3.1	Beaches, dunes, and sand plain

Code	Habitats name	D	P	M	EUNIS code	EUNIS name	CLC code	CLC name
2340	Pannonic inland dunes	1			E1.9	Non-Mediterranean dry acid and neutral open grassland, including inland dune grassland	3.3.1	Beaches, dunes, and sand plain
4010	Northern Atlantic wet heaths with Erica tetralix	1			F4.1	Wet heaths	3.3.3	Sparsely vegetated areas
4020	Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix	1			F4.1	Wet heaths	3.3.3	Sparsely vegetated areas
4030	European dry heaths	1			F4.2	Dry heaths	3.2.2	Moors and heathland
4040	Dry Atlantic coastal heaths with Erica vagans	1			F4.2	Dry heaths	3.2.2	Moors and heathland
4060	Alpine and Boreal heaths		1	1	F2.2	Evergreen alpine and subalpine heath and scrub	3.2.2	Moors and heathland
4090	Endemic oro-Mediterranean heaths with gorse		1		F7.4	Hedgehog-heaths	3.2.3	Sclerophyllous vegetation
5120	Mountain Cytisus purgans formations		1	1	F3.2	Submediterranean deciduous thickets and brushes	3.2.2	Moors and heathland
5130	Juniperus communis formations on heaths or calcareous grasslands		1		F3.1	Temperate thickets and scrub	3.2.2	Moors and heathland
5210	Arborescent matorral with Juniperus spp.		1	1	F5.1	Arborescent matorral	3.2.3	Sclerophyllous vegetation
5330	Thermo-Mediterranean and pre-desert scrub		1	1	F5.5	Thermo-Mediterranean scrub	3.2.3	Sclerophyllous vegetation
5420	Sarcopoterium spinosum phryganas		1		F7.3	East Mediterranean phrygana	3.2.3	Sclerophyllous vegetation
5430	Endemic phryganas of the Euphorbio-Verbascion		1		F7.1	West Mediterranean spiny heaths	3.2.3	Sclerophyllous vegetation
6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi		1	1	E1.1	Inland sand and rock with open vegetation	3.2.1	Natural grassland
6120	Xeric sand calcareous grasslands		1		E1.1	Inland sand and rock with open vegetation	3.2.1	Natural grassland
6140	Siliceous Pyrenean Festuca eskia grasslands		1		E4.3	Acid alpine and subalpine grassland	3.2.1	Natural grassland
6150	Siliceous alpine and boreal grasslands		1		E4.3	Acid alpine and subalpine grassland	3.2.1	Natural grassland
6160	Oro-Iberian Festuca indigesta grasslands		1		E4.3	Acid alpine and subalpine grassland	3.2.1	Natural grassland

Code	Habitats name	D	P	M	EUNIS code	EUNIS name	CLC code	CLC name
6170	Alpine and subalpine calcareous grasslands		1		E4.3	Acid alpine and subalpine grassland	3.2.1	Natural grassland
6180	Macaronesian mesophile grasslands		1		E2.1	Permanent mesotrophic pastures and aftermath-grazed meadows	3.2.1	Pasture
6190	Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis)	1			E1.29	Pale fescue grassland	3.2.1	Natural grassland
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)	1			E1.2	Perennial calcareous grassland and basic steppes	3.2.1	Natural grassland
6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	1			E1.3	Mediterranean xeric grassland	3.2.1	Natural grassland
6230	Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in continental Europe)	1			E1.7	Non-Mediterranean dry acid and neutral closed grassland	3.2.1	Natural grassland
6240	Sub-pannonic steppic grassland		1		E1.2	Perennial calcareous grassland and basic steppes	3.2.1	Natural grassland
6250	Pannonic loess steppic grasslands	1			E1.2	Perennial calcareous grassland and basic steppes	3.2.1	Natural grassland
6260	Pannonic sand steppes	1			E1.2	Perennial calcareous grassland and basic steppes	3.2.1	Natural grassland
6270	Fennoscandian lowland species-rich dry to mesic grasslands	1			E1.7	Non-Mediterranean dry acid and neutral closed grassland	3.2.1	Natural grassland
6280	Nordic alvar and precambrian calcareous flatrocks	1			E1.2	Perennial calcareous grassland and basic steppes	3.2.1	Natural grassland
62A0	Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae)	1			E1.55	Eastern sub-Mediterranean dry grassland	3.2.1	Natural grassland
62C0	Ponto-Sarmatic steppes		1	1	E1.2D	Ponto-Sarmatic steppes	3.2.1	Natural grassland
62D0	Oro-Moesian acidophilous grasslands		1	1	E4.39	Oro-Moesian acidophilous grassland	3.2.1	Natural grassland
6310	Dehesas with evergreen Quercus spp.	1			E7.3	Dehesa	2.4.4	Agro-forestry area
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	1			E3.5	Moist or wet oligotrophic grassland	3.2.1	Natural grassland

Code	Habitats name	D	P	M	EUNIS code	EUNIS name	CLC code	CLC name
6420	Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion		1		E3.1	Mediterranean tall humid grassland	3.2.1	Natural grassland
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels		1	1	E5.4	Moist or wet tall-herb and fern fringes and meadows	3.2.1	Natural grassland
6440	Alluvial meadows of river valleys of the Cnidion dubii	1			E3.4	Moist or wet eutrophic and mesotrophic grassland	3.2.1	Natural grassland
6450	Northern boreal alluvial meadows	1			E3.4	Moist or wet eutrophic and mesotrophic grassland	3.2.1	Natural grassland
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	1			E2.2	Low and medium altitude hay meadows	3.2.1	Natural grassland
6520	Mountain hay meadows	1			E2.3	Mountain hay meadows	3.2.1	Natural grassland
6530	Fennoscandian wooded meadows	1			X09	Pasture woods (with a tree layer overlying pasture)	2.3.1	Pasture
6540	Sub-Mediterranean grasslands of the Molinio-Hordeion secalini		1					
7140	Transition mires and quaking bogs		1	1	D2.3	Transition mires and quaking bogs	4.1.1	Inland marshes
7150	Depressions on peat substrates of the Rhynchosporion		1	1	D2.3	Transition mires and quaking bogs	4.1.1	Inland marshes
7210	Calcareous fens with Cladium mariscus and species of the Caricion davallianae		1	1	D5.2	Beds of large sedges normally without free-standing water	4.1.1	Inland marshes
7230	Alkaline fens		1		D4.1	Rich fens, including eutrophic tall-herb fens and calcareous flushes and soaks	4.1.1	Inland marshes
8230	Siliceous rock with pioneer vegetation of the Sedo-Scleranthion or of the Sedo albi-Veronicion dillenii		1	1	H3.6	Weathered rock and outcrop habitats	3.3.3	Sparsely vegetated areas
8240	Limestone pavements		1		H3.511	Limestone pavements	3.3.2	Bare rock
9070	Fennoscandian wooded pastures	1			X09	Pasture woods (with a tree layer overlying pasture)	2.3.1	Pasture

Annex 2 Summary table of 'representative' stocking rates for Halada habitats expressed as averages over the grazing season

Table A2. 1: Summary table of 'representative' stocking rates for Halada habitats expressed as averages over the grazing season

Notes: A) These values where developed by the study and mostly represent the median value between low and high values of suitable Halada stocking rates per habitat type. B) A grey cell indicates that the habitat was not declared in that biogeographical region (BGR) in the Article 17 report from any EU Member State; a dark orange cell indicates that the habitat's maintenance is considered to be best achieved via mowing in the given BGR; a light orange cell indicates that the respective habitat only benefits from grazing in part of its range in that BGR.

Code	Habitat name	Atl	Cont	Bor	Pan	Alp	Black S	Step	Mac	Med
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	0.60	0.60	1.00						0.80
1340	Inland salt meadows	0.30	0.30		0.40	0.60	0.30			
1530	Pannonic salt steppes and salt marshes		0.10		0.40		0.30	0.30		
1630	Boreal Baltic coastal meadows		0.80	0.85						
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)	0.10	0.10	0.10			0.05		0.05	0.05
2140	Decalcified fixed dunes with Empetrum nigrum	0.15	0.15	0.10						
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	0.15	0.15							0.15
2160	Dunes with Hippophae rhamnoides	0.10	0.10				0.00			
2170	Dunes with Salix repens ssp. argentea (Salicion arenariae)	0.10	0.10	0.10			0.00			
2190	Humid dune slacks	0.20	0.15	0.30			0.15			0.10
2250	Coastal dunes with Juniperus spp.	0.10	0.10							0.10
2310	Dry sandy heaths with Calluna and Genista	0.10	0.10							
2320	Dry sandy heaths with Calluna and Empetrum nigrum	0.10	0.60	0.20						
2330	Inland dunes with open Corynephorus and Agrostis grasslands	0.10	0.15	0.30	0.15	0.15				0.15
2340	Pannonic inland dunes		0.20		0.20					
4010	Northern Atlantic wet heaths with Erica tetralix	0.10	0.15	0.15						0.15
4020	Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix	0.80	0.8			0.60				0.40
4030	European dry heaths	0.35	0.40	0.30	0.20	0.20	0.20			0.40
4040	Dry Atlantic coastal heaths with Erica vagans	0.70								
4060	Alpine and Boreal heaths	0.05	0.30	0.30		0.10	0.30		0.30	0.40
4090	Endemic oro-Mediterranean heaths with gorse	0.50	0.30			0.30	0.30		0.40	0.30

Code	Habitat name	Atl	Cont	Bor	Pan	Alp	Black S	Step	Mac	Med
5120	Mountain Cytisus purgans formations	0.70	0.70			0.70				0.50
5130	Juniperus communis formations on heaths or calcareous grasslands	0.15	0.15	0.30	0.40	0.40				0.30
5210	Arborescent matorral with Juniperus spp.	0.50	0.30			0.30	0.30			0.20
5330	Thermo-Mediterranean and pre-desert scrub		0.15						0.10	0.10
5420	Sarcopoterium spinosum phryganas									0.10
5430	Endemic phryganas of the Euphorbio-Verbascion									0.10
6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi	0.01	0.10	0.10	0.10	0.10	0.10			0.10
6120	Xeric sand calcareous grasslands	0.10	0.10	0.10	0.10		0.10	0.10		0.10
6140	Siliceous Pyrenean Festuca eskia grasslands					0.40				
6150	Siliceous alpine and boreal grasslands		0.40	0.40	0.40	0.30				0.15
6160	Oro-Iberian Festuca indigesta grasslands	0.50								0.30
6170	Alpine and subalpine calcareous grasslands	0.40	0.30			0.30				0.20
6180	Macaronesian mesophile grasslands								0.20	
6190	Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis)		0.15		0.15	0.15				
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)	0.45	0.60	0.30	0.50	0.40	0.40	0.40		0.30
6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	0.30	0.30			0.30	0.40	0.30		0.10
6230	Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in continental Europe)	0.30	0.60	0.20	0.30	0.50				0.40
6240	Sub-pannonic steppic grassland	0.60	0.30		0.30	0.40	0.30			
6250	Pannonic loess steppic grasslands		0.20		0.40	0.30				
6260	Pannonic sand steppes		0.20		0.20					0.05
6270	Fennoscandian lowland species-rich dry to mesic grasslands		2.00	0.50		1.00				
6280	Nordic alvar and Precambrian calcareous flatrocks		0.10	0.20						
6310	Dehesas with evergreen Quercus spp.									0.40
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	0.20		0.50	0.20	0.10				0.20
6420	Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion	0.40	0.30			0.40	0.10		0.15	0.40

Code	Habitat name	Atl	Cont	Bor	Pan	Alp	Black S	Step	Mac	Med
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	0.20	0.15	0.30	0.10	0.20	0.01	0.01		0.50
6440	Alluvial meadows of river valleys of the Cnidion dubii				0.50					
6450	Northern boreal alluvial meadows			0.50						
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	0.75		0.75	0.80	0.50				0.30
6520	Mountain hay meadows				0.20					
6530	Fennoscandian wooded meadows			0.5						
6540	Sub-Mediterranean grasslands of the Molinio-Hordeion secalini									0.60
7140	Transition mires and quaking bogs	0.05	0.05	0.05	0.00	0.05		0.05	0.05	0.05
7150	Depressions on peat substrates of the Rhynchosporion	0.05	0.05	0.05		0.05				0.05
7210	Calcareous fens with Cladium mariscus and species of the Caricion davallianae	0.10	0.10	0.10	0.10	0.10				0.10
7230	Alkaline fens	0.10	0.20	0.30	0.10	0.10				0.10
8230	Siliceous rock with pioneer vegetation of the Sedo-Scleranthion or of the Sedo albi-Veronicion dillenii	0.05	0.05	0.05	0.01	0.05	0.01	0.01	0.01	0.01
8240	Limestone pavements	0.20	0.05	0.05		0.01				0.01
9070	Fennoscandian wooded pastures		1.20	0.50		1.00				
21A0	Machairs	0.50								
62A0	Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae)		0.40			0.40	0.40			0.30
62C0	Ponto-Sarmatic steppes		0.20				0.10	0.10		
62D0	Oro-Moesian acidophilous grasslands		0.70			0.70				0.70

Annex 3 Results for estimates of grazing share and grazing density of semi-natural Corine Land Cover (CLC) classes

Grazing share and grazing density per semi-natural CLC class were explored using an expert survey. The design and implementation of the expert survey involved the following steps (for more detailed documentation please consult Malek et al., 2024):

The semi-quantitative survey involved ca. 70 grazing experts, including ecologists, agricultural experts and agricultural officials and was conducted between January and December 2020. Each of the grazing experts filled in the survey, where they defined which agricultural and semi-natural land cover classes (using the CLC classification, explained below) are grazed. Then, we asked them to provide estimated shares of grazing per class for those classes that are being grazed, differentiating between environmental zones within Member States. All experts provided input for different environmental zones in their respective countries and could provide suggestions on different levels. For example, in some countries specific regions had considerably different grazing shares.

This was followed by interviews with all experts to clarify and estimate uncertainties in the actual land use of CLC classes. These bilateral exchanges were done with the help of on-screen shared land cover maps and street view photographs of areas covered with particular land cover types to confirm or modify their first grazing estimates. After the interviews, we prepared a summary and shared it with the expert for further feedback and potential adjustment of their estimates. We prepared tables with the calculated potential grazing areas using the land cover classes they identified as being grazed.

Based on experts' responses and collected statistical information, estimations on the grazed share and the livestock densities for the considered semi-natural (and agricultural) CLC classes in the respective environmental zones for the EU27+ were compiled. The estimations were also matched across environmental zones and national livestock husbandry practices were taken into account, by discussing with the surveyed experts on the shares of livestock kept indoors (e.g. most of goats in the Netherlands are kept inside), transhumance systems (such as in the Alps and in the Mediterranean), and potential grazing livestock we did not consider (such as pigs grazing in the Dehesa/Montado landscapes of Spain and Portugal). While the experts provided some estimations on trends of grazing, these were mostly qualitative (e.g. grazing has decreased considerably in the past decades), or related to the fact, that the extent of open semi-natural land cover types has decreased, meaning we could not use them to prepare a time series of estimates. Our estimates therefore present the current distribution of extensive livestock grazing on semi-natural land cover.

Final verification of the estimates for grazing per CLC class, grazing shares and livestock densities was done during four webinars with experts grouped by environmental zones. All experts who provided information at one point during the process were invited to join. With the exceptions of Luxembourg and Malta, at least one expert provided feedback for each country. This iterative approach was finished in December 2020, resulting in data on semi-natural land cover classes that are grazed and the share of grazing per CLC class.

Results for estimates of grazing share and grazing density of semi-natural CLC classes per country

AUSTRIA				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Alpine				
321	Natural grassland	**65%**	0.80	0.04
322	Moors and heathlands	**10%**	0.10	0.02
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**10%**	0.10	0.02
333	Sparsely vegetated areas	**15%**	0.10	0.02
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-
Mediterranean Mountains				
321	Natural grassland	**65%**	0.80	0.04
322	Moors and heathlands	**10%**	0.10	0.02
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**10%**	0.10	0.02
333	Sparsely vegetated areas	**15%**	0.10	0.02
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-
Continental				
321	Natural grassland	**65%**	0.80	0.04
322	Moors and heathlands	**0%**	0.10	0.02
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**0%**	0.10	0.02
333	Sparsely vegetated areas	**0%**	0.10	0.02
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-
Pannonian				
321	Natural grassland	**65%**	0.80	0.04
322	Moors and heathlands	**0%**	0.10	0.02
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**0%**	0.10	0.02
333	Sparsely vegetated areas	**0%**	0.10	0.02
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-

BELGIUM				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Continental				
321	Natural grassland	**80%**	0.60	0.20
322	Moors and heathlands	**25%**	0.00	0.30
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**5%**	0.50	0.00
333	Sparsely vegetated areas	**-**	-	-
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	**0%**	0.00	0.00
421	Salt marshes	**0%**	0.00	1.00
Atlantic				
321	Natural grassland	**80%**	0.60	0.20
322	Moors and heathlands	**25%**	0.00	0.30
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**5%**	0.50	0.00
333	Sparsely vegetated areas	**-**	-	-
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	**0%**	0.00	0.00
421	Salt marshes	**20%**	0.00	1.00

BULGARIA				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Alpine				
321	Natural grassland	**80%**	0.25	0.25
322	Moors and heathlands	**30%**	0.10	0.20
323	Sclerophyllous vegetation	**10%**	-	0.00
324	Transitional woodland-shrub	**5%**	-	0.20
333	Sparsely vegetated areas	**30%**	-	0.10
411	Inland marshes	**-**	-	0.00
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	-	-
Continental				
321	Natural grassland	**70%**	0.25	0.25
322	Moors and heathlands	**30%**	0.10	0.20
323	Sclerophyllous vegetation	**-**	-	0.00
324	Transitional woodland-shrub	**5%**	-	0.20
333	Sparsely vegetated areas	**10%**	-	0.10
411	Inland marshes	**10%**	-	0.00
412	Peat bogs	**5%**	-	-
421	Salt marshes	**0%**	-	-
Pannonian				
321	Natural grassland	**50%**	0.25	0.25
322	Moors and heathlands	**-**	0.10	0.20
323	Sclerophyllous vegetation	**-**	-	0.00
324	Transitional woodland-shrub	**5%**	-	0.20
333	Sparsely vegetated areas	**5%**	-	0.10
411	Inland marshes	**10%**	-	0.00
412	Peat bogs	**0%**	-	-
421	Salt marshes	**0%**	-	-
Mediterranean Mountains				
321	Natural grassland	**70%**	0.25	0.25
322	Moors and heathlands	**-**	0.10	0.20
323	Sclerophyllous vegetation	**-**	-	0.00
324	Transitional woodland-shrub	**5%**	-	0.20
333	Sparsely vegetated areas	**20%**	-	0.10
411	Inland marshes	**10%**	-	0.00
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	-	-

CYPRUS				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Mediterranean				
321	Natural grassland	**80%**	-	0.40
322	Moors and heathlands	**80%**	-	0.20
323	Sclerophyllous vegetation	**65%**	-	0.10
324	Transitional woodland-shrub	**65%**	-	0.10
333	Sparsely vegetated areas	**65%**	-	0.10
411	Inland marshes	**75%**	-	0.00
412	Peat bogs	**-**	-	-
421	Salt marshes	**0%**	-	0.00
Mediterranean Mountains				
321	Natural grassland	**80%**	-	0.40
322	Moors and heathlands	**80%**	-	0.20
323	Sclerophyllous vegetation	**65%**	-	0.10
324	Transitional woodland-shrub	**65%**	-	0.10
333	Sparsely vegetated areas	**65%**	-	0.10
411	Inland marshes	**-**	-	0.00
412	Peat bogs	-	-	-
421	Salt marshes	-	-	0.00

CZECHIA				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Alpine				
321	Natural grassland	**25%**	0.60	0.20
322	Moors and heathlands	**0%**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**0%**	-	-
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-
Continental				
321	Natural grassland	**25%**	0.60	0.20
322	Moors and heathlands	**0%**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**0%**	-	-
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-

DENMARK				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Atlantic				
321	Natural grassland	**80%**	0.60	0.05
322	Moors and heathlands	**20%**	-	0.10
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**-**	-	-
411	Inland marshes	**10%**	0.50	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	**50%**	-	0.60
Continental				
321	Natural grassland	**80%**	0.60	0.05
322	Moors and heathlands	**40%**	-	0.10
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**-**	-	-
411	Inland marshes	**13%**	0.50	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	**75%**	-	0.60

ESTONIA				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Nemoral				
321	Natural grassland	**40%**	0.60	0.20
322	Moors and heathlands	**50%**	-	0.30
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**1%**	0.50	0.00
333	Sparsely vegetated areas	**50%**	0.10	0.00
411	Inland marshes	**10%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	**75%**	-	1.00
Boreal				
321	Natural grassland	**40%**	0.60	0.20
322	Moors and heathlands	**50%**	-	0.30
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**1%**	0.50	0.00
333	Sparsely vegetated areas	**50%**	0.10	0.00
411	Inland marshes	**10%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	**75%**	-	1.00

SPAIN				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Alpine				
321	Natural grassland	**80%**	0.1	0.1
322	Moors and heathlands	**25%**	-	0.0
323	Sclerophyllous vegetation	**25%**	-	0.0
324	Transitional woodland-shrub	**25%**	-	0.0
333	Sparsely vegetated areas	**15%**	-	0.0
411	Inland marshes	**-**	-	0.0
412	Peat bogs	**0%**	-	-
421	Salt marshes	**-**	-	0.2
Mediterranean Mountains				
321	Natural grassland	**90%**	0.1	0.1
322	Moors and heathlands	**25%**	-	0.0
323	Sclerophyllous vegetation	**25%**	-	0.0
324	Transitional woodland-shrub	**25%**	-	0.0
333	Sparsely vegetated areas	**15%**	-	0.0
411	Inland marshes	**40%**	-	0.0
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	-	0.2
Mediterranean North / South				
321	Natural grassland	**90%**	0.1	0.1
322	Moors and heathlands	**25%**	-	0.0
323	Sclerophyllous vegetation	**25%**	-	0.0
324	Transitional woodland-shrub	**25%**	-	0.0
333	Sparsely vegetated areas	**15%**	-	0.0
411	Inland marshes	**40%**	-	0.0
412	Peat bogs	**-**	-	-
421	Salt marshes	**50%**	-	0.2
Atlantic				
321	Natural grassland	**100%**	0.15	0.05
322	Moors and heathlands	**10%**	-	0.01
323	Sclerophyllous vegetation	**10%**	-	0.01
324	Transitional woodland-shrub	**10%**	-	0.01
333	Sparsely vegetated areas	**5%**	-	0.00
411	Inland marshes	**0%**	-	-
412	Peat bogs	**-**	-	0.00
421	Salt marshes	**-**	-	-
Lusitanian				
321	Natural grassland	**100%**	0.15	0.05
322	Moors and heathlands	**10%**	-	0.01
323	Sclerophyllous vegetation	**10%**	-	0.01
324	Transitional woodland-shrub	**10%**	-	0.01
333	Sparsely vegetated areas	**5%**	-	0.00
411	Inland marshes	**-**	-	-
412	Peat bogs	**30%**	-	0.00
421	Salt marshes	**0%**	-	-

FRANCE				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Alpine				
321	Natural grassland	**90%**	0.80	0.15
322	Moors and heathlands	**50%**	-	0.20
323	Sclerophyllous vegetation	**10%**	-	0.20
324	Transitional woodland-shrub	**5%**	-	0.20
333	Sparsely vegetated areas	**20%**	-	0.10
411	Inland marshes	**20%**	-	0.00
412	Peat bogs	**10%**	-	0.00
421	Salt marshes	**0%**	-	0.00
Continental				
321	Natural grassland	**90%**	0.70	0.10
322	Moors and heathlands	**25%**	0.10	0.20
323	Sclerophyllous vegetation	**0%**	-	0.00
324	Transitional woodland-shrub	**0%**	-	0.30
333	Sparsely vegetated areas	**10%**	-	0.10
411	Inland marshes	**20%**	-	0.00
412	Peat bogs	**10%**	-	0.00
421	Salt marshes	**0%**	-	0.00
Pannonian				
321	Natural grassland	**90%**	0.70	0.10
322	Moors and heathlands	**25%**	0.10	0.20
323	Sclerophyllous vegetation	**0%**	-	0.00
324	Transitional woodland-shrub	**0%**	-	0.30
333	Sparsely vegetated areas	**10%**	-	0.10
411	Inland marshes	**20%**	-	0.00
412	Peat bogs	**10%**	-	0.00
421	Salt marshes	**0%**	-	0.00
Atlantic				
321	Natural grassland	**90%**	0.70	0.10
322	Moors and heathlands	**25%**	-	0.30
323	Sclerophyllous vegetation	**0%**	-	0.00
324	Transitional woodland-shrub	**0%**	-	0.30
333	Sparsely vegetated areas	**10%**	-	0.10
411	Inland marshes	**20%**	-	0.00
412	Peat bogs	**0%**	-	0.00
421	Salt marshes	**20%**	-	1.00
Lusitanian				
321	Natural grassland	**90%**	0.70	0.10
322	Moors and heathlands	**40%**	-	0.30
323	Sclerophyllous vegetation	**-**	-	0.00
324	Transitional woodland-shrub	**5%**	-	0.30
333	Sparsely vegetated areas	**10%**	-	0.10
411	Inland marshes	**20%**	-	0.00
412	Peat bogs	**0%**	-	0.00
421	Salt marshes	**20%**	-	1.00
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Mediterranean				
321	Natural grassland	**90%**	0.80	0.15
322	Moors and heathlands	**25%**	-	0.20
323	Sclerophyllous vegetation	**25%**	-	0.20
324	Transitional woodland-shrub	**5%**	-	0.10
333	Sparsely vegetated areas	**15%**	-	0.05
411	Inland marshes	**20%**	-	0.00
412	Peat bogs	**0%**	-	0.00
421	Salt marshes	**40%**	-	0.00
Mediterranean Mountains				
321	Natural grassland	**90%**	0.80	0.15
322	Moors and heathlands	**25%**	-	0.20

323	Sclerophyllous vegetation	**25%**	-	0.20
324	Transitional woodland-shrub	**5%**	-	0.10
333	Sparsely vegetated areas	**25%**	-	0.05
411	Inland marshes	**20%**	-	0.00
412	Peat bogs	**0%**	-	0.00
421	Salt marshes	**0%**	-	0.00

FINLAND				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Nemoral				
321	Natural grassland	**0%**	-	-
322	Moors and heathlands	**0%**	-	-
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**0%**	-	-
411	Inland marshes	**2%**	0.5	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	**10%**	0.0	1.0
Boreal (except FI1D7)				
321	Natural grassland	**0%**	-	-
322	Moors and heathlands	**10%**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**0%**	-	-
411	Inland marshes	**5%**	0.5	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	**10%**	0.0	1.0
Boreal (FI1D7)				
321	Natural grassland	-	-	-
322	Moors and heathlands	-	-	-
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**0%**	-	-
411	Inland marshes	**2%**	0.5	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	**10%**	0.0	1.0
Alpine North				
321	Natural grassland	-	-	-
322	Moors and heathlands	-	-	-
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**0%**	-	-
411	Inland marshes	**0%**	0.5	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	**10%**	0.0	1.0

GERMANY				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Alpine				
321	Natural grassland	**80%**	0.5	0.2
322	Moors and heathlands	**20%**	-	0.2
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**5%**	0.5	0.0
333	Sparsely vegetated areas	**10%**	0.1	-
411	Inland marshes	**-**	0.5	0.0
412	Peat bogs	**5%**	-	0.2
421	Salt marshes	-	-	0.6
Continental				
321	Natural grassland	**80%**	0.5	0.2
322	Moors and heathlands	**20%**	-	0.2
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**5%**	0.5	0.0
333	Sparsely vegetated areas	**10%**	0.1	-
411	Inland marshes	**10%**	0.5	0.0
412	Peat bogs	**5%**	-	0.2
421	Salt marshes	**50%**	-	0.6
Pannonian				
321	Natural grassland	**80%**	0.5	0.2
322	Moors and heathlands	**20%**	-	0.2
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**5%**	0.5	0.0
333	Sparsely vegetated areas	**10%**	0.1	-
411	Inland marshes	**10%**	0.5	0.0
412	Peat bogs	**5%**	-	0.2
421	Salt marshes	**50%**	-	0.6
Alpine Central / North				
321	Natural grassland	**80%**	0.5	0.2
322	Moors and heathlands	**20%**	-	0.2
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**5%**	0.5	0.0
333	Sparsely vegetated areas	**10%**	0.1	-
411	Inland marshes	**10%**	0.5	0.0
412	Peat bogs	**5%**	-	0.2
421	Salt marshes	**50%**	-	0.6

GREECE				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Mediterranean South/North				
321	Natural grassland	**75%**	0.25	0.25
322	Moors and heathlands	**30%**	0.15	0.10
323	Sclerophyllous vegetation	**40%**	-	0.30
324	Transitional woodland-shrub	**25%**	-	0.30
333	Sparsely vegetated areas	**30%**	-	0.10
411	Inland marshes	**5%**	0.25	0.15
412	Peat bogs	**0%**	-	-
421	Salt marshes	**5%**	0.25	0.25
Mediterranean Mountains				
321	Natural grassland	**75%**	0.25	0.25
322	Moors and heathlands	**30%**	0.15	0.10
323	Sclerophyllous vegetation	**40%**	-	0.30
324	Transitional woodland-shrub	**25%**	-	0.30
333	Sparsely vegetated areas	**30%**	-	0.10
411	Inland marshes	**5%**	0.25	0.15
412	Peat bogs	**0%**	-	-
421	Salt marshes	**5%**	0.25	0.25
Other environmental zones				
321	Natural grassland	**75%**	0.25	0.25
322	Moors and heathlands	**30%**	0.15	0.10
323	Sclerophyllous vegetation	**40%**	-	0.30
324	Transitional woodland-shrub	**25%**	-	0.30
333	Sparsely vegetated areas	**30%**	-	0.10
411	Inland marshes	**-**	0.25	0.15
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	0.25	0.25

CROATIA				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Continental				
321	Natural grassland	**30%**	0.25	0.25
322	Moors and heathlands	**-**	-	0.00
323	Sclerophyllous vegetation	**10%**	-	0.10
324	Transitional woodland-shrub	**2%**	-	0.10
333	Sparsely vegetated areas	**-**	-	0.10
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	**-**	-	0.00
421	Salt marshes	**-**	-	0.00
Pannonian				
321	Natural grassland	**30%**	0.25	0.25
322	Moors and heathlands	**-**	-	0.00
323	Sclerophyllous vegetation	**10%**	-	0.10
324	Transitional woodland-shrub	**2%**	-	0.10
333	Sparsely vegetated areas	**-**	-	0.10
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	**-**	-	0.00
421	Salt marshes	**-**	-	0.00
Alpine				
321	Natural grassland	**30%**	0.40	0.10
322	Moors and heathlands	**0%**	-	0.00
323	Sclerophyllous vegetation	**10%**	-	0.00
324	Transitional woodland-shrub	**2%**	-	0.10
333	Sparsely vegetated areas	**15%**	-	0.00
411	Inland marshes	**-**	0.50	0.00
412	Peat bogs	**0%**	-	0.00
421	Salt marshes	**-**	-	0.00
Mediterranean South/North				
321	Natural grassland	**30%**	0.40	0.10
322	Moors and heathlands	**0%**	-	0.00
323	Sclerophyllous vegetation	**10%**	-	0.00
324	Transitional woodland-shrub	**2%**	-	0.10
333	Sparsely vegetated areas	**15%**	-	0.00
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	-	-	0.00
421	Salt marshes	**0%**	-	0.00
Mediterranean Mountains				
321	Natural grassland	**30%**	0.40	0.10
322	Moors and heathlands	**0%**	-	0.00
323	Sclerophyllous vegetation	**10%**	-	0.00
324	Transitional woodland-shrub	**2%**	-	0.10
333	Sparsely vegetated areas	**15%**	-	0.00
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	-	-	0.00
421	Salt marshes	**0%**	-	0.00

HUNGARY				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Pannonian				
321	Natural grassland	**80%**	0.3	0.1
322	Moors and heathlands	**-**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**5%**	0.3	0.1
333	Sparsely vegetated areas	**0%**		
411	Inland marshes	**5%**	0.3	0.0
412	Peat bogs	**0%**	-	0.0
421	Salt marshes	**-**	-	-
Other environmental zones				
321	Natural grassland	**80%**	0.25	0.25
322	Moors and heathlands	**-**	0.15	0.10
323	Sclerophyllous vegetation	**-**	-	0.30
324	Transitional woodland-shrub	**5%**	-	0.30
333	Sparsely vegetated areas	**0%**	-	0.10
411	Inland marshes	**5%**	0.25	0.15
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	0.25	0.25

IRELAND				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Atlantic				
321	Natural grassland	**95%**	0.30	0.30
322	Moors and heathlands	**95%**	-	0.20
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**10%**	0.05	0.05
333	Sparsely vegetated areas	**10%**	-	0.10
411	Inland marshes	**50%**	0.15	0.15
412	Peat bogs	**75%**	-	0.10
421	Salt marshes	**50%**	-	0.50

ITALY				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Alpine				
321	Natural grassland	**80%**	0.80	0.10
322	Moors and heathlands	**10%**	-	0.30
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**10%**	-	0.30
411	Inland marshes	**0%**	-	-
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	-	-
Mediterranean (North) for Northern Italy (ITC1, ITC2, ITC3, ITC4, ITH1, ITH2, ITH3, ITH4, ITH5)				
321	Natural grassland	**30%**	-	0.70
322	Moors and heathlands	**10%**	-	0.40
323	Sclerophyllous vegetation	**3%**	-	0.30
324	Transitional woodland-shrub	**5%**	-	0.30
333	Sparsely vegetated areas	**5%**	-	0.20
411	Inland marshes	**0%**	-	-
412	Peat bogs	**-**	-	-
421	Salt marshes	**0%**	-	-
Mediterranean Mountains for Northern Italy (ITC1, ITC2, ITC3, ITC4, ITH1, ITH2, ITH3, ITH4, ITH5)				
321	Natural grassland	**30%**	-	0.70
322	Moors and heathlands	**10%**	-	0.40
323	Sclerophyllous vegetation	**3%**	-	0.30
324	Transitional woodland-shrub	**3%**	-	0.30
333	Sparsely vegetated areas	**10%**	-	0.20
411	Inland marshes	**5%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	**-**	-	-
Mediterranean South/North for Southern Italy (ITF1, ITF2,ITF3, ITF4, ITI3, ITI4, ITI2, ITI1, ITF5, ITF6, ITG1)				
321	Natural grassland	**70%**	-	0.60
322	Moors and heathlands	**10%**	-	0.20
323	Sclerophyllous vegetation	**15%**	-	0.20
324	Transitional woodland-shrub	**10%**	-	0.20
333	Sparsely vegetated areas	**15%**	-	0.30
411	Inland marshes	**5%**	-	-
412	Peat bogs	**-**	-	-
421	Salt marshes	**0%**	-	-
Mediterranean Mountains for Southern Italy (ITF1, ITF2,ITF3, ITF4, ITI3, ITI4, ITI2, ITI1, ITF5, ITF6, ITG1)				
321	Natural grassland	**45%**	-	0.60
322	Moors and heathlands	**10%**	-	0.20
323	Sclerophyllous vegetation	**15%**	-	0.20
324	Transitional woodland-shrub	**10%**	-	0.20
333	Sparsely vegetated areas	**15%**	-	0.30
411	Inland marshes	**5%**	-	0.00
412	Peat bogs	**0%**	-	0.00
421	Salt marshes	**-**	-	0.00
Mediterranean South/North for Sardinia (ITG2)				
321	Natural grassland	**70%**	-	0.90
322	Moors and heathlands	**10%**	-	0.2
323	Sclerophyllous vegetation	**15%**	-	0.35
324	Transitional woodland-shrub	**10%**	-	0.3
333	Sparsely vegetated areas	**15%**	-	0.40
411	Inland marshes	**0%**	-	-
412	Peat bogs	**-**	-	-
421	Salt marshes	**0%**	-	-
Mediterranean Mountains for Sardinia (ITG2)				
321	Natural grassland	**70%**	-	0.90
322	Moors and heathlands	**10%**	-	0.2

323	Sclerophyllous vegetation	**15%**	-	0.35
324	Transitional woodland-shrub	**10%**	-	0.3
333	Sparsely vegetated areas	**15%**	-	0.40
411	Inland marshes	**0%**	-	-
412	Peat bogs	**-**	-	-
421	Salt marshes	**0%**	-	-

LITHUANIA				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Nemoral				
321	Natural grassland	**70%**	0.6	0.2
322	Moors and heathlands	**5%**	-	0.3
323	Sclerophyllous vegetation	**-**	-	0.0
324	Transitional woodland-shrub	**0%**	-	0.0
333	Sparsely vegetated areas	**0%**	-	0.0
411	Inland marshes	**40%**	0.5	0.0
412	Peat bogs	**0%**	-	0.0
421	Salt marshes	-	-	0.0
Continental				
321	Natural grassland	**70%**	0.6	0.2
322	Moors and heathlands	**5%**	-	0.3
323	Sclerophyllous vegetation	**-**	-	0.0
324	Transitional woodland-shrub	**0%**	-	0.0
333	Sparsely vegetated areas	**0%**	-	0.0
411	Inland marshes	**40%**	0.5	0.0
412	Peat bogs	**0%**	-	0.0
421	Salt marshes	-	-	0.0

LUXEMBOURG				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Continental				
321	Natural grassland	**-**	-	-
322	Moors and heathlands	**-**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**5%**	0.50	0.00
333	Sparsely vegetated areas	**-**	-	-
411	Inland marshes	**-**	-	-
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	-	-
Atlantic				
321	Natural grassland	**-**	-	-
322	Moors and heathlands	**-**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**5%**	0.50	0.00
333	Sparsely vegetated areas	**-**	-	-
411	Inland marshes	**-**	-	-
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	-	-

LATVIA				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Nemoral				
321	Natural grassland	**20%**	0.6	0.2
322	Moors and heathlands	**-**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**0%**	-	-
411	Inland marshes	**5%**	0.0	0.0
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-
Boreal				
321	Natural grassland	**20%**	0.6	0.2
322	Moors and heathlands	**-**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**0%**	-	-
411	Inland marshes	**5%**	0.0	0.0
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-
Continental				
321	Natural grassland	**20%**	0.6	0.2
322	Moors and heathlands	**-**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**0%**	-	-
411	Inland marshes	**5%**	0.0	0.0
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-

MALTA				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Mediterranean				
321	Natural grassland	**-**	-	-
322	Moors and heathlands	**-**	-	-
323	Sclerophyllous vegetation	**10%**	-	0.10
324	Transitional woodland-shrub	**-**	-	-
333	Sparsely vegetated areas	**0%**	-	-
411	Inland marshes	**-**	-	-
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	-	-

NETHERLANDS				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Continental				
321	Natural grassland	**70%**	0.60	0.05
322	Moors and heathlands	**-**	-	0.15
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**-**	0.50	0.00
333	Sparsely vegetated areas	**-**	-	-
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	**-**	-	0.00
421	Salt marshes	**20%**	-	1.00
Atlantic				
321	Natural grassland	**70%**	0.60	0.05
322	Moors and heathlands	**15%**	-	0.15
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**5%**	0.50	0.00
333	Sparsely vegetated areas	**-**	-	-
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	**0%**	-	0.00
421	Salt marshes	**20%**	-	1.00

NORWAY				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Nemoral				
321	Natural grassland	-	-	-
322	Moors and heathlands	**50%**	0.10	0.105
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**5%**	0.10	0.10
333	Sparsely vegetated areas	**30%**	0.10	0.10
411	Inland marshes	**0%**	-	-
412	Peat bogs	**35%**	-	0.05
421	Salt marshes	-	-	-
Boreal				
321	Natural grassland	-	-	-
322	Moors and heathlands	**50%**	0.10	0.105
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**5%**	0.10	0.10
333	Sparsely vegetated areas	**30%**	0.10	0.10
411	Inland marshes	**0%**	-	-
412	Peat bogs	**35%**	-	0.05
421	Salt marshes	-	-	-
Alpine North exl. NO0073 (Finnmark)				
321	Natural grassland	**-**	-	-
322	Moors and heathlands	**35%**	0.10	0.105
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**10%**	0.10	0.10
333	Sparsely vegetated areas	**10%**	0.10	0.10
411	Inland marshes	**0%**	-	-
412	Peat bogs	**20%**	-	0.05
421	Salt marshes	-	-	-
Alpine North NO0073 (Finnmark)				
321	Natural grassland	**-**	-	-
322	Moors and heathlands	**0%**	0.10	0.105
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**0%**	0.10	0.10
333	Sparsely vegetated areas	**0%**	0.10	0.10
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	0.05
421	Salt marshes	-	-	-
Atlantic				
321	Natural grassland	**-**	-	-
322	Moors and heathlands	**20%**	0.10	0.105
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**5%**	0.10	0.10
333	Sparsely vegetated areas	**30%**	0.10	0.10
411	Inland marshes	**0%**	-	-
412	Peat bogs	**20%**	-	0.05
421	Salt marshes	-	-	-
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Continental				
321	Natural grassland	**-**	-	-
322	Moors and heathlands	**20%**	0.10	0.105
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**5%**	0.10	0.10
333	Sparsely vegetated areas	**30%**	0.10	0.10
411	Inland marshes	**0%**	-	-
412	Peat bogs	**20%**	-	0.05
421	Salt marshes	-	-	-

POLAND				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Nemoral				
321	Natural grassland	**60%**	0.60	0.20
322	Moors and heathlands	**20%**	-	0.30
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**5%**	0.50	0.00
333	Sparsely vegetated areas	**10%**	0.10	0.00
411	Inland marshes	**20%**	0.50	0.00
412	Peat bogs	**0%**	-	0.20
421	Salt marshes	-	-	-
Alpine South/North				
321	Natural grassland	**70%**	0.60	0.20
322	Moors and heathlands	**30%**	-	0.30
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**5%**	0.50	0.00
333	Sparsely vegetated areas	**10%**	0.10	0.00
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	-	-	0.20
421	Salt marshes	-	-	-
Continental				
321	Natural grassland	**60%**	0.60	0.20
322	Moors and heathlands	**20%**	-	0.30
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**5%**	0.50	0.00
333	Sparsely vegetated areas	**10%**	0.10	0.00
411	Inland marshes	**20%**	0.50	0.00
412	Peat bogs	**0%**	-	0.20
421	Salt marshes	-	-	-

PORTUGAL				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Mediterranean Mountains				
321	Natural grassland	**90%**	0.20	0.30
322	Moors and heathlands	**20%**	-	0.20
323	Sclerophyllous vegetation	**-**	-	0.10
324	Transitional woodland-shrub	**20%**	-	0.10
333	Sparsely vegetated areas	**15%**	-	0.05
411	Inland marshes	**-**	0.50	0.00
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	-	0.50
Mediterranean North/South				
321	Natural grassland	**90%**	0.20	0.30
322	Moors and heathlands	**20%**	-	0.20
323	Sclerophyllous vegetation	**30%**	-	0.10
324	Transitional woodland-shrub	**20%**	-	0.10
333	Sparsely vegetated areas	**15%**	-	0.05
411	Inland marshes	**40%**	0.50	0.00
412	Peat bogs	**-**	-	-
421	Salt marshes	**50%**	-	0.50
Lusitanian				
321	Natural grassland	**100%**	0.20	0.30
322	Moors and heathlands	**20%**	-	0.20
323	Sclerophyllous vegetation	**20%**	-	0.10
324	Transitional woodland-shrub	**20%**	-	0.10
333	Sparsely vegetated areas	**10%**	-	0.05
411	Inland marshes	**20%**	0.50	0.00
412	Peat bogs	**-**	-	-
421	Salt marshes	**30%**	-	0.50

ROMANIA				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Pannonian				
321	Natural grassland	**80%**	0.05	0.15
322	Moors and heathlands	**-**	-	0.10
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**2%**	-	0.10
333	Sparsely vegetated areas	**70%**	-	0.10
411	Inland marshes	**10%**	-	0.10
412	Peat bogs	**-**	-	-
421	Salt marshes	**0%**	-	-
Alpine South				
321	Natural grassland	**80%**	0.05	0.15
322	Moors and heathlands	**70%**	-	0.10
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**2%**	-	0.10
333	Sparsely vegetated areas	**70%**	-	0.10
411	Inland marshes	**10%**	-	0.10
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	-	-
Continental				
321	Natural grassland	**80%**	0.05	0.15
322	Moors and heathlands	**70%**	-	0.10
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**2%**	-	0.10
333	Sparsely vegetated areas	**70%**	-	0.10
411	Inland marshes	**10%**	-	0.10
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	-	-

SLOVENIA				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Alpine South				
321	Natural grassland	**40%**	0.80	0.05
322	Moors and heathlands	**1%**	0.30	0.01
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	0.00
333	Sparsely vegetated areas	**5%**	-	0.04
411	Inland marshes	**0%**	-	0.00
412	Peat bogs	**-**	-	-
421	Salt marshes	**-**	-	0.00
Continental				
321	Natural grassland	**70%**	0.80	0.05
322	Moors and heathlands	**-**	0.30	0.01
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	0.00
333	Sparsely vegetated areas	-	-	0.04
411	Inland marshes	-	-	0.00
412	Peat bogs	-	-	-
421	Salt marshes	-	-	0.00
Pannonian				
321	Natural grassland	**70%**	0.80	0.05
322	Moors and heathlands	**-**	0.30	0.01
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	0.00
333	Sparsely vegetated areas	-	-	0.04
411	Inland marshes	-	-	0.00
412	Peat bogs	-	-	-
421	Salt marshes	-	-	0.00
Mediterranean North / Mediterranean Mountains				
321	Natural grassland	**70%**	0.80	0.05
322	Moors and heathlands	**-**	0.30	0.01
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	0.00
333	Sparsely vegetated areas	-	-	0.04
411	Inland marshes	-	-	0.00
412	Peat bogs	-	-	-
421	Salt marshes	-	-	0.00

SLOVAKIA				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Pannonian				
321	Natural grassland	**30%**	0.1	0.1
322	Moors and heathlands	**0%**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**20%**	0.05	0.05
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-
Alpine South				
321	Natural grassland	**90%**	0.1	0.1
322	Moors and heathlands	**0%**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**0%**	0.05	0.05
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	**-**	-	-
Continental				
321	Natural grassland	**70%**	0.1	0.1
322	Moors and heathlands	**0%**	-	-
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**20%**	0.05	0.05
411	Inland marshes	**0%**	-	-
412	Peat bogs	**0%**	-	-
421	Salt marshes	-	-	-

SWEDEN				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Boreal				
321	Natural grassland	reindeer	0.60	0.20
322	Moors and heathlands	reindeer	-	0.10
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**5%**	0.30	0.00
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	**5%**	0.05	0.05
421	Salt marshes	**10%**	-	0.80
Alpine North				
321	Natural grassland	reindeer	0.60	0.20
322	Moors and heathlands	reindeer	-	0.10
323	Sclerophyllous vegetation	-	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**0%**	0.30	0.00
411	Inland marshes	**0%**	0.50	0.00
412	Peat bogs	**0%**	0.05	0.05
421	Salt marshes	**-**	-	0.80
Nemoral				
321	Natural grassland	**80%**	0.60	0.20
322	Moors and heathlands	**10%**	-	0.10
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**5%**	0.30	0.00
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	**5%**	0.05	0.05
421	Salt marshes	**10%**	-	0.80
Continental				
321	Natural grassland	**80%**	0.60	0.20
322	Moors and heathlands	**10%**	-	0.10
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**0%**	-	-
333	Sparsely vegetated areas	**5%**	0.30	0.00
411	Inland marshes	**10%**	0.50	0.00
412	Peat bogs	**5%**	0.05	0.05
421	Salt marshes	**10%**	-	0.80

UNITED KINGDOM				
CLC code	**CLC name**	**Estimated grazing share**	**Estimated LU/ha**	
			Total bovine	**Total ovine**
Atlantic				
321	Natural grassland	**95%**	0.25	0.25
322	Moors and heathlands	**60%**	-	0.30
323	Sclerophyllous vegetation	**-**	-	-
324	Transitional woodland-shrub	**10%**	-	0.20
333	Sparsely vegetated areas	**0%**	-	-
411	Inland marshes	**50%**	-	0.30
412	Peat bogs	**50%**	-	0.10
421	Salt marshes	**80%**	-	0.50

Annex 4 Comparison of likely grazing capacity with Halada grazing needs per country – a first approximation

This annex presents results derived by the study team for each EU-27 Member State and the United Kingdom. These are presented here for information and feedback rather than as authoritative results. Nevertheless, it is hoped that they can support further work and reflection at country level. Overall, the country level comparisons indicate that lack of grazing capacity, or at least under-grazing of certain habitat types, is a far more common problem for maintaining Annex I grazing-dependent habitats in good condition than overgrazing. This aligns with the analysis presented in chapter 2 and in the recent EU State of Nature report (EEA, 2020) which lists abandonment of grassland management as the most frequently reported agricultural pressure for habitats and species.

However, as discussed in **Chapter 5**, caution must be exercised in drawing general inferences from comparing the two main data sets (CLC semi-natural area and Halada habitat extent) with each other. For example, in situations where the estimated CLC total semi-natural grazing use is higher than the estimated grazing needs of the corresponding Halada habitats, there may be significant areas of non-Halada habitats within that CLC class. The vegetation on these areas is likely to be more productive than Halada habitats and livestock grazing may be focused on these non-Halada areas for economic and livestock management reasons. Which means that even if sufficient grazing livestock is available low-productivity Halada habitats may remain under-grazed – a pattern that can be observed frequently in the field.

The uncertainty in the data sets generated carries through into the country level analysis below. The confidence in the country level results is influenced by two main factors: a) the uncertainty in the data sets generated and b) the comparability between the different data sets utilised for the country level analysis (or lack of). Table A4 reviews the level of uncertainty in the main input data sets per country based on a qualitative assessment by the study team. Green indicates high confidence in the reliability of the respective data set at country level, orange indicates substantial uncertainty and red indicates low confidence in currently available data for the country concerned.

Table A4. 1: Review of reliability of estimates per country

Country	CLC data as surrogate for semi-natural vegetation	% CLC grazing rate estimate	Halada stocking rate (grazing need) per habitat	Halada habitat area estimate (from Art.17)
Austria	green	green	green	green
Belgium	amber	green	green	green
Bulgaria	green	green	amber	green
Croatia	amber	amber	amber	amber
Cyprus	amber	amber	amber	amber
Czechia	amber	green	green	green
Denmark	amber	green	green	green
Estonia	amber	green	green	green
Finland[1]	amber	green	green	green
France	green	green	green	red
Germany	amber	green	green	green
Greece	green	green	green	green
Hungary	amber	amber	green	green
Ireland	green	green	green	green
Italy	green	amber	green	amber
Latvia	amber	green	green	green
Lithuania	amber	amber	green	green
Luxembourg	amber	amber	green	green
Malta[2]			amber	green
Netherlands	amber	green	green	green
Poland	amber	amber	green	green
Portugal	green	amber	amber	red
Romania	green	green	green	red
Slovakia	amber	green	green	green
Slovenia	amber	green	green	green
Spain	green	amber	green	green
Sweden[1]	amber	green	green	green
United Kingdom	green	green	green	green

[1] not including reindeer grazing

[2] officially no grazed semi-natural vegetation

Austria

Table A4. 2: Austria - Comparison of grazing estimates.

AUSTRIA – comparison of grazing estimates						
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	101%	152%	37%	Pasture
3.2.2	*Moors and heathland*	153%	1623%	1353%	Mosaic, Abandonment
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	18%	123%	2%	Mosaic
4.1.1	*Inland marshes*	56%	-	-	
4.2.1	*Salt marshes*	-	-	-	
	total	87%	210%	45%	

The most significant share of grazing on semi-natural areas in Austria occurs on mountain pastures in the alpine region, which is well documented. The CLC grazing area estimates are based on an overlap of INVEKOS (LPIS, Land Parcel Identification System) data and the CLC classes. The estimates can thus be considered reliable. However, due to the minimal mapping unit rules of CLC, small-structured areas are not sufficiently mapped. Smaller mountain pastures, essentially semi-natural grasslands, are thus often “lost” amongst larger areas of 3.2.2. Moors and heathland and 3.2.3. Sclerophyllous vegetation. Also, available mountain pasture data usually includes areas larger than the actual “grazing areas”, for example in some cases including the area that is passed when driving up the animals to the pastures. Further, due to dense settlement in the lowlands grazed semi-natural settlements are generally mapped as 2.3.1. Pastures.

There was no Halada habitat expert available for Austria. Instead estimates from Switzerland and Italy (Südtirol) were used. Their ‘needs’ estimates for the major Halada habitats in Austria (6150, 6170) were broadly consistent with each other and were therefore used in the Austrian case.

The dominant grazed CLC land cover class in Austria is 3.2.1 (Semi-)Natural Grassland. Looking at the global figures, this seems at first sight to be just slightly ‘overgrazed’. But national data and LPIS mapping indicate that only around two thirds of the total is in fact grazed. Class 3.2.2. Moors and heathlands are, according to the experts and national data, also substantially undergrazed, with less than 10% grazed at all.

The overall picture therefore is that the total 'overstocking' shown by the national totals is roughly 100%. These livestock are largely concentrated on about one third of the Halada/CLC resource, with large areas significantly undergrazed or ungrazed. Grazed semi-natural grasslands have an estimated livestock density of around 0.55 LU/ha; though national grazing data and LPIS gives an even higher value of 0.68 LU/ha.

Table A4. 3: Austria - CLC grazing estimates.

AUSTRIA – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural grassland*	615 300	407 160	66%	342 014	0.8	Reliable, mostly mountain pastures
3.2.2	*Moors and heathland*	196 300	18 510	9%	2 221	0.1	Areas surrounding mountain pastures
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	305 700	44 220	14%	5 306	0.1	Areas surrounding mountain pastures
4.1.1	*Inland marshes*	19 200	-	-	-	-	Not grazed
4.2.1	*Salt marshes*	-	-	-	-	-	
total		1 136 500	469 890	41%	349 542	0.7	

Table A4. 4: Austria - Halada grazing expert estimates.

AUSTRIA – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1.	*(Semi-)Natural grassland*	619 930	127 481	0.2	Mostly 6150 (siliceous alpine and boreal grasslands), 6170 (alpine and subalpine calcareous grasslands)
3.2.2.	*Moors and heathland*	300 409	30 063	0.1	4060 (Alpine and boreal heaths)
3.2.3.	*Sclerophyllous vegetation*	-	-	-	
3.3.3.	*Sparsely vegetated areas*	54 500	100	0	8240 (Limestone pavements)
4.1.1.	*Inland marshes*	10 810	720	0.1	7230 (Alkaline fens)
4.2.1.	*Salt marshes*	-	-	-	
	total	985 649	158 364	0.2	

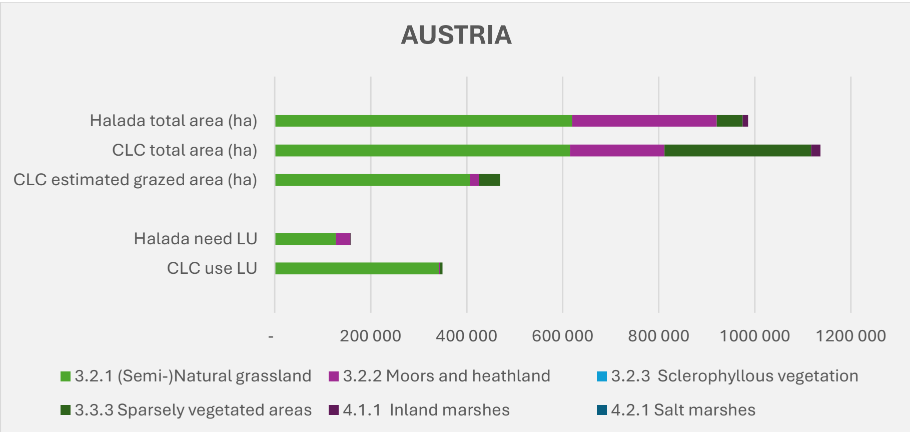

Figure A4. 1: Austria - Comparison Halada needs and CLC use.

Belgium

Table A4. 5: Belgium - Comparison of grazing estimates.

BELGIUM – comparison of grazing estimates						
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	197%	258%	22%	Mosaic
3.2.2	*Moors and heathland*	120%	482%	70%	Undergrazed?
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	17%	191%	-	Mowing, Non Halada significant
4.2.1	*Salt marshes*	208%	208%	67%	
	total	107%	430%	51%	

In Belgium the area of both semi-natural CLC classes and Halada habitats is small, as are the resulting livestock numbers. There are large % differences in the area estimates, but since the totals are small, it is not clear whether there is any real world significance to these. Within that overall context the most extensive group of Halada habitats is 3.2.2 Moors and heathlands, which are estimated to be largely ungrazed (or at least undergrazed). However, the expert's estimates for the needs of those habitats are so low (unusually low compared to neighbouring countries) that the total livestock complement estimated is apparently almost 50% too high even for the total heathland grazing resource. Due to the Belgian landscape, small areas of semi-natural grasslands are "lost" within more intensive agricultural classes or forest, depending on local circumstances, explaining differences between the total CLC area 3.2.1 (Semi-)Natural grassland and the corresponding Halada area. Interestingly, while not surprising, the estimated livestock density is significantly higher than the Halada density needed to maintain the habitat.

Table A4. 6: Belgium - CLC grazing estimates.

BELGIUM – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural grassland*	942	720	76%	576	0.6	Nature reserves
3.2.2	*Moors and heathland*	16 092	4 000	25%	1 200	0.1	Nature reserves, along rivers
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	-	-	
4.1.1	*Inland marshes*	2 747	250	9%	130	0.05	
4.2.1	*Salt marshes*	764	120	16%	120	0.2	
total		20 545	5 090	25%	2 026	0.4	

Table A4. 7: Belgium - Halada grazing expert estimates.

BELGIUM – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural grassland*	1 860	126	0.07	62340 (Species-rich nardus grassland)
3.2.2	*Moors and heathland*	19 295	835	0.04	5130 (Juniperus communis formations); 4030 (European dry heath), 4010 (Northern Atlantic wet heaths)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	478	-	-	7140 (Transition mires and quaking bogs)
4.2.1	*Salt marshes*	250	80	0.3	1330 (Atlantic salt meadows)
	total	21 883	1 042	0.05	

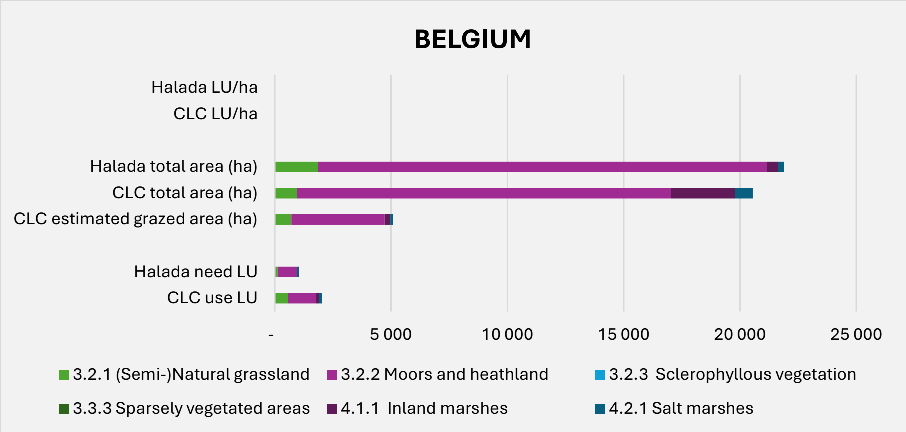

Figure A4. 2: Belgium - Comparison Halada needs and CLC use.

Bulgaria

Table A4. 8: Bulgaria - Comparison CLC use and Halada needs.

BULGARIA – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	83%	128%	128%	
3.2.2	*Moors and heathland*	161%	537%	138%	
3.2.3	*Sclerophyllous vegetation*	9699%	110570%	-	Abandonment, Mosaic
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	7%	68%	-	Non-Halada significant
4.2.1	*Salt marshes*	-	-	-	
	total	81%	139%	130%	

CLC estimates in Bulgaria are based on detailed national reports on grazing density calculated on the basis of LU of grazing animals and the area of LPIS eligible agricultural land. However, this data mostly provides information on intensive livestock holdings and thus was carefully analysed with national experts. According to them, extensive cattle and sheep grazing mainly occurs in the mountain areas with increasing issues of abandonment. Notably, CLC classes

2.4.2. Complex cultivation patterns and 2.4.3. Land principally occupied by agriculture with significant areas of natural vegetation are both mapped as large areas in Bulgaria as well (2617ha and 10576ha respectively). Both of these classes are potentially important for extensive grazing as well but not included in this assessment. For Bulgaria there was no available Halada habitat expert, so we imported values from Austria, Romania and Greece, using professional judgement to select the country most relevant to particular habitats in their individual BGR. Looking at the overall totals, CLC 'overestimates' the area of 3.2.1 (Semi-)Natural Grassland compared to the corresponding Halada area as reported under Article 17 (we are not aware of significant areas of non-Halada Natural Grasslands), while the opposite is the case for both 3.2.2 Moors and Heathlands and 3.2.3 Sclerophyllous Vegetation.

The picture as a whole seems to be that the area of 3.2.1 (Semi-)Natural Grassland grazed receives on average an optimal grazing pressure, but that roughly a third of grasslands are ungrazed, while 3.2.2. Moors and Heathlands and 3.2.3. Sclerophyllous Vegetation are largely ungrazed (though leaving open the possibility that some moorland may in fact be overgrazed). In the country as a whole, there seems to be a clear dearth of livestock on the semi-natural grazing.

Table A4. 9: Bulgaria - CLC grazing estimates.

BULGARIA – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural grassland*	406 958	265 940	65%	132 970	0.50	Mostly mountain regions
3.2.2	*Moors and heathland*	22 991	6 870	30%	2 061	0.30	Rhodope mountains only
3.2.3	*Sclerophyllous vegetation*	114	10	10%	-	-	
3.3.3	*Sparsely vegetated areas*	38 390	5 710	15%	571	0.10	Mostly mountain regions
4.1.1	*Inland marshes*	8 422	860	10%	-	-	Mostly along Danube
4.2.1	*Salt marshes*	500	-	-	-	-	
total		477 375	279 390	59%	135 602	0.49	

Table A4. 10: Bulgaria - Halada grazing expert estimates.

BULGARIA – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural grassland*	339 139	169 664	0.50	Mostly 6210 (Semi-natural dry grasslands and scrubland)
3.2.2	*Moors and heathland*	36 912	2 843	0.08	4060 (Alpine and boreal heath)
3.2.3	*Sclerophyllous vegetation*	11 057	3 317	0.30	5210 (Arborescent matorral)
3.3.3	*Sparsely vegetated areas*	0	0	-	
4.1.1	*Inland marshes*	584	0	-	7140 (Transition mires and quaking bogs)
4.2.1	*Salt marshes*	0	0	-	
	total	387 692	175 824	0.5	

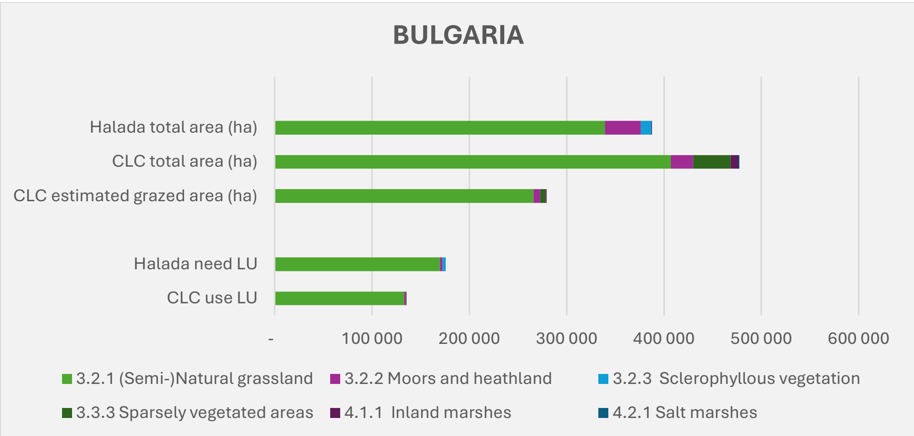

Figure A4. 3: Bulgaria - Comparison Halada needs and CLC use.

Croatia

Table A4. 11: Croatia - Comparison of Halada needs and CLC use.

CROATIA – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1.	*(Semi-)Natural grassland*	291%	964%	417%	Abandonment, Mosaic
3.2.2.	*Moors and heathland*	385%	-	-	Abandonment, Mosaic
3.2.3.	*Sclerophyllous vegetation*	122%	1196%	3415%	Abandonment, Mosaic
3.3.3.	*Sparsely vegetated areas*	-	-	-	Non Halada significant
4.1.1.	*Inland marshes*	1%	6%	1%	
4.2.1.	*Salt marshes*	-	-	-	
	total	202%	904%	490%	

Croatia is one of the few countries providing national statistics on grazing animals and common land grazing on a national level. These statistics were taken into account. There was no Halada expert available for Croatia so, Hungarian and Greek estimates were used. The corresponding livestock expert also pointed out difficulties associated with obtaining reliable data on the areas of pastures and their use at the national level.

For all of the habitats, the estimated grazed area is much smaller than either the Halada or CLC totals, with total livestock needs not being met in any of the important habitat groups. However, it appears as if the grazing pressure on that proportion of 3.2.1 (Semi-)Natural Grasslands which is in fact grazed may be adequate.

Within the Halada habitats, the dominant class is that corresponding to 3.2.1 (Semi-) Natural Grasslands. The area estimated in the Article 17 report is almost three times the apparent CLC area, but note that two thirds of all of the Halada area is made up of one number stated to be an estimate – that for 62A0 Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae). It is also noted that the region shown as its extent has had significant reductions in agricultural activity over recent decades for a variety of reasons.

The conflicting data for 4.1.1 Inland Marshes is concluded to be negligible in the overall picture.

Table A4. 12: Croatia - CLC grazing estimates.

CROATIA – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural grassland*	255 057	76 995	30%	38 888	0.51	
3.2.2	*Moors and heathland*	3 083	-	-	-	-	Not utilised
3.2.3	*Sclerophyllous vegetation*	106 456	10 880	10%	1088	0.10	
3.3.3	*Sparsely vegetated areas*	53 400	8 060	15%	806	0.10	coastal areas
4.1.1	*Inland marshes*	19 099	1 851	10%	1050.35	0.57	Nature reserves
4.2.1	*Salt marshes*	550	-	-	-	-	
total		437 645	97 786	22%	41 832	0.43	

Table A4. 13: Croatia - Halada grazing expert estimates.

CROATIA – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural grassland*	742 105	162 257	0.22	62A0 (Eastern sub-Mediterranean dry grasslands)
3.2.2	*Moors and heathland*	11 880	5 453	0.46	4060 (Alpine and Boreal heaths)
3.2.3	*Sclerophyllous vegetation*	130 110	37 157	0.29	5210 (Arborsecsent matorral)
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	102	10	0.09	7230 (Alkaline fens)
4.2.1	*Salt marshes*	-	-	-	
	total	884 197	204 877	0.2	

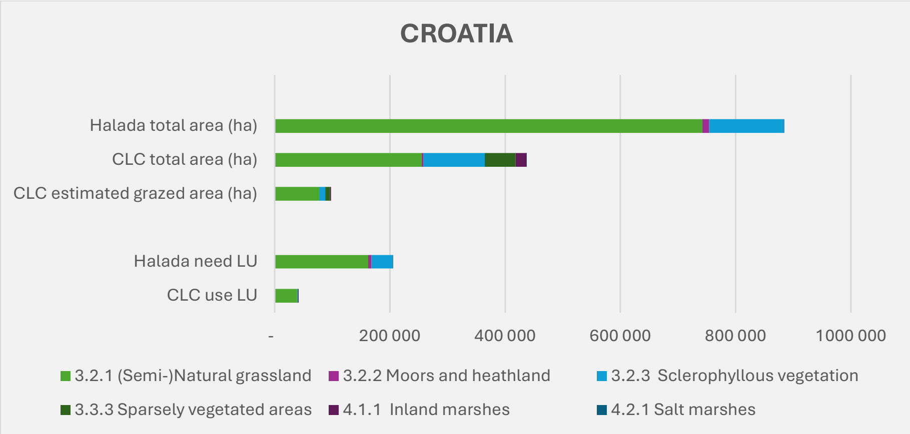

Figure A4. 4: Croatia - Halada grazing expert estimates.

Cyprus

Table A4. 14: Cyprus - Comparison Halada needs and CLC use.

CYPRUS – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Comments**
3.2.1.	*(Semi-)Natural grassland*	9%	11%	1%	
3.2.2.	*Moors and heathland*	-	-	-	
3.2.3.	*Sclerophyllous vegetation*	7%	10%	9%	Non Halada significant
3.3.3.	*Sparsely vegetated areas*	-	-	-	
4.1.1.	*Inland marshes*	-	-	-	
4.2.1.	*Salt marshes*	-	-	-	
	total	6%	10%	5%	

Cyprus is very unusual in that the proportion of (semi-) natural grassland habitat considered to fall into the Halada list is but a small proportion of the total area of the CLC class. While there are some countries (UK, IE) where there are significant non-Halada semi-natural grasslands, the authors came across no comparable examples in the Mediterranean region. This is a question worthy of further investigation.

The national expert consulted gave a modest scale of semi-natural grazing in Cyprus, with much of the resource ungrazed. Beyond that, no comment is possible without further information. It is possible for example that none of the Halada habitats are grazed or conversely that all of the stock is concentrated there.). But at present the picture is very confusing and is definitely in need of further in depth-discussion. The currently available data does not allow for an explanation or a coherent detailed picture of semi-natural grazing occurring in Cyprus.

Table A4. 15: Cyprus - CLC grazing estimates.

CYPRUS – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1.	*(Semi-)Natural grassland*	25 197	20 170	80%	8 068	0.40	
3.2.2.	*Moors and heathland*	1 056	845	80%	169	0.20	
3.2.3.	*Sclerophyllous vegetation*	155 442	101 595	65%	10159.5	0.10	lowlands
3.3.3.	*Sparsely vegetated areas*	12 823	7 708	60%	771	0.10	Mostly coastal
4.1.1.	*Inland marshes*	497	356	72%	-	-	
4.2.1.	*Salt marshes*	2 000	-	-	-	-	
total		197 015	130 673	66%	19 167	0.15	

Table A4. 16: Cyprus - Halada grazing expert estimates.

CYPRUS – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	Main habitat types
3.2.1.	*(Semi-)Natural grassland*	2 205	95	0.04	6220 (Pseudo-steppe with grasses)
3.2.2.	*Moors and heathland*				
3.2.3.	*Sclerophyllous vegetation*	10 548	881	0.08	5420 (Sarcopoterium spinosum phryganas)
3.3.3.	*Sparsely vegetated areas*	-	-	-	
4.1.1.	*Inland marshes*	-	-	-	
4.2.1.	*Salt marshes*	-	-	-	
	total	12 753	976	0.1	

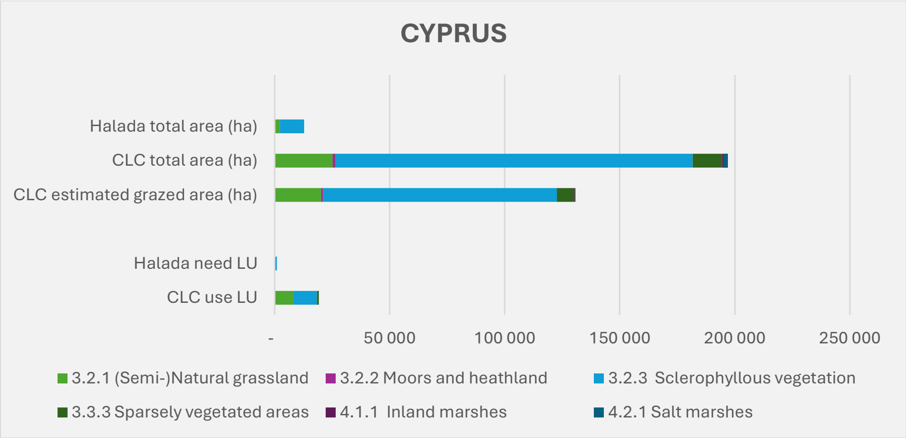

Figure A4. 5: Cyprus - Comparison Halada needs and CLC use.

Czech Republic

Table A4. 17: Czech Republic - Comparison Halada needs and CLC use.

CZECH REPUBLIC – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	798%	3177%	274%	Mosaic, Pasture
3.2.2	*Moors and heathland*	111%	-	-	
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	26%	-	-	Non Halada significant
4.1.1	*Inland marshes*	90%	-	-	Mowing
4.2.1	*Salt marshes*	-	-	-	
	total	613%	3309%	292%	

Statistics for grazing animals and are of pastures are available for the Czech Republich. However, according to our national experts, these data mainly include intensive livestock holdings. Thus, they are of limited use for this assessment.

Further, the available data on area in CLC and Halada diverge significantly. A useful assessment about the Czech data is thus difficult for two reasons:

The CLC 3.2.1 (Semi-)Natural Grasslands, which are much smaller in area than the apparently corresponding Halada habitats, is in fact only mapped in highly discrete areas which seem to be military ranges or Nature Parks

The Halada total is dominated by three meadow classes (6410, 6510, 6520), according to the Article 17 data sheet. These are habitats which the national experts tell us do not require grazing, yet these classes are predominantly being mapped on those same military ranges. By extension, it seems clear that the bulk of those meadow habitats are being mapped in CLC as 2.3.1 Pastures, which in turn either calls into question the expert evaluation of how the habitats should be managed or suggests that very significant areas are being managed in sub-optimal ways but in areas where grazing is the only realistic option.

Thus, while the national experts conclude (assume?) that semi-natural habitats are in general undergrazed, for historic as well as present day reasons, the data does not allow the drawing of conclusions either way.

Table A4. 18: Czech Republic - CLC grazing estimates.

CZECH REPUBLIC – CLC grazing estimates								
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural grassland*	24 593	6 176	25%	4 941	0.80	Military ranges, nature reserves
3.2.2	*Moors and heathland*	2 259	-	-	-	-	National park, border areas
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	377	-	-	-	-	
4.1.1	*Inland marshes*	6 115	-	-	-	-	
4.2.1	*Salt marshes*	-	-	-	-	-	
	total	33 344	6 176	19%	4 941	0.80	

Table A4. 19: Czech Republic - Halada grazing expert estimates.

CZECH REPUBLIC – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	Main habitat types
3.2.1.	*(Semi-)Natural grassland*	196 248	13 562	0.07	6510 (Lowland hay meadows)
3.2.2.	*Moors and heathland*	2 517	827	0.33	4030 (European dry heaths)
3.2.3.	*Sclerophyllous vegetation*	-	-	-	
3.3.3.	*Sparsely vegetated areas*	97	-	-	
4.1.1.	*Inland marshes*	5 489	45	0.01	7140 (Transition mires and quaking bogs)
4.2.1.	*Salt marshes*	-	-	-	
	total	204 351	14 434		

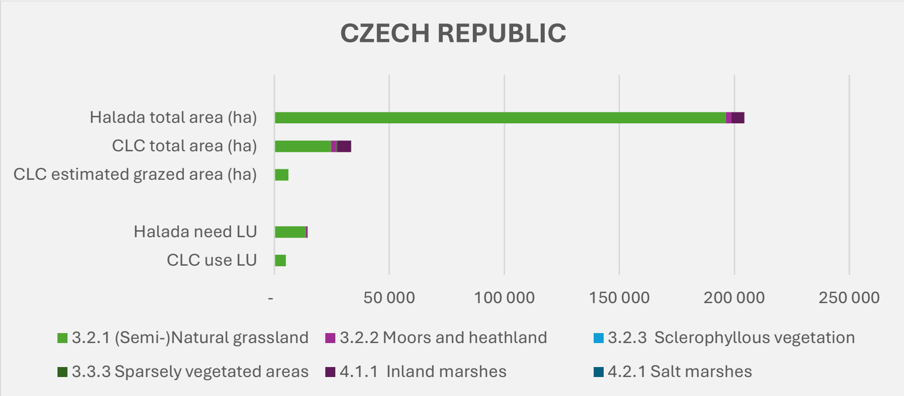

Figure 1. Czech Republic - Comparison Halada needs and CLC use.

Denmark

Table A4. 20: Denmark - Comparison Halada needs and CLC use.

DENMARK – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	149%	187%	94%	Pasture
3.2.2	*Moors and heathland*	124%	329%	885%	Mosaic
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	43%	358%	155%	Non Halada significant, (Mowing)
4.2.1	*Salt marshes*	131%	194%	194%	
	total	113%	241%	191%	

In the case of Denmark, the area of the CLC classes is quite low. Part of this may be due to the generalisation involved in Corine, but there seems also to be a much lower propensity to identify 3.2.1 (Semi-)Natural Grasslands in particular. Similarly, the contrast at the German border is extremely obvious for 2.3.1. Pastures – they are only being mapped on the Danish side at valley bottoms, where they may well be semi-natural grasslands. While dry heaths, fixed dunes and similar habitat classes are common in Denmark, they only exist in mosaic landscapes with other more dominant classes and thus are essentially lost in the CLC picture.

Similarly, fens are subject to different management and uses, but most types are not grazed. Only a small proportion of their CLC area falls into the Halada habitats, explaining the divergence in numbers between Table 2 and Table 3. The perceived grazing need of 4.2.1 Saltmarsh is perhaps related to different traditions in Denmark, but there is no impression that there is an overall issue of undergrazing. Overall, the picture is one common to many countries, with 3.2.1 (Semi-)Natural Grasslands receiving a livestock load which is close to optimal at first sight, but with the experts estimating that in fact only a proportion are actually grazed, while other less palatable habitats (3.2.2 Moors and Heathlands in particular) receive much less grazing than they are estimated to need.

Table A4. 21: Denmark - CLC grazing estimates.

DENMARK – CLC grazing estimates							
CLC Code	CLC Name	CLC total area (ha)	CLC estimated grazed area		CLC LU	CLC LU/ha (est. grazed area)	Comments
			ha	%			
3.2.1	*(Semi-)Natural grassland*	25 677	20 480	80%	13 312	0.65	Mainly in coastal areas and on islands
3.2.2	*Moors and heathland*	50 256	18 940	38%	1 894	0.10	Mainly in nature reserves
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	-	-	
4.1.1	*Inland marshes*	28 594	3 423	12%	1 711	0.50	Mainly along rivers
4.2.1	*Salt marshes*	30 222	20 350	67%	12 210	0.60	
total		134 749	63 193	47%	29 127	0.46	

Table A4. 22: Denmark - Halada grazing expert estimates.

DENMARK– ‚Halada‘ grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada‘ area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1.	*(Semi-)Natural grassland*	38 384	12 567	0.33	6230 (Species-rich Nardus grassland)
3.2.2.	*Moors and heathland*	62 256	16 765	0.27	2140 (Decalcified fixed dune); 4030 (European dry heaths)
3.2.3.	*Sclerophyllous vegetation*	-	-	-	
3.3.3.	*Sparsely vegetated areas*	120	-	-	
4.1.1.	*Inland marshes*	12 241	2 656	0.22	7230 (Alkaline fens)

4.2.1.	*Salt marshes*	39 500	23 700	0.60	1330 (Atlantic salt meadows)
	total	152 501	55 689	0.4	

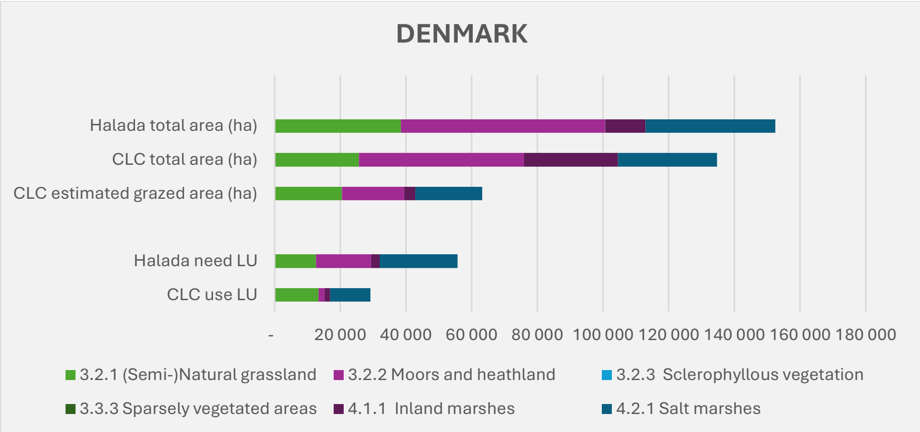

Figure 1. Denmark - Comparison Halada needs and CLC use.

Estonia

Table A4. 23: Estonia - Comparison Halada needs and CLC use.

ESTONIA – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	117%	329%	67%	Mosaic, Pasture
3.2.2	*Moors and heathland*	34%	60%	59%	
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	1589%	3234%	3224%	Mosaic, Abandonment
4.1.1	*Inland marshes*	98%	1059%	-	
4.2.1	*Salt marshes*	3857%	3857%	1928%	Mosaic
	total	116%	559%	212%	

Generally, Estonian data is very reliable, as statistics were conclusive and national experts very helpful. In Estonia the major semi-natural CLC classes are 3.2.1 (Semi-)Natural Grasslands, 4.1.1 Inland Marshes and 4.2.1 Salt Marshes. The latter is in fact predominantly

Boreal Baltic Coastal Meadow 1630, a habitat which has been permanently elevated above the high tide level by isostatic uplift; it is highly unlikely that the expert responses will have taken this into account (i.e. experts are likely to have included this habitat in 3.2.1 (Semi-)Natural Grassland when making their estimates).

The area of CLC 3.2.1. (Semi-) Natural Grassland plus 4.2.1. Salt Marshes is significantly lower than the area of the corresponding Halada habitats – an effect of the grasslands often being in a mosaic with forest. Larger grassland areas are usually more intensively used and thus are mapped as 2.3.1. Pastures. The main habitat type for 3.3.3 Sparsely vegetated Areas is 6280 Nordic Alvar, a habitat that – while commonly considered to be in need of extensive and careful grazing management – has notoriously suffered from abandonment for years, due to economic considerations of low stocking densities.

The estimated Halada grazing need and estimated CLC grazing share for [3.2.1 (Semi-)Natural Grassland + 4.2.1 Salt marshes] habitats are very similar, though the CLC estimate suggests that most of the livestock herd is focussed on perhaps just a third of the total resource. Alongside that, it seems clear that the grazing need of both 3.3.3. Sparsely Vegetated Areas (mostly alvar) and 4.1.1. Inland Marshes (particularly riverine fens) hugely exceed the current grazing stock. The overall picture of a significant lack of grazing livestock seems consistent with the picture set out over many years by Estonian experts and official bodies.

Table A4. 24: Estonia – CLC grazing estimates.

ESTONIA– CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural grassland*	37 007	13 162	36%	10 529	0.80	Coastal areas, along rivers
3.2.2	*Moors and heathland*	9 979	5 697	57%	1 709	0.30	Islands
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	633	311	49%	31	0.10	
4.1.1	*Inland marshes*	82 715	7 678	9%	-	-	On the mainland mostly along rivers
4.2.1	*Salt marshes*	363	363	100%	363	1.00	Limited to 1 island
total		130 697	27 211	21%	12 633	0.46	

Table A4. 25: Estonia - Halada grazing expert estimates.

ESTONIA – ‚Halada‘ grazing expert estimates

CLC Code	CLC Name	Corresponding ‚Halada' area (ha)	Halada LU	Halada LU/ha	Main habitat type
3.2.1	*(Semi-)Natural grassland*	43 300	7 100	0.16	6450 (Northern boreal alluvial meadows)
3.2.2	*Moors and heathland*	3 410	1 006	0.30	5139 (Juniperus communis)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	10 060	1 003	0.10	6280 (Nordic alvar)
4.1.1	*Inland marshes*	81 300	10 700	0.13	7140 (Transition mires and quaking bogs)
4.2.1	*Salt marshes*	14 000	7 000	0.50	1630 (Boreal Baltic coastal meadows)
	total	152 070	26 809	0.2	

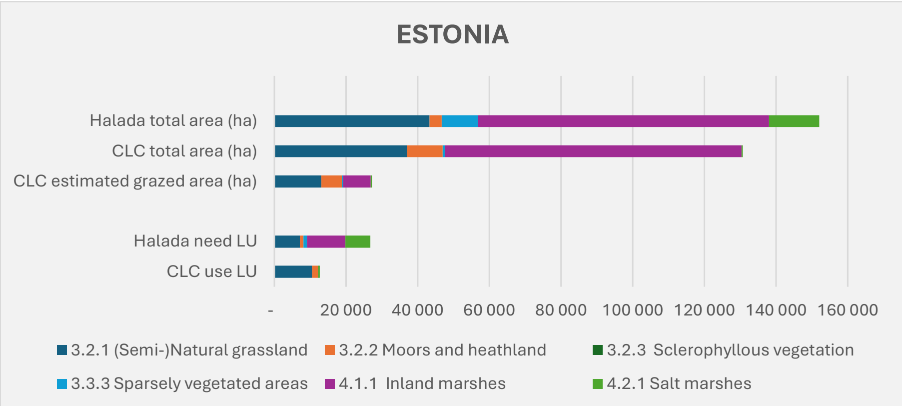

Figure A4. 6: Estonia - Comparison Halada needs and CLC use.

Finland

Table A4. 26: Finland - Comparison of Halada needs and CLC use.

FINLAND – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	240%	-	-	Not grazed
3.2.2	*Moors and heathland*	96%	-	-	
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	14%	-	-	

4.1.1	*Inland marshes*	-	-	-	
4.2.1	*Salt marshes*	47%	930%	465%	Mosaic, Abandonment
	total	89%	33649%	430%	

In Finland the 3.2.1 (Semi-)Natural Grasslands are mostly truly natural grasslands (i.e. not semi-natural) and for the sake of an estimate, our expert opinion is that essentially none is grazed by livestock (we did not consider the case of reindeer). The same is true for almost all of the apparently semi-natural CLC classes. The Halada estimates (using Estonian and Swedish values) are therefore unlikely to be valid in general. The one exception is 4.2.1 Salt marshes where the same issue as in Estonia and Sweden occurs, in that the major component of this group is in fact 1630 Boreal Baltic coastal meadows – not in any sense a saltmarsh habitat and one with completely different issues. Here the estimated undergrazing is likely to be a real phenomenon.

Other semi-natural pastures, also largely undergrazed in Finland according to the experts, and forming as they do part of a mosaic, will fall within various forest and 'non-semi-natural' inbye CLC classes such as 2.4.3. Land principally occupied by agriculture with significant areas of natural vegetation.

Table 2. Finland - CLC grazing estimates.

FINLAND – CLC grazing estimates								
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural grassland*	16 048	-	-	-	-	True natural grasslands, ungrazed
3.2.2	*Moors and heathland*	703 954	-	-	-	-	Only northern region
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	43 723	-	-	-	-	Only northern region
4.1.1	*Inland marshes*	31 527	1 482	5%	741	0.50	
4.2.1	*Salt marshes*	13 333	667	5%	666	1.00	
	total	808 585	2 149	0%	1 408	0.66	

Table A4. 27: Finland - Halada grazing expert estimates.

FINLAND – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat types**

3.2.1.	*(Semi-)Natural grassland*	38 440	2 025	0.05	6150 (Siliceous alpine and boreal grasslands)
3.2.2.	*Moors and heathland*	672 448	925	0.001	4060 (Alpine and boreal heaths)
3.2.3.	*Sclerophyllous vegetation*	-	-	-	
3.3.3.	*Sparsely vegetated areas*	6 050	5	0.001	8230 (Siliceous rock with pioneer vegetation)
4.1.1.	*Inland marshes*	-	-	-	
4.2.1.	*Salt marshes*	6 200	3 100	0.50	1630 (Boreal Baltic coastal meadows)
	total	723 138	6 055	0.01	

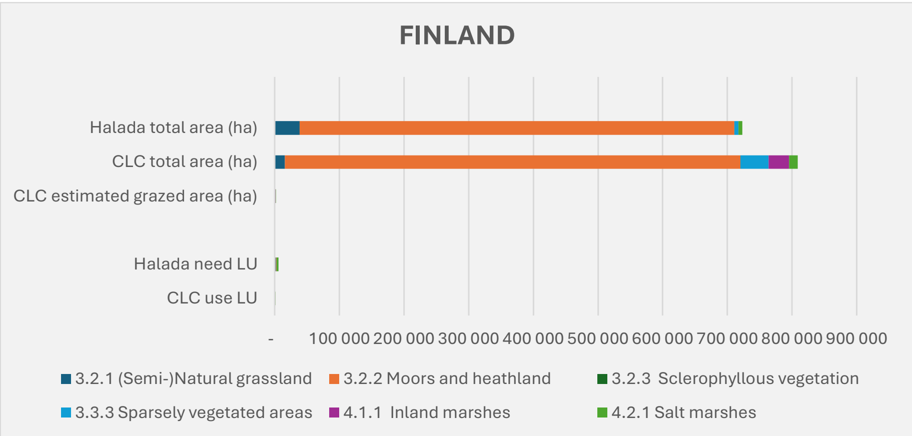

Figure A4. 7: Finland - Comparison of Halada needs and CLC use.

France

The team was unable to source expert knowledge on the CLC use side (updating previous information from various official data sources) but we cannot present data on the Halada side due to a lack of general precision in France's Article 17 report (see 2.2.2 above) alongside a lack of expert contacts who might enable us to narrow down those estimates. It would of course be very useful to have been able to carry out this exercise in the case of such a significant country for semi-natural habitats and grazing systems.

Germany

Table A4. 28: Germany - Comparison Halada needs and CLC use.

GERMANY – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1.	*(Semi-)Natural grassland*	169%	212%	27%	Pasture, Mowing
3.2.2.	*Moors and heathland*	67%	334%	604%	Mosaic
3.2.3.	*Sclerophyllous vegetation*	-	-	-	
3.3.3.	*Sparsely vegetated areas*	5%	51%	-	Non Halada significant
4.1.1.	*Inland marshes*	52%	527%	109%	Non Halada significant
4.2.1.	*Salt marshes*	102%	205%	205%	Abandonment, Mosaic
	total	116%	232%	62%	

The German data is complicated by a certain degree of uncertainty on the CLC side. It appears as if most of 3.2.1. (Semi-) Natural grasslands (with notable exceptions such as the Lünebergerheide, the Schwäbische Alb and the Alps) are mapped on military ranges, whereas it seems clear from comparing the Halada totals with the CLC classes that a significant area of semi-natural grasslands must have been classified as 2.3.1 Pasture in Corine. Given that plus the large proportion of Halada grasslands which possibly require no grazing (6410, 6510, 6520) but mowing, it is very difficult to make a meaningful assessment from the estimates. The question of management regimes which, while deemed sub-optimal in theory, might be most appropriate in practice was not one which had been foreseen and might be fruitfully re-examined with the national experts not only in Germany but in many other countries (e.g. CZ) where areas such as military ranges are significant refuges for semi-natural habitats.

The remaining heaths and moors are in most cases limited to nature reserves, possibly without grazing, or are small areas lost in the minimum mapping unit rules of Corine. Both 3.3.3. Sparsely vegetated areas and 4.1.1 Inland marshes are to a large extent made up by habitats that do not require any grazing and thus are not included in the Halada list. In addition, 4.1.1. Inland marshes are mostly found in eastern coastal regions and are probably not grazed due to historic reasons.

In the case of 3.2.2 Moors and Heathlands and possibly 4.2.1 Saltmarshes, it looks likely that there is significant undergrazing.

Table A4. 29: Germany - CLC grazing estimates.

GERMANY – CLC grazing estimates								
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural grassland*	164 771	131 531	80%	92 129	0.70	Military ranges, alpine region
3.2.2	*Moors and heathland*	94 250	18 831	20%	3 770	0.20	Limited to E & N, nature reserves
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	10 200	1 104	11%	110	0.10	Alpine region only
4.1.1	*Inland marshes*	42 200	4 132	10%	2066	0.50	Mainly E & coastal areas
4.2.1	*Salt marshes*	25 700	12 829	50%	7700	0.60	
total		337 121	168 427	50%	105 776	0.63	

Table A4. 30: Germany - Halada grazing expert estimates.

GERMANY – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural grassland*	278 769	24 427	0.09	6510 (Lowland hay meadows)
3.2.2	*Moors and heathland*	62 917	22 774	0.36	4030 (European dry heaths)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	560	-	-	8230 (Siliceous rock with pioneer vegetation)
4.1.1	*Inland marshes*	21 793	2 245	0.10	7140 (Transition mires and quaking bogs)
4.2.1	*Salt marshes*	26 288	15 773	0.60	1330 (Atlantic salt meadows)
	total	390 327	65 219	0.2	

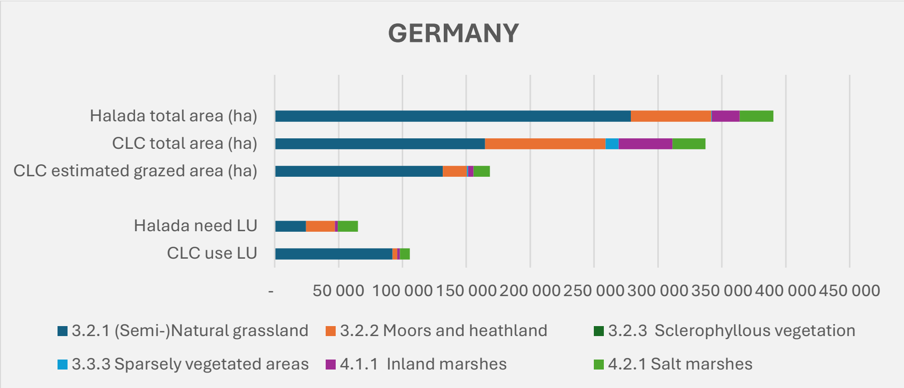

Figure A4. 8: Germany - Comparison of Halada needs and CLC use.

Greece

Table A4. 31: Greece - Comparison Halada needs and CLC use.

GREECE – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	26%	35%	142%	Overmapping of 3.2.1 (see text below)
3.2.2	*Moors and heathland*	32%	108%	1680%	Mosaic
3.2.3	*Sclerophyllous vegetation*	46%	114%	327%	Non Halada signifcant
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	2%	29%	400%	Non Halada significant
4.2.1	*Salt marshes*	-	-	-	
	total	11%	22%	50%	

In Greece, two sets of experts were involved in the CLC discussions; after a joint webinar, consensus was reached on the best estimate for the overall grazing situation. The Halada experts were a different group and a second webinar was held to attempt a final agreement between them and the grazing specialists. One issue arising was that the conventional way of expressing grazing capacity in Greece did not conform to the way we asked experts to express it and it is fair to say that we are still not completely sure that we share a common understanding in the case of the Halada 'needs' (Table 2.14).

Taking that as an important caveat, some important questions were raised by our experts. Firstly, there was bafflement as to why the area totals for 3.2.1 (Semi-)Natural Grassland and the apparently corresponding Halada habitats differed to the degree that they did, with over three times as much CLC as Halada area. One thing noted was that on some of the Aegean islands (see Fig. 2.14), areas mapped as 3.2.1 (Semi-) Natural Grasslands were in fact 5420 Sarcopoterium spinosum phryganas (a very short vegetation community). Given that Article 17 declares up to 764,577 ha of this habitat, it is even possible that this alone can explain the discrepancy.

Second, the colleagues noted that in the case of 3.2.2 Sclerophyllous Vegetation, there are at least three significant non-Halada scrub or scrubby woodland habitats which would have been taken into account in the CLC estimates, namely:

- 5110 Stable xerothermophilous formations with Buxus sempervirens on rocky slopes (Berberidion p.)
- 9250 Quercus trojana woods
- 9560* Endemic forests with Juniperus spp

However, the total area for declared for these habitats in the Greek Article 17 report is only 30,706 ha, so these are unlikely to have caused aberrations of the scale needed to change the estimates significantly.

What then can be concluded from the data? In the case of 3.2.1 (Semi-)Natural Grassland, probably not that much – the overestimation is so large that it swamps any underlying pattern. The experts' view is that the situation for grasslands is the closest to the optimum, with a large degree of variation, but with a possible slight undergrazing overall.

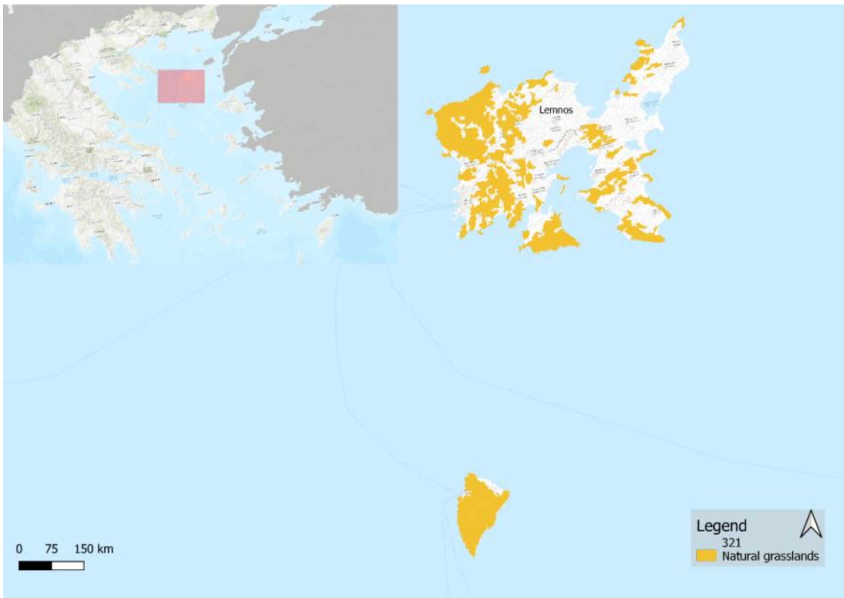

Figure A4. 9: Distribution of 321 Natural grasslands in Lemnos – areas mostly 5420 Sarcopoterium phrygana, according to the experts.

Sclerophyllous vegetation is similarly problematic. Here again, CLC has a much higher total than the apparently corresponding Halada area, and three-quarters of that Halada area is made up of 5420, which is suggested to be mapped as 3.2.1 (Semi-)Natural Grasslands! Thus, it is not possible draw any conclusions from the data. In this case, the experts are of the opinion that these habitats are almost everywhere undergrazed or ungrazed (Fig. 2.15.).

Table A4. 32: Greece - CLC grazing estimates.

GREECE – CLC grazing estimates								
CLC Code	CLC Name	CLC total area (ha)	CLC estimated grazed area		CLC LU	CLC LU/ha (est. grazed area)	Comments
			ha	%			
3.2.1	*(Semi-)Natural grassland*	977 576	729 960	75%	364 980	0.50	
3.2.2	*Moors and heathland*	51 011	15 313	30%	3 828	0.25	Mountain regions
3.2.3	*Sclerophyllous vegetation*	2 322 216	930 524	40%	279 157	0.30	
3.3.3	*Sparsely vegetated areas*	281 034	82 757	29%	8 276	0.10	Mountains, coastal areas, mainly nature reserves
4.1.1	*Inland marshes*	23 611	1 245	5%	498	0.40	
4.2.1	*Salt marshes*	33 860	1 675	5%	838	0.50	

total	3 689 308	1 761 473	48%	657 577	0.37	

Table A4. 33: Greece - Halada grazing expert estimates.

GREECE – ‚Halada‘ grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada‘ area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural grassland*	255 014	517678	2.03	6220 (Pseudo-steppe with grasses)
3.2.2	*Moors and heathland*	16 487	64 299	3.90	4060 (Alpine and Boreal heaths)
3.2.3	*Sclerophyllous vegetation*	1 061 233	911914	0.86	5420 (Sarcopoterium spinosum phryganas)
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	359	1992	5.55	7210 (Calcareous fens)
4.2.1	*Salt marshes*	-	-	-	
	total	390 327	328 107	0.8	

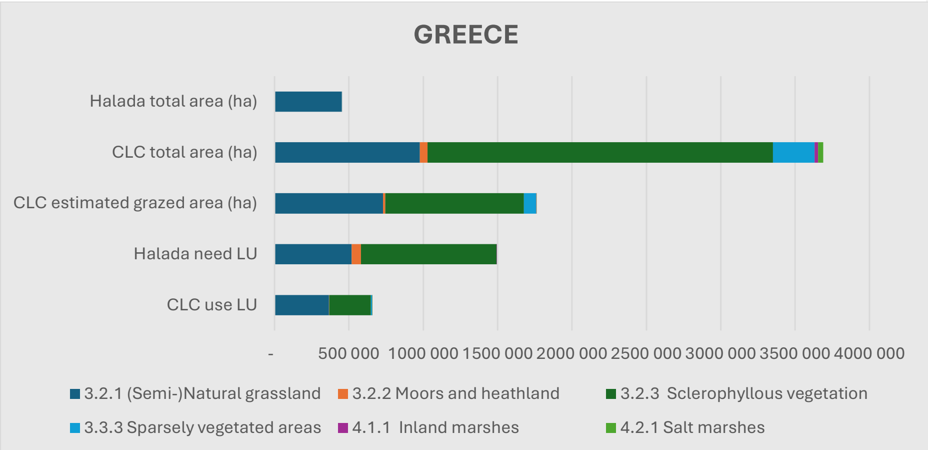

Figure A4. 10: Greece - Comparison Halada needs and CLC use.

Hungary

Table A4. 34: Hungary - Comparison Halada needs and CLC use.

HUNGARY – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	197%	246%	258%	Mosaic, Mowing, Pasture
3.2.2	*Moors and heathland*	-	-	-	
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	2%	47%	62%	Non Halada significant, (Mowing)
4.2.1	*Salt marshes*	-	-	-	
	total	147%	242%	256%	

In Hungary as in many other countries, the area of 3.2.1 (Semi-)Natural Grassland is much lower than that of the corresponding Halada habitats. The usual explanations can be brought to bear – small areas being generalised out into 2.1.1 Non-irrigated Arable (the dominant class over large parts of the Hungarian plain); 3.2.1 (Semi-)Natural Grassland being largely recognised in National Parks and military zones, while grasslands elsewhere are almost always mapped as 2.3.1 Pastures; possibly, some fluvial meadows (especially those not under current management) being mapped as 4.1.1 Inland Marshes. However, it should be noted that even the area of 1530 Pannonic salt steppes and salt marshes (not a habitat likely to be much affected by the issues listed) is greater by itself than the whole of the CLC 3.2.1 (Semi-)Natural Grassland area.

Similarly, there is a large 'surplus' of CLC 4.1.1 Inland Marshes compared to the marshy Halada habitats. In this case there may be significant areas of non-Halada habitats included, as well as a possibility of some of the 6440 Alluvial meadows of the Cnidion dubii being misclassified.

All in all, the discrepancies in the data makes reaching definite conclusions difficult. Having said that, it is difficult to imagine that the Halada estimates are that wildly wrong; one must assume rather that the grasslands are rather fragmentary and disappear in CORINE's process of generalisation. Thus it seems likely that there is a significant undergrazing issue on the Halada habitats.

Table A4. 35: Hungary - CLC grazing estimates.

HUNGARY – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural grassland*	229 059	183 659	80%	73 464	0.40	Nature reserves, military zones
3.2.2	*Moors and heathland*	-	-	-	-	-	
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	2 854	-	-	-	-	
4.1.1	*Inland marshes*	77 745	3 872	5%	1161	0.30	Fluvial meadows
4.2.1	*Salt marshes*	-	-	-	-	-	
total		309 658	187 532	61%	74 625	0.40	

Table A4. 36: Hungary – Halada grazing expert estimates

HUNGARY – ‚Halada‘ grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada‘ area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural grassland*	451 360	189 838	0.42	1530 (Pannonic salt steppes)
3.2.2	*Moors and heathland*	1 559	462	0.30	5130 (Juniperus communis formations)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	10	-	-	
4.1.1	*Inland marshes*	1 810	720	0.40	7210 (Calcareous fens)
4.2.1	*Salt marshes*	-	-	-	
	total	454 739	191 020	0.4	

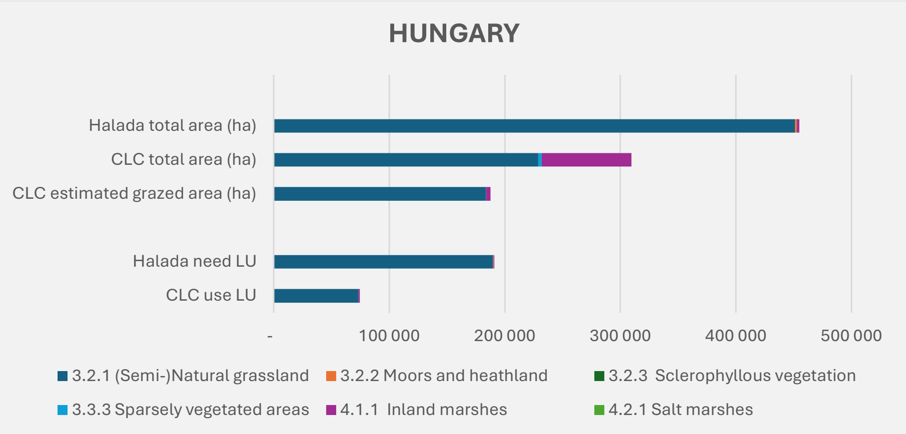

Figure A4. 11: Hungary - Comparison Halada needs and CLC use.

Ireland

Table A4. 37: Ireland - Comparison Halada needs and CLC use.

IRELAND – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	12%	13%	8%	Non Halada significant
3.2.2	*Moors and heathland*	238%	251%	293%	Mapped as 4.1.2. Peat bogs (see text)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	57%	572%	1143%	Mosaic
4.1.1	*Inland marshes*	120%	240%	170%	Mosaic
4.2.1	*Salt marshes*	51%	102%	164%	Mosaic
	total	142%	199%	152%	

The semi-natural CLC classes in Ireland which contain most of the livestock in Ireland are 3.2.1 (Semi-)Natural Grassland and 3.2.2 Moors and Heathlands. For the former, the Halada area is much lower than the CLC area. For the latter, the opposite is the case. This reflects:

The presence of significant areas of non-Halada grassland habitats (upland acid grasslands in particular)

Likely, the interpretation of some CLC 'grasslands' as 'degraded' Annex I heathlands for Article 17 reporting purposes

The picture for 3.3.3. Sparsely Vegetated Areas, 4.1.1. Inland Marshes and 4.2.1. Salt Marshes is more ambiguous, but the totals involved are modest and the big picture is unaffected. Generally speaking, the corresponding habitats are small areas which are in mosaic with more intensively used classes and thus not mapped separately.

Overall, there is a broad balance between livestock densities and needs at the national average level (while still allowing for the possibility of the mix of livestock types and its distribution being sub-optimal).

Table A4. 38: Ireland - CLC grazing estimates.

IRELAND – CLC grazing estimates								
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural grassland*	48 419	45 998	95%	27 588	0.60	
3.2.2	*Moors and heathland*	125 896	119 601	95%	23 921	0.20	
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	55 971	5 597	10%	560	0.10	
4.1.1	*Inland marshes*	24 513	12 257	50%	3675	0.30	
4.2.1	*Salt marshes*	5 320	2 660	50%	1325	0.50	
total		260 119	186 113	72%	57 069	0.31	

Table A4. 39: Ireland - Halada grazing expert estimates.

IRELAND – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural grassland*	5 961	2 192	0.37	21A0 (Machairs), but non-Halada habitats dominate
3.2.2	*Moors and heathland*	299 977	70 008	0.23	4010 (Northern Atlantic wet heaths), 4030 (European dry heaths)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	32 005	6 401	0.20	8240 (Limestone pavements)
4.1.1	*Inland marshes*	29 386	6 238	0.21	7230 (Alkaline fens)
4.2.1	*Salt marshes*	2 719	2 175	0.80	1330 (Atlantic salt meadows)

	total	370 048	87 014	0.2	

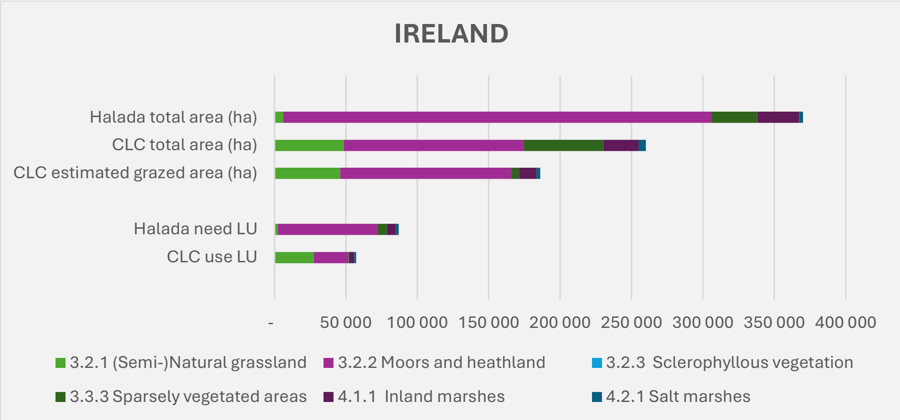

Figure A4. 12: Ireland - Comparison of Halada needs and CLC use.

Italy

Table A4. 40: Italy - Comparison Halada needs and CLC use.

ITALY – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural grassland*	293%	517%	201%	Mosaic, Abandonment
3.2.2	*Moors and heathland*	133%	2053%	2091%	Mosaic, Abandonment
3.2.3	*Sclerophyllous vegetation*	33%	220%	400%	„Overmapped“ (see text)
3.3.3	*Sparsely vegetated areas*	3%	25%	-	
4.1.1	*Inland marshes*	80%	3566%	-	Mosaic
4.2.1	*Salt marshes*	0%	-	-	
	total	94%	402%	206%	Uncertainty

For the CLC classes a webinar with a number of national experts was held. A major issue was the extreme variation between north and south, which was dealt with by essentially producing two different sets of estimates. For Halada, there was no a national expert available and data was attempted to be extrapolate from neighbouring countries. However, the Article 17 reporting was extremely imprecise to the point of being unusable for the Mediterranean part of the country.

Comparing the total areas of the CLC classes and their corresponding Halada habitats, a number of striking discrepancies emerge. First, CLC 3.2.1 (Semi-)Natural Grasslands is only around one third of the apparent Halada total. This CLC class concentrated in the mountainous areas and nature reserves, thus subject to abandonment.

Second, 3.2.2 Moors and Heathlands occupy a higher area according to Article 17 than the corresponding CLC class. This category is limited almost exclusively to the Alpine zone and the discrepancy can be understood in terms of CLC generalisation.

Third, 3.2.3 Sclerophyllous Vegetation is apparently massively over-recorded in CLC (by three times over). While it is tempting to imagine that CLC has therefore largely been classifying 3.2.1 (Semi-)Natural Grasslands as Sclerophyllous Vegetation (perhaps in a mosaic in the southern parts of the Italian mainland, the maps of the CLC classes show this to be very unlikely. Very strangely, 3.2.3 is mapped almost exclusively on Sardinia, where it dominates the island. In contrast, range maps for the commonest Halada sclerophyllous scrub habitat (5330) shows a much wider distribution (Fig. 2.20.1. and Fig. 2.20.2.). The most likely explanation for any real discrepancy (as opposed to the effects of data imprecision) is classification of mosaics as forest.

It is not possible to draw any conclusions from the table, but the impression is that as in other Mediterranean countries, there is likely to be an underutilisation of many or most semi-natural habitats.

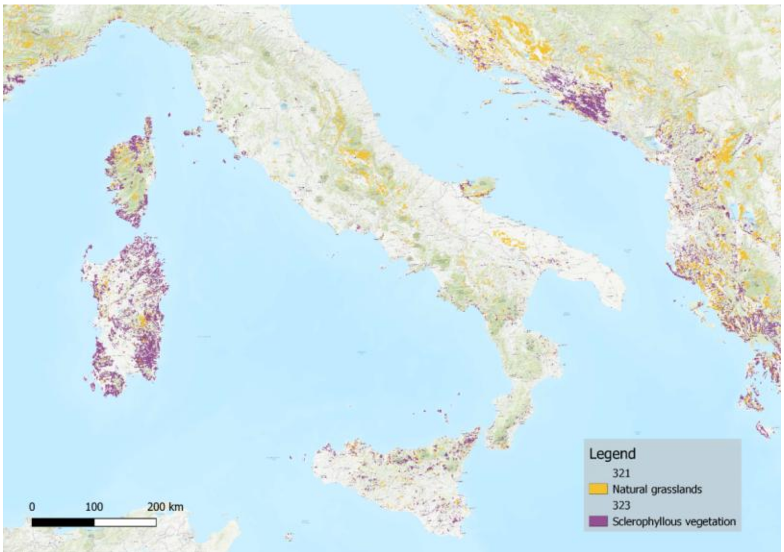

Figure A4. 13: Distribution of CLC class 321 Natural grassland (orange) and 323 Sclerophyllous vegetation (purple) in Southern Italy.

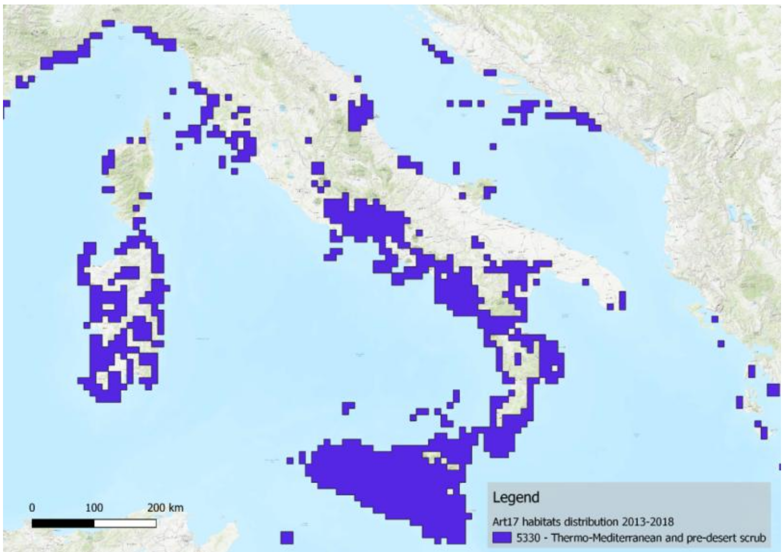

Figure A4. 14: Distribution of Art 17 habitat 5330 Thermo Mediterranean and pre-desert scrub (purple) in Southern Italy.

Table A4. 41: Italy - CLC grazing estimates.

ITALY – CLC grazing estimates

CLC Code	CLC Name	CLC total area (ha)	CLC estimated grazed area		CLC LU	CLC LU/ha (est. grazed area)	Comments
			ha	%			
3.2.1	*(Semi-)Natural grassland*	761 846	431 496	57%	308 134	0.71	Mountainous areas, nature reserves
3.2.2	*Moors and heathland*	163 606	10 585	6%	3 121	0.29	Mainly Alpine zone
3.2.3	*Sclerophyllous vegetation*	997 160	147 234	15%	9852.687	0.07	Mostly in Sardinia
3.3.3	*Sparsely vegetated areas*	1 000 735	109 753	11%	31 153	0.28	Mountainous areas
4.1.1	*Inland marshes*	18 818	422	2%	0	0.03	
4.2.1	*Salt marshes*	39 413	-	-	-	-	Mostly limited to Gulf of Venice
	total	2 981 578	699 491	23%	352 261	0.50	

Table A4. 42: Italy - Halada grazing expert estimates.

ITALY – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1.	*(Semi-)Natural grassland*	2 230 802	620 705	0.28	6210 (Semi-natural dry grasslands and scrubland facies)
3.2.2.	*Moors and heathland*	217 362	65 247	0.30	4060 (Alpine and Boreal heaths)
3.2.3.	*Sclerophyllous vegetation*	324 164	39 384	0.12	5330 (Thermo-Mediterranean and pre-desert scrub)
3.3.3.	*Sparsely vegetated areas*	27 246	-	-	8240 (Limestone pavements)
4.1.1.	*Inland marshes*	15 052	1 013	0.07	7230 (Alkaline fens)
4.2.1.	*Salt marshes*	4	0	0.08	1340 (Inland salt meadows)
	total	2 814 630	726 349	0.3	

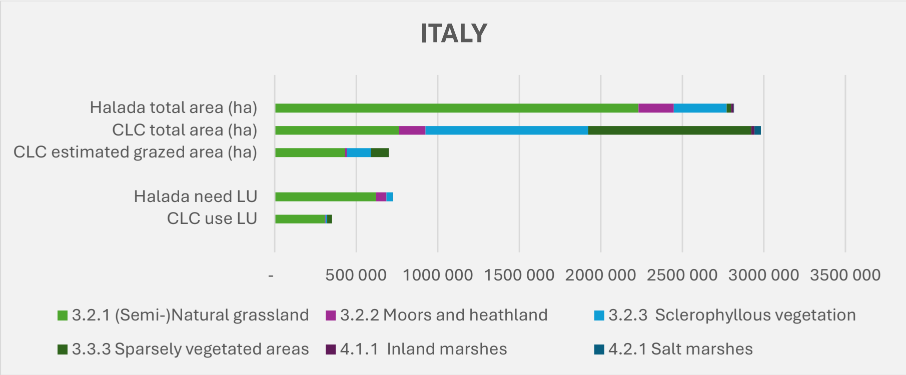

Figure A4. 15: Italy - Comparison of Halada needs and CLC use.

Latvia

Table A4. 43: Latvia - Comparison Halada needs and CLC use in Latvia.

LATVIA – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1.	*(Semi-)Natural Grasslands*	622%	2498%	369%	Pasture, Mosaic
3.2.2.	*Moors and heathland*	0%	-	-	Mosaic
3.2.3.	*Sclerophyllous vegetation*	-	-	-	
3.3.3.	*Sparsely vegetated areas*	-	-	-	
4.1.1.	*Inland marshes*	63%	124796%	0%	Non Halada significant, (Mowing)
4.2.1.	*Salt marshes*	0%	-	-	Mosaic
	total	221%	3090%	379%	

In Latvia a national expert guided the work on the CLC side, but Estonian statistics were also used. On the Halada side, national published data[6] was again compared with our Estonian estimates.

There would seem to be a clear CLC interpretation issue underlying the fact that the total area of 3.2.1 (Semi-)Natural Grassland (the predominant semi-natural class) is much lower than that of the corresponding Halada habitats. 3.2.1 (Semi-)Natural Grassland is being mapped

[6] Rūsiņa S. (Ed.) 2017. Protected Habitat Management Guidelines for Latvia. Volume 3. Semi-natural grasslands. Nature Conservation Agency, Sigulda.

only on floodplains (and then only on a subset); inspection of Google Earth imagery suggests that most semi-natural grasslands seem to being mapped as 2.3.1 Pastures.

3.2.2. Moors and heathlands is mostly mapped as small areas and due to the CLC minimal mapping unit rules mostly "lost" within more dominant, forest classes.

The strong message from the local expert was of underuse of semi-natural habitats, which is completely credible. However it cannot be shown definitively from the data collected because the vast majority of the Halada habitat is in areas which are mapped as non-semi-natural CLC classes (e.g. 2.4.1. Complex cultivation patterns; 2.4.3. Land principally occupied by agriculture with significant areas of natural vegetation), where the project has no data on livestock density.

Table A4. 44: Latvia - CLC grazing estimates.

LATVIA – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural Grasslands*	9 236	2 300	25%	1 840	0.80	floodplains
3.2.2	*Moors and heathland*	-	-	-	-	-	
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	3 548	-	-	-	-	
4.1.1	*Inland marshes*	19 522	10	0%	0	0.00	Mostly nature reserves
4.2.1	*Salt marshes*	-	-	-	-	-	
	total	32 306	2 310	7%	1 840	0.80	

Table A4. 45: Latvia - Halada grazing expert estimates.

LATVIA – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural Grasslands*	57 460	6 797	0.12	6270 (Fennoscandian lowland species-rich dry to mesic grasslands)
3.2.2	*Moors and heathland*	1 407	14	0.01	4010 (Northern Atlantic wet heaths)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	12 230	0	0.00	7140 (Transition mires and quaking bogs)

4.2.1	*Salt marshes*	270	162	0.60	16390 (Boreal baltic coastal meadows)
	total	71 367	6 973	0.1	

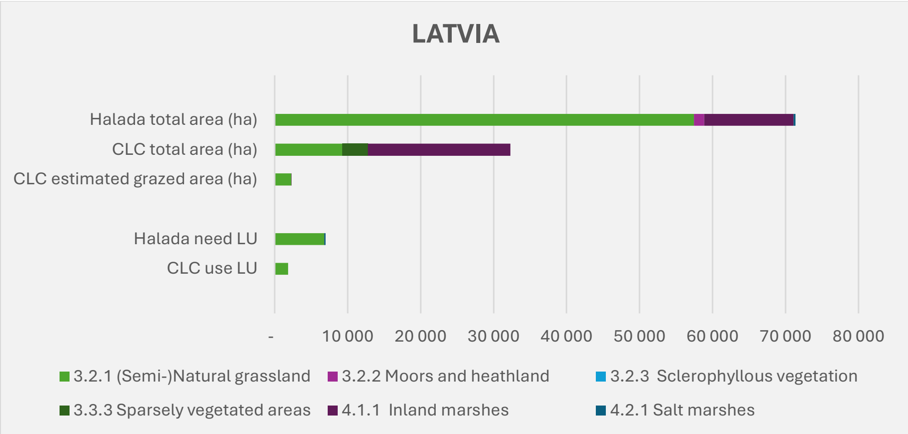

Figure A4. 16: Latvia - Comparison Halada needs and CLC use

Lithuania

Table A4. 46: Lithuania - Comparison Halada needs and CLC use.

LITHUANIA – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural Grasslands*	2208%	4666%	555%	Pasture, Mosaic
3.2.2	*Moors and heathland*	7%	166%	96%	Mosaic
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	43%	112%	9%	
4.2.1	*Salt marshes*	-	-	-	
	total	319%	967%	158%	

National expertise was used for the CLC estimates, but for the Halada work Latvian and Estonian numbers were combined

The strong impression from the comparison of areas and inspection of satellite and Google Streetview images is that the same pattern is apparent in Lithuania as in Latvia, namely that very few areas of likely semi-natural grass vegetation are mapped as 3.2.1 (Semi-)Natural Grasslands and that the corresponding habitats (the largest in area is 6510, followed by 6270 – both typical 'inbye' vegetation communities) are being interpreted as 2.3.1 Pastures. With that in mind, it is impossible to draw conclusions from the table, but undergrazing of the less productive semi-natural habitats is highly likely.

Table A4. 47: Lithuania - CLC grazing estimates.

LITHUANIA – CLC grazing estimates								
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural Grasslands*	3 402	1 610	47%	1 288	0.80	Very small areas
3.2.2	*Moors and heathland*	3 011	130	4%	39	0.30	Nature reserves
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	1 991	-	-	-	-	
4.1.1	*Inland marshes*	17 630	6 840	39%	3420	0.50	
4.2.1	*Salt marshes*	-	-	-	-	-	
	total	26 034	8 580	33%	4 747	0.55	

Table A4. 48: Lithuania - Halada grazing expert estimates.

LITHUANIA – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural Grasslands*	75 126	7 151	0.10	6270 (Fennoscandian lowland species-rich dry to mesic grasslands)
3.2.2	*Moors and heathland*	216	38	0.17	5130 (Juniperus communis formations)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	7 660	305	0.04	7140 (Transition mires and quaking bogs)
4.2.1	*Salt marshes*	-	-	-	
	total	83 002	7 493	0.1	

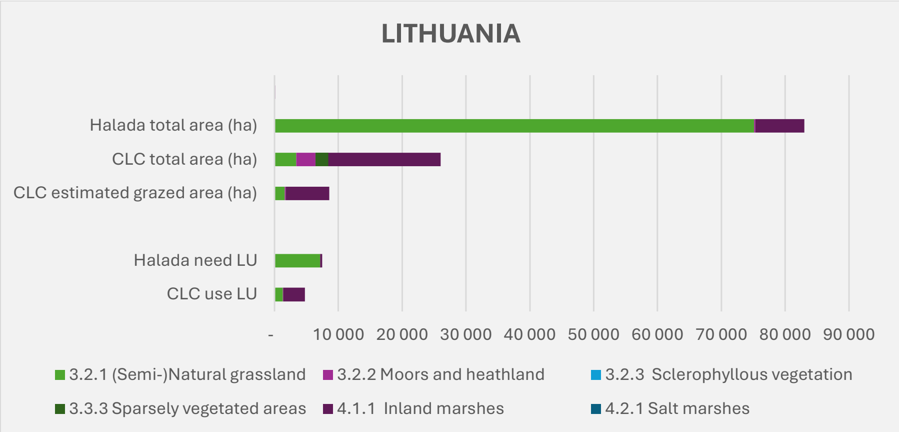

Figure A4. 17: Lithuania - Comparison Halada needs and CLC use.

Luxembourg

Table A4. 49: Luxembourg - Comparison Halada needs and CLC use.

LUXEMBOURG – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural Grasslands*	-	-	-	Pasture, Mosaic
3.2.2	*Moors and heathland*	-	-	-	
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	-	-	-	
4.2.1	*Salt marshes*	-	-	-	
	total	0%	0%	0%	

Luxembourg records no CLC semi-natural area. This is due to the largest Halada habitat by far being 6510 Lowland meadows, accounting for 98% of the total area. This will have been classified with 2.3.1 Pastures or other 'agricultural' classes. It is nevertheless quite a significant area for a small country. The expert view from neighbouring countries was that 6510 does not require grazing, but this, as in those same nearby MS, raises the possibility that management which is not required may nevertheless be acceptable, or even most appropriate in many circumstances. Are all of Luxembourg's 'meadows' actually meadows, or are many patches on land which is managed by grazing or perhaps was never in fact mown? This question was not anticipated, but could be usefully discussed with national experts.

Table A4. 50: Luxembourg - CLC grazing estimates.

LUXEMBOURG – CLC grazing estimates							
CLC Code	CLC Name	CLC total area (ha)	CLC estimated grazed area		CLC LU	CLC LU/ha (est. grazed area)	Comments
			ha	%			
3.2.1	*(Semi-)Natural Grasslands*	-	-	-	-	-	
3.2.2	*Moors and heathland*	-	-	-	-	-	
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	-	-	
4.1.1	*Inland marshes*	-	-	-	-	-	
4.2.1	*Salt marshes*	-	-	-	-	-	
total		0	0	0%	0	0.00	

Table A4. 51: Luxembourg - Halada grazing expert estimates Luxembourg.

LUXEMBOURG – ‚Halada' grazing expert estimates					
CLC Code	CLC Name	Corresponding ‚Halada' area (ha)	Halada LU	Halada LU/ha	Main habitat type
3.2.1	*(Semi-)Natural Grasslands*	16 939	87	0.01	6510 (Lowland hay meadows)
3.2.2	*Moors and heathland*	20	1	0.05	4030 (European dry heaths)
3.2.3	*Sclerophyllous vegetation*	8	0	0.00	
3.3.3	*Sparsely vegetated areas*	8	0	0.00	8230 (Siliceous rock with pioneer vegetation)
4.1.1	*Inland marshes*	1	0	0.00	7140 (Transition mires and quaking bogs)
4.2.1	*Salt marshes*	-	-	-	
	total	16 976	88	0.0	

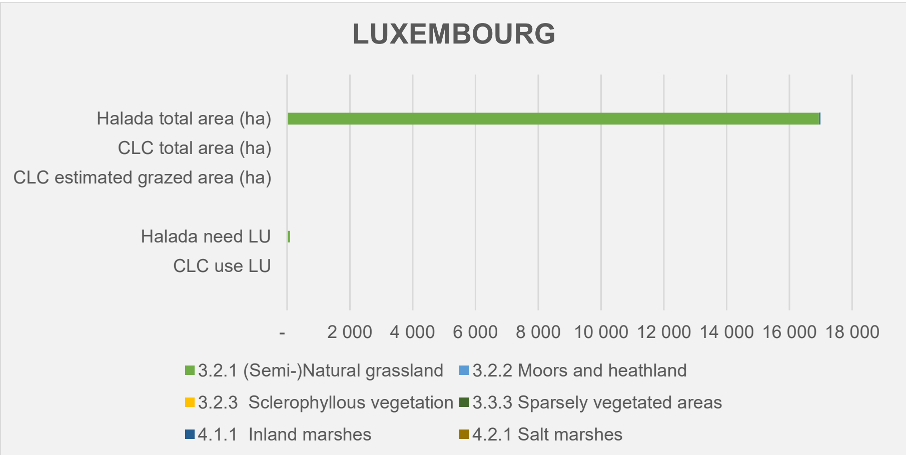

Figure A4. 18: Luxembourg - Comparison Halada needs and CLC use.

Netherlands

Table A4. 52: Netherlands - Comparison Halada needs and CLC use.

NETHERLANDS – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural Grasslands*	9%	13%	3%	Mapping (see text)
3.2.2	*Moors and heathland*	102%	683%	643%	Mapping (see text)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	5%	51%	0%	Non Halada significant
4.2.1	*Salt marshes*	111%	551%	551%	Not grazed ?
	total	54%	161%	72%	

The map of the Netherlands CLC classes is interesting. 3.2.1 (Semi-)Natural Grasslands are almost exclusively a coastal phenomenon, clearly linked to stabilised sand behind active dune systems. In the Halada list, the commonest habitat (albeit with a small area) is the 6430 Hydrophilous fringe communities, but hardly any of these are mapped as 3.2.1. On the other hand, most of the communities which might be expected where 3.2.1 (Semi-)Natural Grasslands are mapped (2140, 2150, 2160, 2170, as well as the very extensive 2130 which is surprisingly not on the Halada list) should, according to the Halada crosswalk, be mapped as 3.2.2 Moors and Heathlands. In the Netherlands, that CLC class is restricted to inland heaths.

The situation with grasslands is for that reason somewhat unclear from the data we gathered. However it is clear that moorland is significantly undergrazed or ungrazed as, it appears, are 4.2.1. Salt marshes, which are commonly not grazed in the Netherlands... 4.1.1. Inland Marshes is as always a rather ambiguous class, as it is mostly comprised of non-Halada habitats.

Table A4. 53: Netherlands - CLC grazing estimates.

NETHERLANDS – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural Grasslands*	50 220	35 154	70%	22 850	0.65	mostly coastal area
3.2.2	*Moors and heathland*	41 081	6 157	15%	924	0.15	Nature reserves
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	-	-	
4.1.1	*Inland marshes*	38 228	3 823	10%	1911.4	0.50	Coastal areas
4.2.1	*Salt marshes*	9 767	1 961	20%	1961.4	1.00	
total		139 296	47 095	34%	27 647	0.59	

Table A4. 54: Netherlands - Halada grazing expert estimates.

NETHERLANDS – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural Grasslands*	4 662	694	0.15	6430 (Hydrophilous tall herb fringe communities of plains)
3.2.2	*Moors and heathland*	42 070	5 945	0.14	4030 (European dry heaths)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	-	-	-	
4.1.1	*Inland marshes*	1 931	0	0.00	7130 (Transition mires)
4.2.1	*Salt marshes*	10 800	10 800	1.00	1330 (Atlantic salt meadows)
	total	75 763	19 884	0.3	

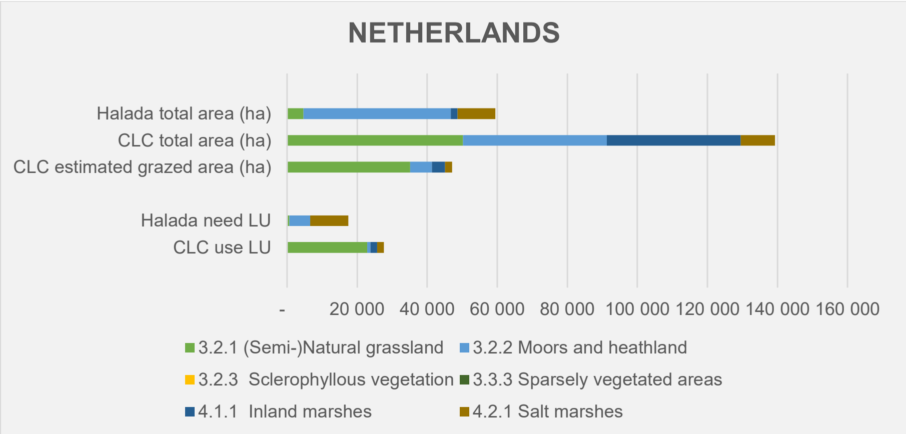

Figure A4. 19: Netherlands - Comparison Halada needs and CLC use.

Poland

Table A4. 55: Poland - Comparison Halada needs and CLC use.

POLAND – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural Grasslands*	3014%	6392%	67%	Mosaic, Mowing, Pasture
3.2.2	*Moors and heathland*	240%	576%	720%	Mosaic
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	0%	4%	0%	
4.1.1	*Inland marshes*	57%	288%	87%	Abandonment
4.2.1	*Salt marshes*	-	-	-	
	total	624%	2450%	99%	

There was very little expert help for Poland. The team produced estimates for the CLC work while Slovakian, German and European summary values were used for the Halada work.

The striking feature of the Polish table is the apparent huge under-recording of 3.2.1 (Semi-)Natural Grassland compared to its Halada counterpart habitats. By far the most extensive of those is 6510 Lowland hay meadows, which does not necessarily require grazing. Inspection of satellite images in areas which are central to the range of this habitat according to the Article 17 report shows that grasslands in general are concentrated on floodplains and adjacent low-lying areas. These are universally mapped as 2.3.1 Pastures.

Apparent under-recording of 3.2.2 Moors and Heathland could be explained by CLC generalisation since 4030 European dry heaths, for example, seem to exist in rather small areas within mosaics.

In conclusion, we are unable to draw any definitive meaningful conclusions. While the pattern of fragmentary Halada habitats being ‘hidden’ in the CLC generalisation is one shared by other countries in the region, the trend towards land abandonment seen there is not as strong in Poland. The fate of small areas of meadow or pasture in the wider agricultural landscape is therefore far from clear and it is regrettable that the project was not able to work with Polish experts to shed further light on this question.

Table A4. 56: Poland - CLC grazing estimates.

POLAND – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural Grasslands*	27 148	12 800	47%	10 240	0.80	Floodplains, nature reserves
3.2.2	*Moors and heathland*	5 633	2 350	42%	705	0.30	
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	7 198	780	11%	78	0.10	
4.1.1	*Inland marshes*	102 850	20 430	20%	10215	0.50	
4.2.1	*Salt marshes*	-	-	-	-	-	Not mapped
total		142 829	36 360	25%	21 238	0.58	

Table A4. 57: Poland - Halada grazing expert estimates.

POLAND – ‚Halada‘ grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada‘ area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural Grasslands*	818 209	6 876	0.01	6510 (Lowland hay meadows)
3.2.2	*Moors and heathland*	13 525	5 076	0.38	4030 (European dry heaths)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	31	0	0.00	8230 (Siliceous rock with pioneer vegetation)

4.1.1	*Inland marshes*	58 861	8 896	0.15	7140 (Transition mires), 7230 (Alkaline fens)
4.2.1	*Salt marshes*	345	207	0.60	1330 (Atlantic salt meadows)
	total	890 971	21 055	0.0	

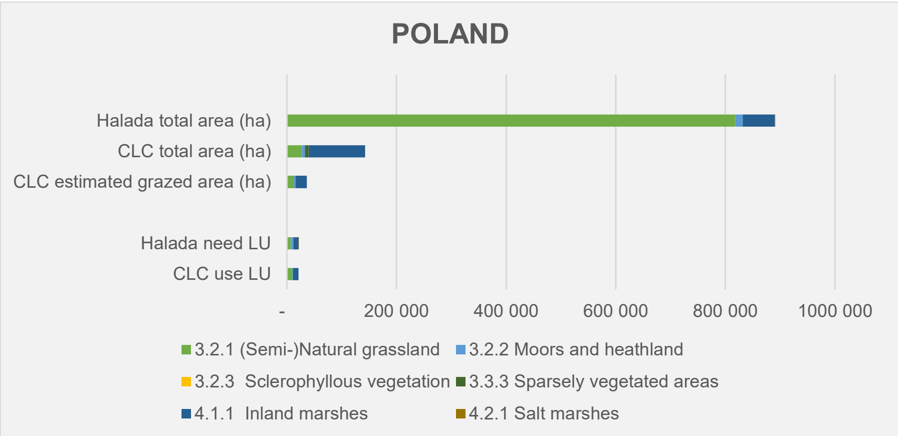

Figure A4. 20: Poland - Comparison of Halada needs and CLC use.

Portugal

Expert knowledge was sourced on the CLC use side (updating previous information from various official data sources) but no data can be presented on the Halada side due to a lack of general precision in Portugal's Article 17 report in the case of non-Macaronesian habitats, alongside a lack of expert contacts who might enable the narrowing down of those estimates.

Romania

Expert knowledge was sourced on the CLC use side but independent data cannot be presented on the Halada side, despite having expert input on the habitats' grazing 'needs', due to a lack of general precision in Romania's Article 17 report. Romania brings together many BGR, making generalising Halada estimates and applying them to CLC totals very difficult indeed; unlike in FR, PT and IT, it was not attempted. It is a regrettable situation that one of the most important countries for grazed semi-natural communities in the whole of Europe has such poor data on which to base its policies and the reporting of the legal obligations to which it has bound itself.

Slovakia

Table A4. 58: Slovakia - Comparison Halada needs and CLC use.

SLOVAKIA – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural Grasslands*	809%	1097%	700%	Pasture, Mowing, Mosaic
3.2.2	*Moors and heathland*	102%	0%	0%	
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	1%	19%	0%	
4.1.1	*Inland marshes*	30%	0%	0%	Not grazed
4.2.1	*Salt marshes*	-	-	-	
	total	454%	1170%	924%	

As in many other countries, there is a huge under-recording of 3.2.1 (Semi-)Natural Grasslands compared to the corresponding Halada habitats areas declared under Article 17. And again, the largest of those habitats by far is 6510 Lowland hay meadows (75% of the total). Looking at the distribution of 3.2.1 (Semi-)Natural grassland, it is largely mapped above the tree line in the various mountain ranges, with the few exceptions being Natura sites, many of them apparently on former military areas (where they seem at times to be indicating sandy habitats which should, according to the Halada crosswalk, be mapped as 3.2.2 Moors and Heathlands). 6510 is in all probability mapped as 2.3.1 Pastures or other 'agricultural' CLC classes, such as 2.4.2. Complex cultivation patterns.

Given this lack of correspondence between our data sources, it is not possible to draw meaningful conclusions from the data. Slovakia had a very detailed and regularly maintained national dataset of grasslands, used at least for a period to underpin a grasslands agri-environment scheme. This may be something worth following up.

Table A4. 59: Slovakia - CLC grazing estimates.

SLOVAKIA – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural Grasslands*	26 269	19 370	74%	3 874	0.20	Mountainous areas
3.2.2	*Moors and heathland*	15 230	0	0%	0	0.00	Mountain tops and border areas, nature reserves
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	5 148	220	4%	22	0.10	Mostly in Tatra, nature reserves
4.1.1	*Inland marshes*	3 901	0	0%	0	0.00	

4.2.1	*Salt marshes*	-	-	-	-	-	
	total	50 548	19 590	39%	3 896	0.20	

Table A4. 60: Slovakia - Halada grazing expert estimates.

SLOVAKIA – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1.	*(Semi-)Natural Grasslands*	212 532	27 116	0.13	6510 (Lowland hay meadows)
3.2.2.	*Moors and heathland*	15 546	8 605	0.55	5130 (Juniperus communis formations)
3.2.3.	*Sclerophyllous vegetation*	-	-	-	
3.3.3.	*Sparsely vegetated areas*	42	0	0.00	8230 (Siliceous rock with pioneer vegetation)
4.1.1.	*Inland marshes*	1 162	264	0.23	7230 (Alkaline fens)
4.2.1.	*Salt marshes*	-	-	-	
	total	229 282	35 986	0.2	

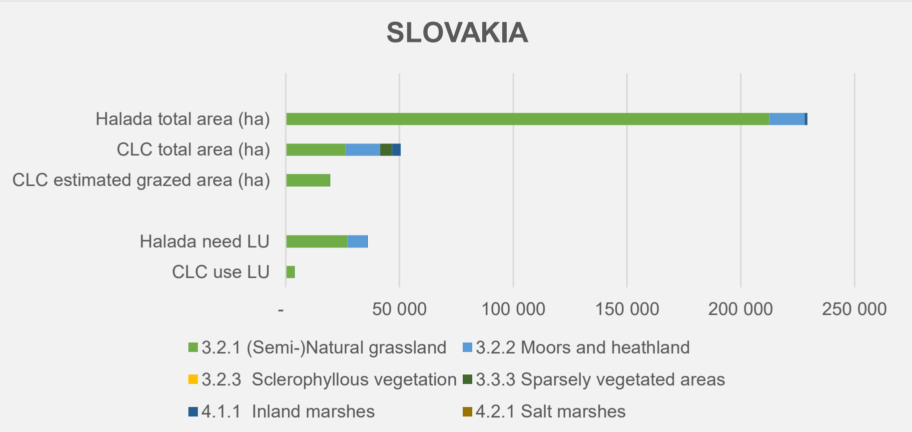

Figure A4. 21: Slovakia - Comparison Halada needs and CLC use.

Slovenia

Table A4. 61: Slovenia - Comparison Halada needs and CLC use.

SLOVENIA – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural Grasslands*	747%	1672%	294%	Pasture, Mosaic
3.2.2	*Moors and heathland*	116%	11713%	61%	Mosaic, Abandonment
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	29%	588%	0%	Mosaic, Abandonment
4.1.1	*Inland marshes*	17%	0%	0%	

4.2.1	*Salt marshes*	-	-	-	
	total	332%	1825%	177%	

In Slovenia there is a large underestimate of CLC 3.2.1 (Semi-)Natural Grasslands compared to the area of the corresponding Halada habitats. For once, these are not dominated by hay meadows, perhaps reflecting the significant survival of a broader range of 'inbye' semi-natural grasslandsBut once again, the mapped CLC class is extremely geographically concentrated, leading to the conclusion that most of the semi-natural grasslands have apparently been mapped as 2.3.1 Pastures. Given that, and having also consulted the national Article 17 reporting, the authors felt unable to draw meaningful comparative conclusions on grazing pressures/needs

Table A4. 62: Slovenia - CLC grazing estimates.

SLOVENIA – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural Grasslands*	19 662	8 780	45%	7 463	0.85	Mountainous areas
3.2.2	*Moors and heathland*	19 625	195	1%	7 463	38.27	Mountainous areas, nature reserves
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	10 206	510	5%	20	0.04	Mountainous areas, nature reserves
4.1.1	*Inland marshes*	2 546	0	0%	0	0.00	
4.2.1	*Salt marshes*	144	0	0%	0	0.00	
	total	52 183	9 485	18%	14 946	1.58	

Table A4. 63: Slovenia - Halada grazing expert estimates.

SLOVENIA – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural Grasslands*	146 798	21 946	0.15	62A0 (Eastern sub-Mediterranean dry grasslands)
3.2.2	*Moors and heathland*	22 840	4 552	0.20	4060 (Alpine and Boreal heaths); 5130 (Juniperus communis formations)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	3 000	0	0.00	8240 (Limestone pavements)
4.1.1	*Inland marshes*	438	16	0.04	7140 (Transition mires and quaking bogs)
4.2.1	*Salt marshes*	-	-	-	
	total	173 076	26 514	0.2	

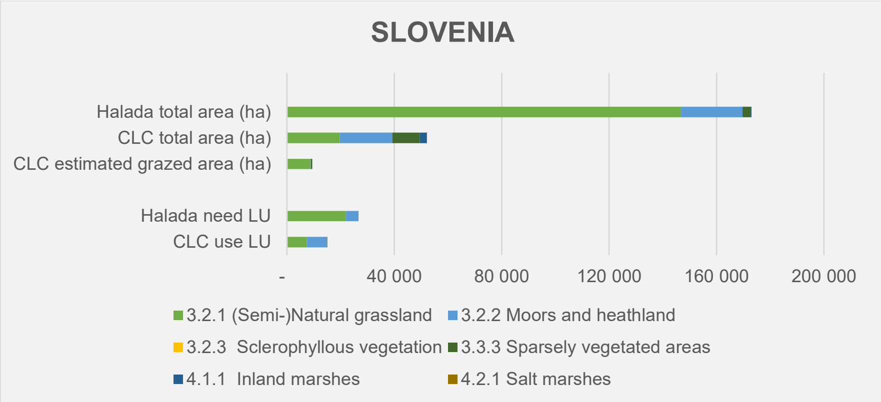

Figure A4. 22: Slovenia - Comparison Halada needs and CLC use.

Spain

Table A4. 64: Spain - Comparison Halada needs and CLC use.

SPAIN – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
2.4.4	*Agro-forestry area*	121%	162%	1044%	Mosaic
3.2.1	*(Semi-)Natural Grasslands*	89%	99%	122%	
3.2.2	*Moors and heathland*	80%	455%	27335%	Abandonment
3.2.3	*Sclerophyllous vegetation*	52%	213%	7519%	Non Halada significant
3.3.3	*Sparsely vegetated areas*	9%	94%	0%	
4.1.1	*Inland marshes*	55%	143%	0%	Non Halada significant
4.2.1	*Salt marshes*	3%	7%	14%	Non Halada significant
	total	75%	155%	535%	

Most of the Spanish Halada estimates are the work of a single expert. However, the data seems internally very consistent. The CLC grazing area estimates are a combination of various experts. Notably, even though 2.4.4. Agro-forestry is not normally considered an agricultural class, it is included in our Spanish estimate due to its importance to national grazing practices.

The correspondence between the CLC and Halada total areas by habitat class is remarkably high in Spain, except in the case of 3.2.3 Sclerophyllous Vegetation, where CLC seems to over-record by around 100%, assuming that there are no non-Halada sclerophyllous habitats.

The national expert provided estimates per CLC class and Halada habitat, but also estimated overall figures for the Spanish land use classes:

Table A4. 65: Spanish land use classes grazing expert estimates.

Land use class	MED LU/ha	MED % used	ATL LU/ha	ATL % used
Pastizales - grasslands	0.16	56.25	0.4	50
Pastos arbustivos – 'heathy' pastures	0.04	22.5	0.2	40
Pastos arbolados – 'scrubby' pastures	0.3	63.75	0.6	95
Forestal – grazed forest	0.04	11.25	0.2	10

The data can be summarised as follows:

- Grasslands – overall livestock use apparently optimal, but in fact some areas overused and many areas not grazed or under-utilised
- Moors and heathlands – under- or non-use is extremely common. These habitats are concentrated in the north and west of the country (Asturias, Galicia etc.) in areas where there is a known abandonment/underuse issue
- Sclerophyllous vegetation – under- or non-use is similarly extremely common. In contrast, these habitats are concentrated in the south and east of the country (Andalucia, Extremadura, Valencia etc.), where again there is a known abandonment/underuse issue
- Agro-forestry areas – a more complicated picture as the category includes non-Halada habitats (ones not fitting the narrow sense in which 'dehesa' is understood outwith Spain), and some of the Halada areas have over-utilisation, but in the broader sense, this group of habitats is also becoming increasingly prone to underuse and abandonment

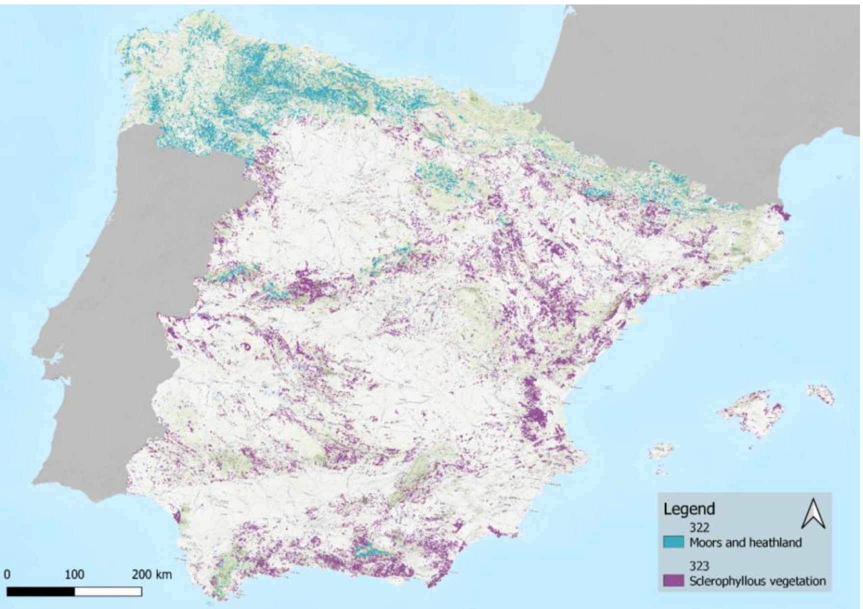

Figure A4. 23: Spain - distribution of CLC 322 Moors and heathlands (blue) and 323 Sclerophyllous vegetation (purple).

Spain is the country with by far the greatest area of Halada habitats (10 million ha) and by far the largest estimated livestock grazing 'needs' on those habitats (>4.2 million LU). Spain also has one of the largest deficits when this number is compared with estimated actual use (c. 3.5 million LU). While this estimate is subject to some degree of potential error, the general picture of the situation in Spain is quite unambiguous and should be a central concern of EU nature and biodiversity policy and of the Spanish CAP Strategic Plans.

Table A4. 66: Spain - CLC grazing estimates.

SPAIN – CLC grazing estimates								
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	Comments
			ha	**%**			
2.4.4.	*Agro-forestry area*	2 370 100	1 776 661	75%	165 229	0.09	Only in Extremadura, Castilla y León & Andalucia
3.2.1	*(Semi-)Natural Grasslands*	3 408 100	3 046 447	89%	609 289	0.20	
3.2.2	*Moors and heathland*	1 891 400	331 556	18%	3 316	0.01	Mountain areas, nature reserves
3.2.3	*Sclerophyllous vegetation*	4 744 200	1 169 132	25%	11 691	0.01	Lowlands
3.3.3	*Sparsely vegetated areas*	786 700	72 297	9%	0	0.00	Mountain areas, nature reserves
4.1.1	*Inland marshes*	18 700	7 240	39%	0	0.00[1]	
4.2.1	*Salt marshes*	70 800	31 900	45%	6 380	0.20	
total		13 290 000	6 435 233	48%	795 906	0.12	

[1] Not estimated

Table 3. Spain - Halada grazing expert estimates.

SPAIN – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
2.4.4	*Agro-forestry area*	2 874 253	1 724 552	0.60	6310 (Dehesas)
3.2.1	*(Semi-)Natural Grasslands*	3 018 368	743 900	0.25	6220 (Pseudo-steppe with grasses)
3.2.2	*Moors and heathland*	1 508 534	906 316	0.60	4030 (European dry heaths
3.2.3	*Sclerophyllous vegetation*	2 484 705	879 054	0.35	5330 (Thermo-Mediterranean and pre-desert scrub)
3.3.3	*Sparsely vegetated areas*	67 981	0	0.00	8230 (Siliceous rock with pioneer vegetation)
4.1.1	*Inland marshes*	10 334	1 648	0.16	7150 (Depressions on peat substrates)
4.2.1	*Salt marshes*	2 268	907	0.40	1330 (Atlantic salt meadows)
	total	9 966 443	4 256 376	0.4	

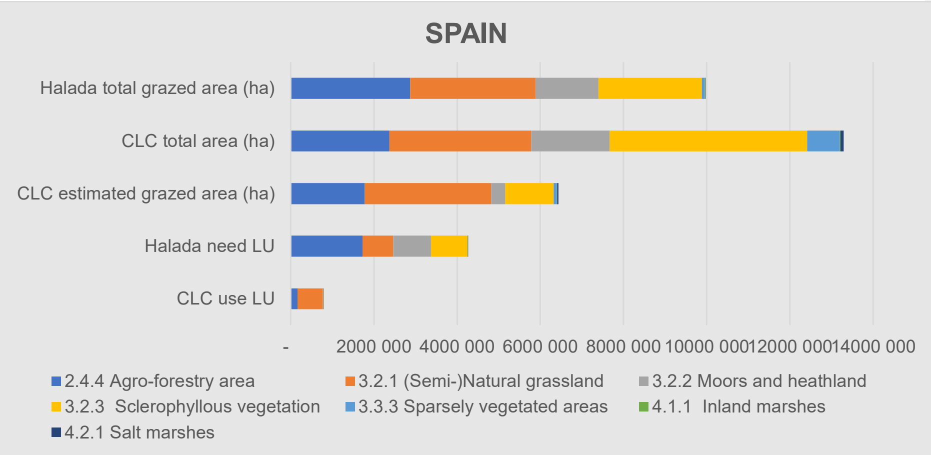

Figure A4. 24: Comparison Halada needs and CLC use.

Sweden

Table A4. 67: Sweden - Comparison Halada needs and CLC use.

SWEDEN – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1.	*(Semi-)Natural Grasslands*	443%	34819%	27717%	Largely not grazed, Pasture,
3.2.2.	*Moors and heathland*	69%	2309355%	0%	Mosaic
3.2.3.	*Sclerophyllous vegetation*	-	-	-	

3.3.3.	*Sparsely vegetated areas*	5%	169%	35%	Non Halada significant, Abandonment, Mosaic
4.1.1.	*Inland marshes*	4141%	48527%	1373%	Non Halada significant
4.2.1.	*Salt marshes*	719%	1243%	2911%	Mosaic
	total	153%	18012%	5487%	

Carrying out this exercise for Sweden is extremely challenging. Like Finland, most of the land covers that are generally taken in this exercise to be 'semi-natural' habitats (3.2.1 (Semi-)Natural Grasslands, 3.2.2 Moors and Heathlands) in this case really are 'natural' habitats, situated above the treeline where if grazing is significant in their maintenance, it is grazing by deer. But unlike Finland, Sweden has some large areas of truly semi-natural habitat, large enough to be classified as such in CLC; the challenge is to direct attention solely at those areas.

In 2011 it was estimated that approximately 70,000 ha of semi-natural habitats were likely to be excluded from payment due to CAP eligibility rules. These are habitats which don't 'look like' standard inbye semi-natural grasslands (i.e. they were alvars etc.). We therefore had an estimate of the approximate upper value for the areas of non-grassland habitats, with 'non-grassland' here possibly being used in a rather pedantic agricultural sense.

Turning to the CLC classes individually, 3.2.1 (Semi-)Natural grasslands is hardly mapped outwith the truly natural grassland area (where there can be habitats which in some countries would be considered to need agricultural grazing); knowing the context of most patches of semi-natural grasslands in Sweden (small areas next to arable fields and forest), they are ripe for generalisation into 2.3.1 Pasture or one of the forest classes. 2.3.2 Moors and Heathlands similarly (more into forest in this case). That essentially leaves 3.3.3 Sparsely Vegetated Areas (largely alvar) and 4.2.1 Salt marshes (in fact, largely 1630 Boreal Coastal Meadows which is most definitely a very different habitat). In both those cases, the total area is relatively small, but there quite some focus on their conservation on the part of the Swedish stateThe apparent very large underestimate of 4.2.1 by CLC is curious, but perhaps explained by narrow coastal zones being subsumed by the other habitats present in the CLC pixel. Notably, 3.3.3. Sparsely Vegetated Areas is located in the northern alpine, ungrazed region and on Gotland and Kalmar Island in the continental part of Sweden. These islands are well known for their extensive grazing practices on alvar systems, and thus are considered separately in the CLC grazing estimates.

In sum, little can be said which doesn't involve circular argument. It would be more honest to say that the Swedish expert input is that many semi-natural habitats are undergrazed, especially those with lower productivity.

Table A4. 68: Sweden - CLC grazing estimates.

SWEDEN – CLC grazing estimates								
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural Grasslands*	193 100	2 454	1%	1 964	0.80	
3.2.2	*Moors and heathland*	2 760 500	82	0%	0	0.00	NW border area with Norway
3.2.3	*Sclerophyllous vegetation*	-	-	-	-	-	
3.3.3	*Sparsely vegetated areas*	694 900	21 901	3%	12 298	0.56	Northern most region
4.1.1	*Inland marshes*	69 900	5 965	9%	2906	0.49	
4.2.1	*Salt marshes*	2 100	1 215	58%	1214.9	1.00	
	total	3 720 500	31 617	1%	18 382	0.58	

Table A4. 69: Sweden - Halada grazing expert estimates.

SWEDEN – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1.	*(Semi-)Natural Grasslands*	854 600	544 235	0.64	6150 (Siliceous alpine and boreal grasslands)
3.2.2.	*Moors and heathland*	1 893 671	384 836	0.20	4060 (Alpine and Boreal heaths)
3.2.3.	*Sclerophyllous vegetation*	-	-	-	
3.3.3.	*Sparsely vegetated areas*	37 000	4 262	0.12	6280 (Nordic alvar)
4.1.1.	*Inland marshes*	2 894 580	39 890	0.01	7140 (Transition mires)
4.2.1.	*Salt marshes*	15 100	35 360	2.34	1630 (Boreal Baltic coastal meadows)
	total	5 694 951	1 008 583	0.2	

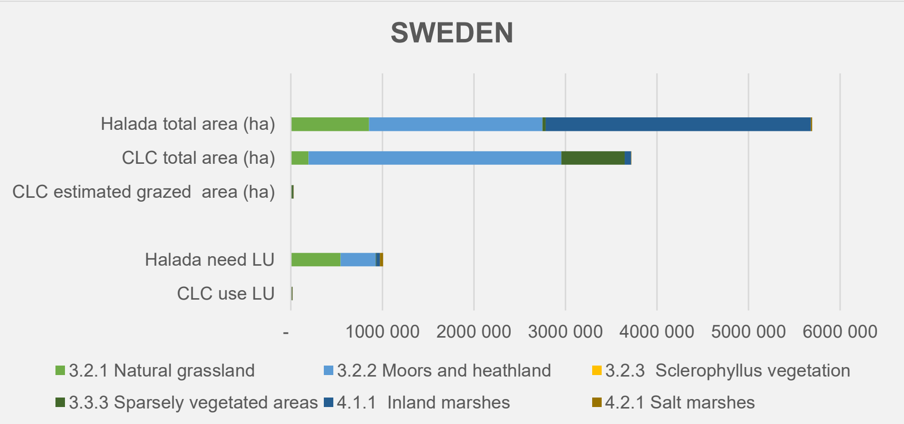

Figure A4. 25: Sweden - Comparison Halada needs and CLC use.

United Kingdom

Table A4. 70: United Kingdom - Comparison Halada needs and CLC use.

UNITED KINGDOM – comparison of grazing estimates					
CLC Code	**CLC Name**	**Halada area as % of CLC area**	**Halada area as % of CLC grazing area estimate**	**Halada grazing need LU as % of current CLC use LU**	**Main issues arising**
3.2.1	*(Semi-)Natural Grasslands*	20%	22%	7%	Non Halada significant, Mosaic
3.2.2	*Moors and heathland*	69%	115%	89%	Mapped as 4.1.2. Peat bogs
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	1%	17%	0%	Not grazed
4.1.1	*Inland marshes*	30%	24%	29%	Non Halada significant
4.2.1	*Salt marshes*	71%	90%	145%	
	total	45%	63%	36%	

The striking aspect of the UK's data is that Halada habitats only make up 45% of the corresponding CLC classes – in particular there is a massive area (>>1 million ha) non-Halada grasslands, largely made up of upland acid grasslands.

Secondly, a significant proportion of the potential grazing resource is not in fact grazed by domestic livestock (mostly in the Scottish Highlands).

Taking the total grazing resource as a comparison, livestock densities seem to be of the same order as Halada needs (though some would argue that the mix of species is sub-optimal), but when corrected for the estimated area actually grazed, the picture is of an excess of livestock on average. The actual picture will vary hugely from place to place, but reflects the perception from environmental circles that the area of (Halada) heaths and heathy mosaics should be increased at the expense of upland acid grasslands where previous environmental analysis suggests that a significant areas of former heathland needs to be restored.

Table A4. 71: United Kingdom - CLC grazing estimates.

UNITED KINGDOM – CLC grazing estimates							
CLC Code	**CLC Name**	**CLC total area (ha)**	**CLC estimated grazed area**		**CLC LU**	**CLC LU/ha (est. grazed area)**	**Comments**
			ha	**%**			
3.2.1	*(Semi-)Natural Grasslands*	1 429 571	1 356 695	95%	678 348	0.50	Mostly nature reserves
3.2.2	*Moors and heathland*	1 861 246	1 117 320	60%	335 196	0.30	Mostly nature reserves

3.2.3	*Sclerophyllous vegetation*	18	0	0%	0	0.00	
3.3.3	*Sparsely vegetated areas*	261 878	14 950	6%	0	0.00	Nature reserves only, very limited
4.1.1	*Inland marshes*	30 612	37 520	123%	4485	0.12	
4.2.1	*Salt marshes*	47 752	37 520	79%	18760	0.50	
	total	3 631 077	2 564 005	71%	1 036 789	0.40	

Table A4. 72: United Kingdom - Halada grazing expert estimates.

UNITED KINGDOM – ‚Halada' grazing expert estimates					
CLC Code	**CLC Name**	**Corresponding ‚Halada' area (ha)**	**Halada LU**	**Halada LU/ha**	**Main habitat type**
3.2.1	*(Semi-)Natural Grasslands*	292 148	47 732	0.16	6150 (Siliceous alpine and boreal grasslands)
3.2.2	*Moors and heathland*	1 288 745	298 305	0.23	4030 (European dry heaths)
3.2.3	*Sclerophyllous vegetation*	-	-	-	
3.3.3	*Sparsely vegetated areas*	2 573	129	0.05	8240 (Limestone pavements)
4.1.1	*Inland marshes*	9 169	1 293	0.14	7140 (Transition mires and quaking bogs)
4.2.1	*Salt marshes*	33 894	27 115	0.80	1330 (Atlantic salt meadows)
	total	1 626 529	374 574	0.2	

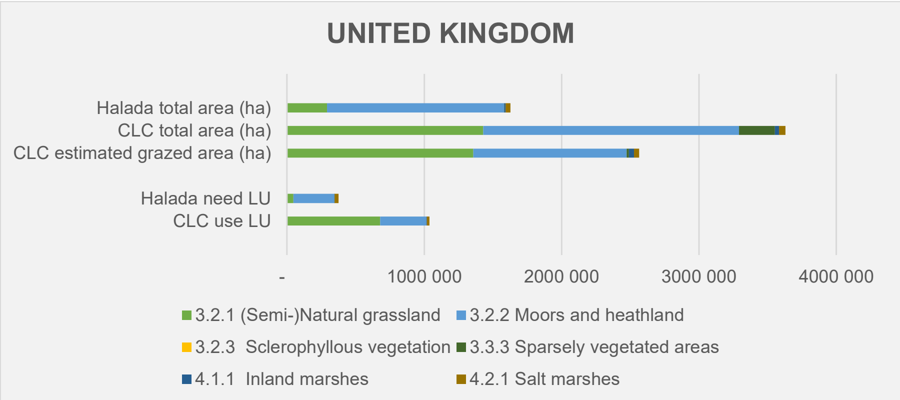

Figure A4. 26: United Kingdom - Comparison Halada needs and CLC use.

Annex 5 Review of supporting work and further research questions

This annex reviews additional work and research questions that are related to the main topics of this study but could not be included in the main body of text.

a) Additional material developed during the preparatory phase for this study:

Robust livestock breeds are more suited for the management of semi-natural habitats than breeds optimised for high productivity in modern farming systems. In this context, the study team conducted a review of the actual and potential role of traditional livestock breeds in the management of semi-natural habitats, and in particular for those types of habitats, including those on the 'Halada list', which are of EU conservation concern. This activity included a discussion of the meaningfulness or otherwise of the terminology involved, a brief literature and expert-based review of the characteristics of traditional livestock breeds that might make them particularly suitable for the management of grazed semi-natural habitats of conservation significance and, in passing, a review of the availability of data on traditional livestock breeds at country level (building on work by the ETC/BD and the FAO DAD-IS database). This element of the work was centred on a series of case study interviews with experts, in which the reality of a number of HNV farming hotspots from the perspective of breed types and trends in the numbers of those breed types and of the possible nature conservation implications were analysed.

Lack of economic viability is a key reason for the decline of extensive grazing systems linked to semi-natural habitats. This can potentially be addressed by a re-design of (agricultural) policy support and by strengthening the market position of extensive livestock systems (as well as other measures). Based on a literature review and consultation with experts, the study team produced a short discussion paper that reviews which potential market strategies and policies are available and can be further developed to support grazing in semi-natural habitats.

These two unpublished papers are available on request by contacting the EEA project manager for this work (jan-erik.petersen [@] eea.europa.eu).

b) Further research questions to be considered for improving the management of semi-natural habitats by grazing:

There are a number of thematic analyses that could be undertaken to build on or expand the results presented in this study. These could look at the following themes:

- Which of the current EU livestock systems could best integrate extensive grazing of Halada habitats in their approach at farm level? For example, suckler cow systems, mobile or stationary sheep or goat production systems? Are dairy product or meat-oriented systems more flexible among the intensive cattle systems with regard to integrating conservation grazing? Are organic farming systems more suited to integrating the grazing of semi-natural habitats? What economic incentives or practical support (e.g. mobile slaughter facilities) could facilitate such a function?

- What is the role of conservation grazing systems or of 'rewilding' approaches? Are these potentially more suited for certain habitat types, e.g. the least productive ones? What factors would allow them to generate economic returns from their livestock rather than rely only on public support?

- What is the potential role of horses and ponies for maintaining semi-natural habitats, either as part of re-wilding approaches or by using recreational horses for direct grazing of habitats or in consuming hay from extensive meadows?

- How to maintain the 'meadow' habitats that are particularly difficult to manage due to the labour-intensive nature of conservation-friendly mowing regimes? Could grazing be an option, in particular where mowing regimes became dominant during parts of the 20th century but grazing was often practiced for part of the summer in other historic periods?

- What are the interactions between extensive grazing and the management of wild-fire risk in southern Europe in particular? It is known that the decline of extensive grazing practices facilitates the build-up of flammable biomass in Mediterranean shrub and forest areas. What are the potential synergies between the re-introduction of grazing for conservation reasons and managing wild-fire risk?

c) Additional detailed expert comments to be considered in using the study results for information grazing management decisions

- Timing and/or the type of animal used are significant factors which the current work does not address.

- Timing of grazing is just one element of management which involves the skills and experience of the grazier; conserving the habitats also involves conserving that living knowledge tradition.

- Many habitat classes cover a wide spectrum of sub-types depending on soil conditions; this is bound to be reflected in a variation in grazing needs estimates; some habitat types were felt to be rather broadly described – 7210 was, for example, considered to be two quite different habitats
- The effect of terminology is not to be underplayed – the use of the word 'meadow' in a habitat name is possibly a case in point

Reiterating what had been noted in previous work, the Greek experts stressed that several habitat types not included on Halada et al. (2011) list did in fact depend on grazing[7]; the same might be said of at least some areas of 7130 in sub-optimal condition

In the context of the Nature Restoration Regulation, it should be noted that there are in some cases considerable areas of potential habitat which are currently not included in Article 17 reporting (e.g. 1530 in Hungary), which might be targeted for nature restoration. In such a case the total livestock requirement in a conservation perspective will potentially be substantially higher that currently estimated.

[7] • 5110 (+) Stable xerothermophilous formations with Buxus sempervirens on rocky slopes (Berberidion p.)
- 5130 (+) Juniperus communis formations on heaths or calcareous grasslands
- 5160 (-) South-eastern sub-Mediterranean deciduous thickets (Schilbjak)
- 5340 (+) Eastern Garrigues
- 6290 (-) Mediterranean subnitrophilous grasslands
- GR645 (ex 6450 (-) Greek hyper-Mediterranean humid grasslands
- 9250 (+) Quercus trojana woods
- 9562* Endemic forests with Juniperus spp