Proposals for the ecological grouping of the Habitats Directive habitats and species

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Contents

[1 Executive summary 7](#_Toc122334091)

[2 Introduction 8](#_Toc122334092)

[3 Rationale of the work 9](#_Toc122334093)

[3.1 Agricultural habitats 10](#_Toc122334094)

[3.2 Grassland habitats 10](#_Toc122334095)

[3.3 Heath and scrub habitats 11](#_Toc122334096)

[3.4 Forest habitats 11](#_Toc122334097)

[3.5 Freshwater habitats 11](#_Toc122334098)

[3.6 Wetland habitats 12](#_Toc122334099)

[3.7 Coastal habitats 12](#_Toc122334100)

[3.8 Marine habitats 12](#_Toc122334101)

[4 Methodological approach 14](#_Toc122334102)

[4.1 Habitats 14](#_Toc122334103)

[4.1.1 Identification of ecological groups 14](#_Toc122334104)

[4.1.2 Habitats assignment to ecological groups 16](#_Toc122334105)

[4.2 Species 17](#_Toc122334106)

[4.2.1 Identification of ecological groups 17](#_Toc122334107)

[4.2.2 Species assignment to ecological groups 19](#_Toc122334108)

[4.2.3 Dealing with uncertainty of the species attribution to ecological groups 20](#_Toc122334109)

[5 Ecological groups of habitats 21](#_Toc122334110)

[5.1 Agricultural habitats 21](#_Toc122334111)

[5.1.1 Habitats depending on agricultural management 21](#_Toc122334112)

[5.1.2 Productivity of agricultural habitats 22](#_Toc122334113)

[5.2 Grassland habitats 22](#_Toc122334114)

[5.3 Heath and scrub habitats 23](#_Toc122334115)

[5.4 Forest habitats 24](#_Toc122334116)

[5.4.1 Type of leaves/needles 24](#_Toc122334117)

[5.4.2 Production function of forests 25](#_Toc122334118)

[5.4.3 Regional classification of forests 25](#_Toc122334119)

[5.5 Freshwater habitats 26](#_Toc122334120)

[5.5.1 Characteristic of river habitats 26](#_Toc122334121)

[5.5.2 Characteristic of lake habitats 27](#_Toc122334122)

[5.6 Wetland habitats 27](#_Toc122334123)

[5.6.1 Character of wetland habitats 27](#_Toc122334124)

[5.6.2 Floodplains 28](#_Toc122334125)

[5.7 Coastal habitats 29](#_Toc122334126)

[5.7.1 Character of coastal habitats 29](#_Toc122334127)

[5.7.2 Coasts of sea systems 29](#_Toc122334128)

[5.8 Marine habitats 30](#_Toc122334129)

[5.9 Cross-cutting issues 30](#_Toc122334130)

[5.9.1 Altitude 30](#_Toc122334131)

[5.9.2 Character of distribution 31](#_Toc122334132)

[5.9.3 Biogeographical distribution 31](#_Toc122334133)

[5.9.4 Habitat grouping based on habitat classification system 32](#_Toc122334134)

[6 Ecological groups of species 33](#_Toc122334135)

[6.1 Species of agricultural habitats 33](#_Toc122334136)

[6.1.1 Species in need of low-intensity farming 33](#_Toc122334137)

[6.1.2 Species in need of mosaic of agricultural habitats 34](#_Toc122334138)

[6.2 Species of grassland habitats 34](#_Toc122334139)

[6.3 Species of heath and scrub habitats 34](#_Toc122334140)

[6.4 Species of forests habitats 35](#_Toc122334141)

[6.4.1 Forest species living on wood 35](#_Toc122334142)

[6.4.2 Species of old-growth forests 35](#_Toc122334143)

[6.4.3 Insect species in need of mosaic of forest habitats or forest margins 35](#_Toc122334144)

[6.4.4 Forest species adapted to fire 36](#_Toc122334145)

[6.5 Species of freshwater habitats 36](#_Toc122334146)

[6.5.1 Dragonflies and their habitats 36](#_Toc122334147)

[6.5.2 Aquatic mammals 36](#_Toc122334148)

[6.6 Species of wetland habitats 37](#_Toc122334149)

[6.7 Species of coastal habitats 38](#_Toc122334150)

[6.7.1 Species of main coast types 38](#_Toc122334151)

[6.7.2 Coasts of sea systems 38](#_Toc122334152)

[6.8 Species of marine habitats 39](#_Toc122334153)

[6.9 Cross-cutting issues 39](#_Toc122334154)

[6.9.1 Biogeographical distribution of species 39](#_Toc122334155)

[6.9.2 Range size and endemism 40](#_Toc122334156)

[6.9.3 Species of other habitats 41](#_Toc122334157)

[6.9.4 Grouping of species based on the taxonomical categories 41](#_Toc122334158)

[7 Conclusions 43](#_Toc122334159)

[8 Main references 44](#_Toc122334160)

[Annex 1: Pressure analysis using ecological grouping for wetlands habitats and species 47](#_Toc122334161)

[Annex 2: The form for consultations 56](#_Toc122334162)

Abbreviations

|  |  |
| --- | --- |
| CAP | Common Agriculture Policy |
| EEA | European Environment Agency |
| ETC/BD | European Topic Centre on Biological Diversity |
| ETC/ICM | European Topic Centre on Inland, Coastal and Marine Waters |
| ETC/ULS | European Topic Centre on Urban, Land and Soil Systems |
| EU | European Union |
| IUCN | International Union for Conservation of Nature |
| MAES | Mapping and Assessment of Ecosystems and their Services |
| MSFD | Marine Strategy Framework Directive  |
| WFD | Water Framework Directive |

# Executive summary

This document identifies ecological groups of species and habitats that will support different future ETC/BE and EEA assessments. The work on ecological groups was initiated and performed with a particular focus on the Habitats Directive reporting under Article 17 with the broad objective to further exploit the reported information on conservation status and pressures. In this document, the term “ecological group” is used in a wide sense, generally as being an attribute or a feature linked to a species or a habitat type. The ecological groups showcased in this report were selected to meet the needs for performing specific assessments in support of legal frameworks and strategy processes in the EU.

To fulfil the needs for performing targeted assessment related to Annex I habitats eight broad ecosystem level groups were selected agricultural, grassland, heath and scrub, forest, wetland, freshwater, coastal and marine. Within these broad groups 48 specific ecological groups have been identified and elaborated in this work. Additional groups were identified and prepared for cross-cutting issues (24 specific groups in total). In addition, there is possibility to use the Habitats Directive Annex I classification in a similar way as the ecological grouping identified in this study.

For the same selection of broad ecosystem groups 32 specific ecological groups have been identified and elaborated for Habitat Directive species. Four additional classifications have been prepared for cross-cutting issues, such as biogeographical distribution or endemism with in total 25 specific groups. As for habitats the use of a taxonomic group can allow further analysis and this is briefly outlined in the document

To demonstrate a use of the ecological groups for assessments, we prepared a case study focusing on the evaluation of pressures to wetland habitats and species. The case study is provided in Annex 1 of this report. In this example, we used pressures reported by EU Member States for the period 2013-2018 under their obligations related to the Article 17 of the Habitats Directive.

The list of the ecological groups proposed in this study can be further extended, if this is needed in future for other types of assessments. The current ecological grouping work was undertaken by ETC/BD based on published literature, which was in some cases scarce or partial. As an immediate next step we propose to open the current work for comments from users of this work. To collect the user’s feedback, we prepared a feedback form which is attached in Annex 2 of this report.

The classification of individual species and habitats into ecological groups was so far restricted to species and habitats listed in annexes of the Habitats Directive, but it could be expanded to other species and habitats in the future.

# Introduction

This document provides the results of the work dedicated to the ecological grouping that started in 2020. The preparation of the EEA State of Nature report 2020 revealed a need to have a more detailed look into particular ecological groups of habitats and species, to be able, for instance, to assess their conservation status and to derive more information on group-specific pressures.

The term “ecological group” in this work is used in a wide sense related to any attribute or feature linked to a species or a habitat that could be used for an assessment. Some of them are based on ecological requirements of species and their links to particular habitats (“species habitat”) or ecological properties of the habitat types. Some other ecological groups cover different characteristics, such as species or habitat’s distribution or their use by man.

On EU level, legal frameworks and strategy processes (the Nature Directives and the EU Biodiversity Strategy for 2030, etc.) require reoccurring assessments for specific groups of habitats and species, . To be able to prepare such assessments, convincing ecological groups of species and habitats are necessary.

Starting in 2020, the EEA and its ETC/BD therefore worked on

* identifying and defining a suitable grouping system,
* elaborating the draft lists of habitat and species per ecological group and
* elaborating a trial study using these groups.

This technical report gives an overview of this work and results until end 2022. It explains a methodology used for the ecological group identification and describes the individual ecological groups for habitats and species. As such, the main output of this work consists of a comprehensive database of the extensive ecological grouping exercise. To illustrate the approach a trial assessment for wetland habitats and species has been prepared and is provided in Annex 1 of this report.

The work on ecological groupings should continue e.g. with a potential identification of new groups, more in depth revision of some problematic groups, broader consultation of the attribution of habitats and species to groups with external experts and future users of the grouping work and further analytical work based on the ecological groups.

# Rationale of the work

Targeted assessments on habitats and species require adequate groupings or classifications to derive meaningful results. Therefore, some relevant classification schemes have already been developed at ecosystem level, such as the MAES (Mapping and Assessment of Ecosystems and their Services) grouping.

One of the most comprehensive datasets on nature and biodiversity stems from the Member State reporting conducted in line with the Nature Directives (Article 17 of the Habitats Directive and Article 12 of the Birds Directive). Key data entails the assessment of the conservation status of habitat and species as well as the reporting of their pressures, threats and targeted measures. This data is not only used to conduct the EU assessment for the State of Nature in the EU report, but is also fed into other legal reporting or strategic processes. Most importantly, this data will be used to monitor progress to the targets of the EU Biodiversity Strategy for 2030 – as it has also been used for the prior EU Biodiversity Strategy for 2020. Furthermore, this biodiversity dataset also contributes to other EEA work, as for instance to *Indicators to assess progress towards 2030 biodiversity targets,* which is expected to provide expert input to developing and testing of ecologically refined ecosystem extent accounts. Another body of work relates to the assessment of main pressures for priority habitats and species within the EU.

Based on the purpose and the structure of this dataset, our present work identifies a new set of ecological groups. Thus, the overall aim of this exercise is to develop a flexible ecological grouping system tailored to adequately measure progress and the implementation of the relevant policies including for example the targets of the EU Biodiversity Strategy for 2030. The ecological groupings are assessed separately for species and habitats, but are framed by the following main habitat types:

* Agricultural habitats
* Grassland habitats
* Heath and scrub habitats
* Forest habitats
* Wetland habitats
* Freshwater habitats
* Coastal habitats
* Marine habitats

Additionally, the classification also entails a group for ‘cross-cutting issues’ giving the option to identify species and habitats via other characteristics, for instance, its occurrence in biogeographic regions, or its endemism.

In this context, the targeted ecological grouping for each habitat type helps to strategically inform and monitor overarching and sectoral policy processes and their implementation. The approach allows the selection of multiple group attributions per species or habitat, and thus enables more flexibility and the recognition of habitats that lie in between ecosystem types (such as alluvial forests). As a result, it is possible to perform assessments without losing valuable information.

The following sections will present the underlying rationale and the relevant policy context for each of the identified ecosystem types individually.

## Agricultural habitats

Covering over 40% of Europe’s landscape, agriculture belongs to the dominant land use (EC, 2019). Many animal and plant species are adapted to agricultural management regimes of different type and intensity. The results of the latest State of Nature Report (EEA, 2020) show, for example, that activities such as abandoning extensive management, intensifying management practices or removing small landscape features currently lead to loss of habitat area essential for food supply, shelter and breeding sites for species. Thus, targeted action needs to protect such habitats and species.

The ecological group of agricultural habitats and species has been elaborated for the purpose of assessments related to Target 3A of EU Biodiversity Strategy for 2020. Target 3A explicitly referred to species and habitats that depend on or are affected by agriculture. Following this approach to agricultural habitats we prepared a classification of habitats that either fully or partly depend on agricultural management, which allowed tracking the progress towards the target. This classification continues to be of high relevance, not only to inform the new targets of the EU Biodiversity Strategy for 2030, but also to inform other processes, such as the performance indicator of the Common Agricultural Policy (CAP) for biodiversity and the CAP context indicator on conservation status of agricultural habitats (C36) at national and EU level.

As the Habitats Directive only protects natural and semi-natural European habitats, the agricultural habitats represented in the directive’s Annex I are mostly grasslands and heathlands.

##  Grassland habitats

While the group of agricultural habitats mostly consists of grasslands and heathlands, an additional split of grassland habitats was made to ensure a detailed focus on this habitat group. We distinguished natural grasslands and semi-natural grasslands fully and partly depending on agricultural management.

Grasslands in EU are under continuous pressure and experience ongoing decline and deterioration, though many of these habitats are of particular importance for pollinator species. Pollination plays a key role in securing food production and is therefore seen as a key ecosystem service that needs to be preserved. Due to the importance of pollinator species and their serious decline, the European Commission adopted the EU Pollinator Initiative in 2018. The importance of grassland habitats for the overall biodiversity of rural areas is crucial and proper setting of the measures of Common Agricultural Policy is irreplaceable for their protection and maintenance.

Therefore, targeted information on grasslands and dependent species is essential to inform current EU policy processes and initiatives as well as other European and national activities.

## Heath and scrub habitats

Heath and scrubs are perceived as an important cultural heritage and due to their historical relation with traditional pastoral systems, they mainly occupy an intermediate position between more intensively managed grassland types, arable land and mature woodlands. They are often strongly dependent on human interventions, particularly grazing, fire and mowing.

Though heath and scrub habitats are currently not separately targeted by any EU policy processes, these habitats are in need to be conserved and/or restored due to their ongoing decline and their contribution to species and habitat diversity. The dedicated grouping in our work distinguishes natural from semi-natural heath and scrub habitats; the second group is divided to habitats fully and partly depending on agricultural management. This allows for targeted analysis to derive appropriate measures.

## Forest habitats

Forests host a dominant part of Europe´s terrestrial biodiversity and contribute significantly to climate change mitigation. In addition of supplying wood, forests also provide multiple ecosystem functions and services that are vital to society and human well-being. As European forests are mostly rather intensively managed, many of their natural functions are impaired.

The classification of forest habitats was first established to address the Target 3B of the EU Biodiversity Strategy to 2020. Reducing or eliminating deforestation and forest degradation is still one of the central biodiversity goals in Europe. To this aim, the EU not only set concrete targets for forests in its EU Biodiversity Strategy, but also published a dedicated EU Forest Strategy for 2030 (July 2021, https://ec.europa.eu/environment/strategy/forest-strategy\_en). One central aim of the new strategy is to plant 3 billion additional trees by 2030. Moreover, on pan-European level, a set of criteria and indicators for sustainable forest management are developed to inform on forests’ biological diversity, among other aspects (Forest Europe, https://foresteurope.org/workstreams/sustainable-forest-management/).

## Freshwater habitats

Though freshwater habitats, according to the latest Nature Directives’ reporting 2013-2018, experience higher level of improvement than other habitats, the majority of rivers are currently still not healthy (EEA, 2018). Moreover, Europe has the most fragmented river landscape worldwide, with over 1 million barriers according to research by the EU Horizon 2020 project AMBER (Belletti et al. 2020). The importance of free-flowing rivers is increasingly recognised by European environmental policy. The EU Biodiversity Strategy for 2030 targets the restoration of at least 25,000 km into free-flowing rivers.

The Water Framework Directive (WFD), which came into force in 2000, is the legal cornerstone establishing a framework for the assessment, management, protection and improvement of the quality of water resources across the EU. While the WFD aims to achieve good (ecological and chemical) status for water bodies, the Habitats Directive seeks to achieve a good conservation status for the corresponding habitats and species. Historically, the types of rivers and lakes as well as their ecological status and pressures under the WFD are not directly comparable to the conservation status and threats for freshwater habitats and species under the Habitats Directive.

The present classification of ecological groups for freshwater habitats takes these interlinkages into account and intents to promote comparability across both directives. Therefore, the classification builds on the existing freshwater typology of rivers and lakes in Europe established by the EEA and ETC/ICM (Solheim et al., 2019) to allow common assessments.

##  Wetland habitats

Wetland habitats are defined by the WFD as habitats, which depend on frequent inundation or on a high level of groundwater, such as alluvial alder wood, mires, bogs or fens (EC 2003). Wetlands hold an important part of Europe’s biodiversity and are some of the planet’s most productive ecosystems. A significant number of birds and mammals depend on freshwater wetlands for breeding or feeding. In addition, wetlands are particularly important for carbon sequestration. Over 60% of European wetlands were lost before the 1990s and over half of the remaining wetlands are assessed as having a bad conservation status (EEA, 2020).

Due to their biodiversity and climate relevance, wetland habitats are one of the priority habitats for conservation and restoration. For many decades, the Ramsar Convention on wetlands seeks to improve the status of wetlands and urges the countries to take dedicated action.

The derived ecological groups for wetland habitats build on existing definitions and categories to monitor future developments and feed knowledge into relevant processes. The grouping of wetland habitats also includes floodplain (riparian and alluvial) habitats serving as an interface between rivers and their catchment. Studies have shown that 70-90% of European floodplains have been environmentally degraded (EEA, 2019).

## Coastal habitats

Europe’s diverse coastal habitats, such as salt-adapted scrub and grasslands, sheer cliffs and rocky shores provide breeding grounds and habitats for many marine organisms. Also, coastal habitats play an important role in stabilising the European coastline that is highly dynamic and shaped by constant movement of tides and currents, by sediment deposition and erosion as well as by weather. The coastal zone is an interface between the land and the sea with specific ecological conditions and interactions. It merely consists of a narrow stripe, which adds to its fragility. European coasts are exposed to serious pressures and are severely disturbed or damaged by human activities, especially through raw material extraction, urbanisation of different types, transport and recreation activities (EC, 2017).

Coastal habitats are targeted by the EU’s integrated policy response to the challenges facing coastal areas through the Marine Strategy Framework Directive (MSFD), WFD and the Nature Directives. The MSFD sets the objective of achieving a ‘good environmental status’ for many specific environmental aspects across the entire marine ecosystem, the WFD regulates ecological status in coastal and transitional waters, and the EU Nature Directives set conservation objectives for improving coastal habitats and species.

## Marine habitats

Marine ecosystems are hotspots of global biodiversity and provide our citizens with a steady flow of essential goods and services, such as food and climate regulation (EEA, 2021). The marine habitats are habitats with permanent or temporary column of marine water that extends from upper tidal zone and coastal water bodies to open sea and ocean. Marine habitats include those below spring high tide limit (or below mean water level in non-tidal waters) and enclosed coastal saline or brackish waters, without a permanent surface connection to the sea but either with intermittent surface or sub-surface connections (as in lagoons).

To date, the EU has established one of the most comprehensive policy frameworks to protect the marine environment. The MSFD sets the basis for the achievement or maintenance of the good environmental status (GES) of marine waters by 2020. The MSFD obliged Member States to design their own marine strategies to efficiently and effectively achieve this objective.

Within the frame of the Habitats Directive as the basis of this assessment, marine habitats and species are not of a direct focus. The directive for example cover only five marine habitat types. Nonetheless, the ecological grouping of these habitats allows additional assessments, e.g. of their status, trends and current pressures among other perspectives, that support the EU processes on marine protection.

# Methodological approach

This chapter provides information on the development process of the purpose-driven classification of ‘ecological groups’ for species and habitats listed in the annexes of the Habitats Directive. The whole process was divided into several steps:

* Selecting the broad ecological groups, identifying the detailed categories and
* elaborating their definitions
* Assigning species and habitats to selected categories
* Developing of ecological groups-based assessments

Note: this document is focused on the first two steps specified above, for the last step the report provides some examples in the Annex 1.

The following sections give an overview of this process for both habitats (4.1) and species (4.2).

## Habitats

### Identification of ecological groups

The main motivation for preparing ecological groups of Annex I habitats was to refine assessments conducted by the EEA and ETC/BD, specifically in relation to reporting obligations. These assessments are mostly related to the conservation status of habitats and species, their trends, drivers of changes as well as pressures and measures needed for habitat conservation. Another aspect has been raised by the past and current objectives of the EU Biodiversity Strategy focussing on agriculture, forestry and rivers, where some ecological groups may be useful for dedicated assessments. Having in mind these reasons, following classifications were proposed:

Table 1 Proposed ecological grouping for Annex I habitats

|  | **First level** | **Second level** |
| --- | --- | --- |
| **1** | **Agricultural habitats** | Dependency on agricultural management* Agricultural habitats fully dependent on agricultural management
* Agricultural habitats partially dependent on agricultural management
 |
|  |  | Productivity of agricultural habitats* Agricultural habitats on productive stands
* Agricultural habitats on non-productive stands and in mountainous areas
 |
| **2** | **Grassland habitats**  | Dependency on agricultural management* Natural grasslands
* Grasslands partially depending on management
* Semi-natural grasslands fully dependent on management
 |
| **3** | **Heath and scrub habitats** | Dependency on agricultural management* Natural heath and scrub habitats
* Heath and scrub habitats partially depending on management
* Heath and scrub habitats fully dependent on management.
 |
| **4** | **Forest habitats** | Type of leaves/needles* Broadleaved deciduous forests
* Broadleaved evergreen forests
* Mixed deciduous-coniferous forests
* Coniferous forests
 |
|  |  | Production function of forests* Forests with limited potential for exploitation
* Forests with good potential for exploitation – timber production.
* Forests with good potential for exploitation – non-timber production
 |
|  |  | Regional classification of forests* Boreal forests
* Temperate forests
* Mediterranean and sub-Mediterranean forests (including supra-Mediterranean)
* Macaronesian forests
 |
| **5** | **Freshwater habitats** |  Character of river habitats* Lowland rivers
* Mid-altitude rivers
* Highland rivers
* Mediterranean rivers
* Temporary streams and rivers

*note that river contains all kinds and sizes of running waters* |
|  |  | Character of lake habitats* Lowland lakes
* Mid-altitude lakes
* Highland lakes
* Mediterranean lakes
* Temporary lakes
 |
| **6** | **Wetland habitats** | Character of wetland habitats* Bogs and mires
* Calcareous fens and wet meadows
* Inland salt marshes
* Wet heaths and scrubs
* Wet forests
 |
|  |  | Habitats of the floodplains* Riparian & alluvial habitats
 |
| **7** | **Coastal habitats** | Character of coastal habitats* Intertidal flats
* Rocky shores
* Sandy coast
* Lagoons
* Estuarine complexes
 |
|  |  | Coasts of sea systems* Atlantic coast
* Baltic coast
* Mediterranean coast
* Black sea coast
* Macaronesian coast
 |
| **8** | **Marine habitats** | Marine habitats |

In addition to the habitat related grouping, an additional grouping for cross-cutting issues, mainly related to geographic characteristics, was proposed (see Box 1).

Box 1: Proposed cross-cutting classification for Annex I habitats

|  |
| --- |
| Altitude* Lowland habitats
* Upland/mountain habitats
* High-mountain and alpine habitats
 |
| Character of distribution* Habitats endemic to small area (stenoendemic habitats)
* Habitats endemic to region
* Habitats with restricted natural range and scattered distribution
* Common habitats with restricted natural range
* Widespread habitats with scattered distribution
* Widespread common habitats
* Widespread abundant habitats
 |
| Biogeographical distribution* ALP – Alpine
* ATL – Atlantic
* BLS – Black Sea
* BOR – Boreal
* CON – Continental
* MAC – Macaronesian
* MED – Mediterranean
* PAN – Pannonian
* STE – Steppic
* MATL – Marine Atlantic
* MBAL – Marine Baltic
* MBLS – Marine Black Sea
* MMAC – Marine Macaronesian
* MMED – Marine Mediterranean
 |
| Habitat grouping based on habitat classification system |

### Habitats assignment to ecological groups

The present work consisted of specifying which Annex I habitat type belongs to each of the ecological groups. For the assignment of habitats to ecological groups, we used a YES or NO approach, meaning that a habitat either belongs (YES) or does not belong to a group (NO).

For some habitats it is sometimes possible to indicate that a link to a ecological group is partial (only certain forms of a habitat belongs to a particular group e.g. mountain grasslands have managed and natural forms and only managed forms belong to the group **‘**Habitats partially dependent on agricultural management’) but often this is not so straightforward. Therefore, in our work we only indicated whether a habitat does or does not belong to a particular group without indicating a degree of the link.

The particular habitat type can often be assigned to more than one ecological group – e.g. wet meadows were classified both as agricultural habitat and wetland habitat. The multiple assignment of the habitat type to several ecological groups is quite common.

For the assignment of habitats to ecological groups we used different data sources. The most important data sources included habitat manuals and classifications:

* Interpretation Manual of European Union Habitats (European Commission, 2013),
* EUNIS Habitats information,
* Palearctic Habitats and national habitat manuals.
* European red list of habitats (Gubbay et al. 2016, Janssen et al. 2016 and factsheets for individual types),
* phytosociological classifications and phytosociological literature.

The information from literature was completed by the expert knowledge of the authors and ETC/BD experts that commented the proposed habitat classification to ecological groups.

## Species

### Identification of ecological groups

The identification of ecological groups was driven by:

1. General purpose for ecological groups selection as specified in the introduction, and by
2. Groups identified for habitats (see section 4.1) – in most cases, the ecological groups of species were established based on their links with groups identified for habitats.

Following ecological groups were selected:

Table 2: Proposed ecological grouping for species protected under the Habitats Directive

|  | First level |  Second level  |
| --- | --- | --- |
| 1 | Species of agricultural habitats | Species in need of low-intensity farming* Species of low-intensity managed arable land
* Species of low-intensity managed grasslands
* Species of low-intensity managed heaths and scrubs
 |
|  |  | Species in need of mosaic of agricultural habitats |
| 2 | Species of grassland habitats | Management needs* Species of natural grasslands
* Species of managed grasslands
 |
| 3 | Species of heath and scrub habitats | Management needs* Species of natural heath and scrub habitats
* Species of managed heath and scrub habitats
 |
| 4 | Species of forests habitats | Forest species living on wood* Species living on live, standing trees
* Species living on dead wood
 |
|  |  | Species of old-growth forests |
|  |  | Species in need of mosaic of forest habitats or forest margins |
|  |  | Forest species adapted to fire |
| 5 | Species of freshwater habitats | Dragonflies* Dragonflies reproducing in standing water
* Dragonflies reproducing in running water
 |
|  |  | Aquatic mammals |
| 6 | Species of wetland habitats | Character of habitats for species* Species of riparian and alluvial habitats
* Species of bogs and mires
* Species of calcareous fens
* Species of wet meadows
* Species of inland salt marshes
* Species of wet heaths and scrubs
* Species of wet forests
 |
| 7 | Species of coastal habitats | Coasts of main coast types* Species of intertidal flats
* Species of rocky shores
* Species of sandy coast
 |
|  |  | Coasts of sea systems* Atlantic coast
* Baltic coast
* Mediterranean coast
* Black Sea coast
* Macaronesian coast
 |
| 8 | Species of marine habitats | Species of marine habitats |

Box 2: Proposed cross-cutting classification for species protected under the Habitats Directive

|  |
| --- |
| Biogeographical distribution of species* ALP – Alpine
* ATL – Atlantic
* BLS – Black Sea
* BOR – Boreal
* CON – Continental
* MAC – Macaronesian
* MED – Mediterranean
* PAN – Pannonian
* STE – Steppic
* MATL – Marine Atlantic
* MBAL – Marine Baltic
* MBLS – Marine Black Sea
* MMAC – Marine Macaronesian
* MMED – Marine Mediterranean
 |
| Range size and endemism* Monotopic species
* Stenoendemic species
* Species endemic to a region
* Species endemic to Europe
* Species sub-endemic to Europe
* Non-endemic species
 |
| Species of other habitats* Species of rock habitats
* Species of ice/polar habitats
* Species of underground habitats
* Species of urban habitats
* Species of mountain habitats
 |
| Grouping of species based on the taxonomical categories*Already existent by Habitat Directive Article 17* |

### Species assignment to ecological groups

For species we categorised the links between species and individual ecological groups, using the categories from the previous work of the ETC/BD related to links between species and habitats (Halada et al., 2011). The following categories were distinguished exclusive, preferred, suitable and occasional habitat of species:

**E – exclusive habitat**: species is restricted to this habitat and does not occur in any other.

**P – preferred habitat**: main habitat of the species, species usually uses this habitat for its life or main part of population is linked to this habitat type, but can occur also in another habitat.

**S – suitable habitat**: habitat in which the species regularly occurs, while the species optimum is in another (preferred) habitat or preferred habitat is not possible to determine – this is typical for species regularly living in several habitat types. This category is thus also used for species with broad ecological niche and thus occurring in different ecological groups without clear preference of one of them.

**O – occasional habitat**: species sometimes lives in this habitat, but only marginally or small part of the species population uses this habitat.

Thus, the link between species and habitat (ecological group) is mostly categories as indicated above. Some ecological groups identified for species (e.g. Species of old-growth forests) are not related to the type of habitat, but rather to its quality. For these ecological groups the attribution of species is only using YES/NO categories, YES **–** if a species requires the specific quality of the habitat.

Some animal species use different habitats in different parts of their life cycle or for different activities. Therefore, where applicable, breeding habitats, foraging habitats and wintering habitats are distinguished[[1]](#footnote-1).

For assigning the species to specific ecological groups and for categorisation of the links we used different data sources. The global and European IUCN red lists (https://www.iucnredlist.org/) as well as national red books were important sources of information about species ecological requirements, habitat affinity, distribution (regions, altitude etc.). Additional information about these parameters was found in numerous papers, reports and books related to individual species or taxonomical groups. The Habitats Directive reporting under Article 17 submitted by the EU Member States in 2019 was another valuable source of information about species distribution in biogeographical regions, size of range and area. Here, we used both the corresponding databases and maps. The information from literature was completed by the expert knowledge of authors and ETC/BD experts that commented the species classification to ecological groups.

### Dealing with uncertainty of the species attribution to ecological groups

For some species we had sufficient data sources to assign them to all ecological groups, but for others the information availability varied. Due to these differences, we added information on the degree of knowledge and uncertainty and used following categories for this purpose[[2]](#footnote-2):

**G – good:** the species information in relation to the respective classification is complete, fully sufficient to assign the species to particular ecological group(s).

**S – sufficient:** although the species information is not complete, it is sufficient for assignment of the species to particular ecological group(s) with high probability.

**N – not sufficient**: the information on species is not sufficient, the classification of the species into ecological group(s) was estimated based on available information.

**A – absent:** the information on the species in relation to the respective classification is not available and the species was classified into particular ecological group by an expert opinion. In cases that the authors were not able of such expert estimation, the species was not classified and this situation was indicated as “A-NC”.

The identification of the degree of knowledge allows users to take an informed decision on how to use the ecological grouping for assessments with respect to issues in data quality. Users can for example decide whether to use all classified species or a subset with only good background data.

# Ecological groups of habitats

Habitats are classified into the broad ecological groups. In the table below we provide a list of groups used and numbers of habitats in each broad group. Within each group more detailed split(s) are prepared following the criteria listed in Table 1. The detailed split is further described in the following chapters.

**Table 3: Numbers of habitats in broad groups**

|  |  |
| --- | --- |
| **Ecological group** | **Number of habitat types** |
| **Agricultural habitats** | 66 |
| **Grassland habitats** | 49 |
| **Heath and scrub habitats** | 35 |
| **Forest habitats**  | 87 |
| **Freshwater habitats** | 59 |
| **Wetland habitats** | 20 |
| **Coastal habitats** | 64 |
| **Marine habitats** | NA |

The resulting data are available in the Annex 3 of this document or online at <https://tableau-public.discomap.eea.europa.eu/views/1-ecoGrouping_2/Habitats-ecologicalgroups?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=n>

## Agricultural habitats

### Habitats depending on agricultural management

Some habitat types depend on agricultural management in such degree that the absence of management leads to changes in the habitat structure and potentially results in the transition to another habitat type. Such habitat types are considered to be fully dependent on agricultural management. Other habitat types can persist without agricultural management, but the management measures are favourable to them – mostly by enlarging a habitat area or by blocking succession and thus maintaining a habitat in places where without the agricultural management it would disappear. Current classification of the agricultural habitats is built on previous work (Halada et al., 2011). Current work reflects the addition of the habitat type 6540 Sub-Mediterranean grasslands of the *Molinio-Hordeion secalini* to Habitat Directive Annex I due accession of Croatia to the EU and put forward expert comments to individual habitat types. Following the definitions in Halada et al. (2011), two ecological groups are distinguished:

**Agricultural habitats fully dependent on agricultural management.** This group contains semi-natural habitat types established under regular, usually low-intensity agricultural management. The species composition has been subject to selection processes over many decades or centuries and corresponds both to the site conditions and to the type and intensity of human management. Both cessation of this management and significant changes in the management intensity result in (usually irreversible) changes in the habitat structure and species composition leading to a change to other habitat types.

**Agricultural habitats partially dependent on agricultural management.** The habitats in this group profit from agricultural management measures because they either prolong the existence of the habitat or enlarge/maintain an enlarged area of habitat distribution. The prolongation of the habitat existence is usually linked with blocking/reducing secondary succession.

|  |  |
| --- | --- |
| **Ecological group** | **Number of habitat types** |
| **Habitats fully dependent on agricultural management** | 23 |
| **Habitats partially dependent on agricultural management** | 36 |

### Productivity of agricultural habitats

Productivity is the basic attribute of agroecosystems, a feature that is crucial for the agricultural use of certain habitats. The habitats on productive soils are more attractive for (intensive) agricultural utilisation and therefore more subjected to the intensification pressures. In relation to productivity we have distinguished two ecological groups:

**Agricultural habitats on productive stands**. Habitats with potential for intensive use, developed on nutrient-rich soils.

**Agricultural habitats on non-productive stands and in mountainous areas**. Habitats with potential for low-intensive utilisation, developed on soils that are poor or medium-rich on nutrients. Soils are often stony and shallow. In mountains, harsh climate or steep slopes could be a factor decreasing or limiting productivity of these habitats.

|  |  |
| --- | --- |
| **Ecological group** | **Number of habitat types** |
| **Agricultural habitats on productive stands** | 10 |
| **Agricultural habitats on non-productive stands and in mountainous areas** | 55 |

## Grassland habitats

In Europe, grasslands represent natural or semi-natural formations, but also intensively managed areas. To obtain more detailed information on grassland habitats, we classified the habitats based on their management characteristics distinguishing natural types from those in need of management (i.e. grazing, cutting). The following categories were identified:

**Natural grasslands**. Grassland habitats of natural origin, usually not managed and/or not depending on (agricultural) management. Typically, they occur in high altitudes, on shallow, stony, or sandy soils or in places where scrub or tree vegetation cannot be developed due to climate conditions.

**Grasslands partially depending on management**. Grassland habitats of natural origin that profit from agricultural management measures because they either prolong the existence of the habitat or enlarge/maintain an enlarged habitat area or distribution. The prolongation of the habitat existence is usually linked with blocking/reducing secondary succession.

**Semi-natural grasslands fully dependent on management**. Semi-natural grasslands are grasslands developed by long-term interaction of man and nature, in which habitats that evolved from natural communities are now adapted to a certain frequency and intensity of human management.

|  |  |
| --- | --- |
| **Ecological group** | **Number of habitat types** |
| **Natural grasslands** | 35 |
| **Grasslands partially depending on management.** | 24 |
| **Semi-natural grasslands fully dependent on management** | 19 |

## Heath and scrub habitats

Similarly to grasslands, the European heaths are mostly represented by natural or semi-natural formations. In our work we separated the habitats based on their management characteristics. As such, we distinguish natural types from those in need of management (i.e. grazing, cutting) and described the following categories:

**Natural heath and scrub habitats.** Heath and scrub habitats of natural origin usually not managed, not depending on (agricultural) management.

**Heath and scrub habitats partially depending on management**. Heath and scrub habitats of natural origin that profit from agricultural management measures because they either prolong the existence of the habitat or enlarge/maintain an enlarged area of habitat distribution. The prolongation of the habitat existence is usually linked with blocking/reducing secondary succession.

**Heath and scrub habitats fully dependent on management**. Heath and scrub habitats that need a regular agricultural management for their existence. The interaction between humans and nature was crucial for the evolution of these habitats and the absence of management measures leads to their transformation to another habitat type.

|  |  |
| --- | --- |
| **Ecological group** | **Number of habitat types** |
| **Natural heath and scrub habitats** | 31 |
| **Heath and scrub habitats partially depending on management** | 15 |
| **Heath and scrub habitats fully dependent on management** | 4 |

## Forest habitats

While the classification of forest habitats seems to be trivial, it is not always easy to identify if the particular habitat is a forest or non-forest habitat. Therefore, the first step was to specify which habitats of the Habitats Directive Annex I can be considered as forest habitats. For this purpose, we used definition of forests habitats of the Convention of Biological Diversity that defines a forest as a land area of more than 0.5 ha, with a tree canopy cover of more than 10%, and which is not primarily under agricultural or other specific non-forest land use. Based on this definition, we classified all habitats listed in the Annex I of the Habitats Directive under Forest group (habitat code starting with number “9”) as forest habitats. In addition, we identified seven habitats that meet the main criterion – a tree cover greater than 10%. Besides habitats of the Annex I forest group (9XXX), we classified as belonging to ecological forest groups the following habitat types of other Annex I groups:

2180 Wooded dunes of the Atlantic, Continental and Boreal region

2270 \* Wooded dunes with *Pinus pinea* and/or *Pinus pinaster*

3240 Alpine rivers and their ligneous vegetation with *Salix elaeagnos*

5220 \* Arborescent matorral with *Zyziphus*

5230 \* Arborescent matorral with *Laurus nobilis*

6310 Dehesas with evergreen *Quercus* spp.

6530 \* Fennoscandian wooded meadows

This approach was used also for identifying High Nature Value Forest Areas, done in cooperation between the ETC/BD and ETC/ULS (Halada & Condé, 2018). Within a forest ecological group we further identified several detailed groups: based on type of leaves/needles, on production function, and on regional classification.

### Type of leaves/needles

The assimilation organs of trees are adapted to the climate of a particular region. The following categories are distinguished:

**Broadleaved deciduous forests.** Forest types dominated by broadleaved tree species where leaves persist only during one vegetation season followed by period where trees are without leaves.

**Broadleaved evergreen forests.** Forest types dominated by broadleaved tree species, where leaves persist several years, trees are thus evergreen. This ecological group is in Europe typical for the Mediterranean region.

**Mixed deciduous-coniferous forests.** Forest types with significant presence of both trees with leaves and trees with needles.

**Coniferous forests.** Forest types dominated by tree species having needles.

|  |  |  |
| --- | --- | --- |
| **Ecological group** |  | **Number of habitat types** |
| **Broadleaved deciduous forest** |  | 48  |
| **Broadleaved evergreen forests** |  | 13 |
| **Mixed deciduous-coniferous forests** |  | 18 |
| **Coniferous forests** |  | 29 |

### Production function of forests

To address the potential intensity of economical use of forests, we assessed the potential of forest habtiats for exploitation separating the habitats into three categories: forests with limited potential for exploitation, forest with good potential for timber production and forest with good potential for non-timber production

**Forests with limited potential for exploitation**. This group includes forests with mostly non-production function, e.g. forest types on stands with high erosion risk, high altitude forests, forest types on unproductive stands, natural non-exploited forests or extensively exploited Mediterranean forests.

**Forests with good potential for exploitation – timber production**. This group includes forest types on productive stands that are mostly used for timber production.

**Forests with good potential for exploitation – non-timber production**. This group includes forest types that are mostly used for non-timber products, e.g. for fruits (chestnut forests), bark (cork oak forests), resin (*Tetraclinis articulata* forests), etc.

|  |  |  |
| --- | --- | --- |
| **Ecological group** |  | **Number of habitat types** |
| **Forests with limited potential for exploitation** |  | 49 |
| **Forests with good potential for timber** |  | 46 |
| **Forests with good potential for non-timber products** |  | 7 |

### Regional classification of forests

The following categories are distinguished:

**Boreal forests.** Forests of northern boreal zone adapted to harsh climatic conditions.

**Forests of temperate zone.** Forests of nemoral zone of Europe adapted to moderate temperature climate.

**Mediterranean and sub-Mediterranean forests (including supra-Mediterranean).** Forests of Mediterranean and sub-Mediterranean zones of Europe. High-mountain (oro-Mediterranean) habitats are included.

**Macaronesian forests**. Forests of Macaronesian biogeographical region – forest types of Azores, Madeira, and Canary Islands.

|  |  |  |
| --- | --- | --- |
| **Ecological group** |  | **Number of habitat types** |
| **Boreal forests** |  | 14 |
| **Forests of temperate zone** |  | 35 |
| **Mediterranean and sub-Mediterranean forests** |  | 45 |
| **Macaronesian forests** |  | 7 |

## Freshwater habitats

In order to classify the Annex I habtiats as freshwater habitats,we used the concept outlined in the WFD CIS Guidance Document No 12 (European Communities 2003), which defines three groups of water dependant habitats. The freshwater habitats within the frame of this work are those corresponding to category 2a in CIS Guidance Document: ‘*habitats which consist of surface water or occur entirely within surface water*’). The water bodies with saline water were excluded.

The following categories are distinguished:

**Running waters**. All permanent rivers and streams, including rivers, streams, brooks, rivulets, rills, torrents, waterfalls, cascades and rapids.

**Standing waters.** Lakes, ponds and pools with fresh (non-saline) or slightly brackish water. Included are semi-natural, man-made freshwater bodies like artificially created lakes, reservoirs and canals.

**Temporary water bodies**. Freshwater habitats that are typical by periodic flow cessation and may experience partial or complete loss of surface water. Seasonal rivers, streams, ponds, and rivers belong to this group.

|  |  |
| --- | --- |
| **Ecological group** | **Number of habitat types** |
| **Standing waters** | 10 |
| **Running waters** | 9 |
| **Temporary water bodies** | 6 |

### Characteristic of river habitats

In line with the approach used in the recent typology of rivers and lakes in Europe (Solheim et al. 2019), altitude was the main criterion in identifying ecological groups for rivers. Therefor three ecological groups were distinguished based on altitude: lowland rivers, mid-altitude rivers, and highland rivers. Mediterranean rivers are considered a distinct group due to a warmer and drier climate – which corresponds to typology of Solheim et al. (2019) – as well as temporary and permanently flowing streams and rivers. This last group corresponds to the approach of Solheim et al. (2019) as they assume that perennial or temporary/intermittent flow is a more important descriptor to explain variability in reference communities than altitude. The temporary streams and rivers occur only in the Mediterranean region. We distinguish following ecological groups:

**Lowland rivers.** Rivers and streams of lowlands and plains.

**Mid-altitude rivers**. Rivers and streams of uplands and lower mountains.

**Highland rivers**. Rivers and streams of high mountains and alpine zone.

**Mediterranean rivers**. Rivers and streams of the Mediterranean region.

**Temporary streams and rivers**. Rivers and streams drying out for parts of a year, or occasionally running rivers and streams.

|  |  |
| --- | --- |
| **Ecological group** | **Number of habitat types** |
| **Lowland rivers** | 6 |
| **Mid-altitude rivers** | 9 |
| **Highland rivers** | 4 |
| **Mediterranean rivers** | 9 |
| **Temporary streams and rivers** | 1 |

### Characteristic of lake habitats

For the classification of standing waters we used the same approach as for running waters, following the approach of Solheim et al. (2019). Three ecological groups were distinguished based on altitude: lowland lakes, mid-altitude lakes, and highland lakes. Mediterranean lakes are considered a distinct group due to a warmer and drier climate as well as temporal and permanent lakes. We distinguish following ecological groups:

**Lowland lakes.** Lakes of lowlands and plains.

**Mid-altitude lakes.** Lakes of uplands and lower mountains.

**Highland lakes.** Lakes of high mountains and alpine zone.

**Mediterranean lakes**. Lakes of Mediterranean region.

**Temporary lakes**. Lakes drying for part of year.

|  |  |
| --- | --- |
|  **Ecological group** | **Number of habitat types** |
| **Lowland lakes** | 10 |
| **Mid-altitude lakes** | 8 |
| **Highland lakes** | 1 |
| **Mediterranean lakes** | 8 |
| **Temporary lakes** | 5 |

## Wetland habitats

For the identification of wetland habitats, we used the same approach as for the freshwater habitats. We followed the concept outlined in the WFD CIS Guidance Document No 12 (European Communities 2003), which defines water dependant Annex I habitats. The wetlands habitats in our work are those included in the category 2b in CIS Guidance Document: “habitats which depend on frequent inundation, or on the level of groundwater (e.g. alluvial alder wood, blanket bog, fens)”.

### Character of wetland habitats

The habitats depending on high level of ground water: bogs, mires, marshes, fens, wet meadows. The following categories are distinguished:

**Bogs and mires**. Bog and mire complexes, usually acid or neutral, including raised bogs, blanket bogs, acidic fens, transition mires, boreal marsh-fens, aapa, palsa and polygon mires.

**Calcareous fens and wet meadows.** Wetlands mostly with peat or tufa soils permanently waterlogged, with base-rich, nutrient-poor, often calcareous water supply, and with the water table at, or slightly above or below, the substratum. The group includes also managed or unmanaged grasslands on wet and humid stands.

**Inland salt marches.** Habitats of the fringes and emerged beds of inland permanent or temporary saline, hypersaline or brackish waterbodies, including lakes, pools, springs.

**Wet heaths and shrubs.** Heath and scrub habitats of wetlands. Included are scrubby habitats in alluvial and riparian sites, scrubs on periphery of water bodies, scrub habitats in bogs, marches, and other wetlands.

**Wet forests.** Forest with permanently or temporary wet soils. Included are forests in alluvial and riparian positions, bog forest, forests of marshes and forests in other wetlands.

|  |  |  |
| --- | --- | --- |
| **Ecological group** |  | **Number of habitat types** |
| **Bogs and mires** |  | 6 |
| **Calcareous fens and wet meadows**  |  | 17 |
| **Inland salt marches** |  | 4 |
| **Wet heaths and shrubs** |  | 6 |
| **Wet forests** |  | 16 |

### Floodplains

Riparian and alluvial freshwater habitats along streams and rivers are habitats that depend on (frequent) inundation or high water level in the soil. This is a group of habitats linked to the hydrological regime of rivers and streams. The water bodies themselves are excluded.

|  |  |
| --- | --- |
| **Ecological group** | **Number of habitat types** |
| **Riparian and alluvial habitats[[3]](#footnote-3)**  | 27 |

## Coastal habitats

Coastal habitats include habitats that are above the low tide limit or above the mean water level in non-tidal waters occupying coastal features and characterised by their proximity to the sea, including coastal dunes and wooded coastal dunes, beaches and cliffs. This group includes sandy beaches and dunes, sea cliffs and rocky shores and other habitats. It is an ecological group with specific pressures that are related to coastal areas.

### Character of coastal habitats

Coastal habitats are classified according to the character of the coast. The following categories are distinguished:

**Intertidal flats**. Habitats of flat coasts, usually influenced either by the tide or high level of water in the soil profile. They are not linked to the river flow and therefore are flooded by marine water instead brackish water. The coastal saltmarshes and saline reedbeds are included in this group.

**Rocky shores.** Rock exposures adjacent to the seas, or separated from them by a narrow shoreline. This ecological group includes coastal shingle – beaches covered by pebbles, or sometimes boulders, usually formed by wave action.

**Sandy coast.** Sand-covered sea shorelines, fashioned by the action of wind or waves. They include gently sloping beaches and beach-ridges, formed by sands that were brought by waves, longshore drift and storm waves, as well as dunes, formed by aeolian deposits.

**Lagoons.** Water bodies with saline or hypersaline waters either connected or disconnected with neighbouring sea.

**Estuarine complexes**. This includes typical estuarine habitats - normally subjected to tides, even though only to a minimal extend. These habitats have usually brackish water.

|  |  |
| --- | --- |
| **Ecological group** | **Number of habitat types** |
| **Intertidal flats**  | 14 |
| **Rocky shores** | 12 |
| **Sandy coast** | 25 |
| **Lagoons** | 10 |
| **Estuarine complexes** | 7 |

### Coasts of sea systems

The classification of coastal habitats was made based on their affinity to the marine biogeographical division of Europe. Distinguished are following categories:

* Coastal habitats of Atlantic Ocean
* Coastal habitats of Baltic Sea
* Coastal habitats of Mediterranean Sea
* Coastal habitats of Black Sea
* Macaronesian coastal habitats

Note: This classification reflects the attribution of habitats to a sea or ocean coast in contrast to their occurrence within a particular terrestrial biogeographical region. For example, coastal habitats of south-western Portugal are assigned to the coast of the Atlantic Ocean while in terrestrial classification the same area belongs to the Mediterranean biogeographical region.

In the table below, we indicate the number of habitats classified in each category.

|  |  |
| --- | --- |
| **Ecological group** | **Number of habitat types** |
| **Coastal habitats of Atlantic ocean** | 47 |
| **Coastal habitats of Baltic sea** | 35 |
| **Coastal habitats of Mediterranean sea** | 37 |
| **Coastal habitats of Black Sea** | 19 |
| **Macaronesian coastal habitats** | 18 |

## Marine habitats

This group includes coastal lagoons – marine habitat with permanent column of saline water and estuaries – habitats with fluctuating brackish water. From practical reasons, the waterlogged littoral saltmarshes and associated saline or brackish pools above the mean water level in non-tidal waters or above the maximum spring high tide in tidal waters are included with coastal habitats.

Note: the marine group was not defined as a part of our work for habitats, as this groups has already been defined via other processes.

## Cross-cutting issues

The classifications in this chapter are based on different criteria and the ecological groups identified can often be combined with ecological groups described in previous chapters.

### Altitude

This classification is based on altitude zones and distinguishes lowland habitats from mountain habitats. High-mountain and alpine habitats are included as a separate category. The following categories are distinguished:

**Lowland habitats**. Habitats of low altitudes - lowlands and plains.

**Upland/mountain habitats**. Habitats of mid-altitudes of uplands and mountains.

**High-mountain and alpine habitats.** Habitats of high mountains and alpine zone.

|  |  |  |
| --- | --- | --- |
| **Ecological group** |  | **Number of habitat types** |
| **Lowland habitats** |  | 153 |
| **Upland/mountain habitats** |  | 157 |
| **High-mountain and alpine habitats** |  | 48 |

### Character of distribution

We used size of the range/distribution area for characterising the degree of endemism. Following categories are distinguished:

**Habitats endemic to small area (stenoendemic habitats).** The habitat occurs in a very small area and its range does not exceed 1,000 km2.

**Habitats endemic to region.** The habitat occurs in a relatively compact area, restricted to a part of Europe that could be considered as a region. The habitat range does not exceed 10,000 km2.

**Habitats with restricted natural range and scattered distribution**. Habitat with scattered distribution or limited abundance, restricted to one part of Europe. The habitat range exceeds 10,000 km2.

**Common habitats with restricted natural range**. Habitat abundant or common within their range, restricted to one part of Europe. The habitat range exceeds 10,000 km2.

**Widespread habitats with scattered distribution**. Habitats occurring in different parts of Europe, but its distribution has scattered character.

**Widespread common habitats**. Habitats common in different parts of Europe.

**Widespread abundant habitats**. Widespread habitats occurring in different parts of the respective bioclimatic zone in Europe and the habitat is everywhere abundant.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ecological group** | **No** | **No** | **Ecological group** | **No** |
| **Stenoendemic** | 11 |  | **Widespread scattered** | 15 |
| **Endemic to region** | 31 |  | **Widespread common** | 45 |
| **Restricted range and scattered** | 50 |  | **Widespread abundant** | 10 |
| **Restricted range and common** | 70 |  |  |  |

The resulting data are available in the Annex 3 of this document or online at <https://tableau-public.discomap.eea.europa.eu/views/1-ecoGrouping_endemism_4/Introduction?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=n>

### Biogeographical distribution

Habitats are classified on the basis of their occurrence in individual biogeographic regions (see Map 1). We provide the number of habitats occurring in the respective biogeographic region in the table below.

| **Terrestrial region** | **Number of habitats** | **Marine region** | **Number of habitats** |
| --- | --- | --- | --- |
| Alpine region | 121 | Marine Atlantic region | 7 |
| Atlantic region | 105 | Marine Baltic region | 7 |
| Black Sea region | 53 | Marine Black Sea region | 7 |
| Boreal region | 82 | Marine Macaronesian region | 5 |
| Continental region | 157 | Marine Mediterranean region | 8 |
| Macaronesian region | 36 |  |  |
| Mediterranean region | 149 |  |  |
| Pannonian region | 56 |  |  |
| Steppic region | 25 |  |  |

### Habitat grouping based on habitat classification system

The Habitats Directive Annex I uses a hierarchical two-level classification of habitats. It contains nine groups at the first level and 32 groups at the second level of division; all broad habitat groups of level 1 are further divided except Temperate heath and scrub. This classification in the Annex I can be used to focus the analysis in a similar way as the groupings elaborated in this report.

# Ecological groups of species

Species are first classified into broad ecological groups. In the table below we provide a list of groups used and numbers of species in each broad group. Within each group, more detailed split(s) are prepared following the criteria listed in Table 2 and further described in the following chapters.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ecological group** | **Exclusive** | **Preferred** | **Suitable** | **Occasional** |
| **Species of agricultural habitats** | 2 | 44 | 317 | 140 |
| **Grassland species** | 1 | 154 | 340 | 65 |
| **Species of heath and scrub habitats** | 21 | 152 | 397 | 74 |
| **Forest species** | 56 | 199 | 227 | 46 |
| **Species of freshwater habitats** | 275 | 112 | 36 | 8 |
| **Wetland species**  | 16 | 156 | 176 | 20 |
| **Species of coastal habitats** | 62 | 77 | 91 | 18 |
| **Species of marine habitats** | 48 | 25 | 8 | 3 |

The resulting data are available in the Annex 3 of this document or online at

<https://tableau-public.discomap.eea.europa.eu/views/1-ecoGrouping_2/Habitats-ecologicalgroups?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=n>

## Species of agricultural habitats

Within a broad ecological group of species linked to agricultural habitats, we described more detailed ecological groups of species that need a mosaic of agricultural habitats for their life cycle or activities (e.g. feeding), and species in need of low-intensity farming of a different type.

### Species in need of low-intensity farming

This classification focuses the species that either prefer (P) low-intensity farming areas or species that are fully adapted to low-intensity agricultural management, are dependent on it and thus are restricted (E) to habitats that are under low-intensity agricultural management regimes. We distinguish three groups:

**Species of low-intensity managed arable land**. Species adapted to habitats that are ploughed, but otherwise managed in a non-intensive way: either without or with low use of agrochemicals; if fertilisation occurs, usually organic fertilisers are applied, etc.

**Species of low-intensity managed grasslands.** Species adapted to management regimes (cutting and grazing) typical for semi-natural grasslands. In meadow this means usually one, max. 2 cuts per year, absence of ploughing, re-seeding and synthetic fertilisers use. In pastures, low stocking density with no additional fertilisation of pastures and management measures preventing concentration of livestock in restricted places.

**Species of low-intensity managed heaths and scrubs.** Species adapted to heathland grazing of low intensity.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ecological group** | **Exclusive** | **Preferred** | **Suitable** | **Occasional** |
| **Species of low-intensity managed arable land** | 2 | 5 | 74 | 65 |
| **Species of low-intensity managed grasslands.** | 0 | 32 | 250 | 140 |
| **Species of low-intensity managed heaths and scrubs** | 0 | 8 | 133 | 105 |

### Species in need of mosaic of agricultural habitats

This ecological group includes species that either need different agricultural habitats for their life cycle or species which profit from the heterogeneous landscape. The number of species in individual classes are as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Exclusive** | **Preferred** | **Suitable** | **Occasional** |
| 0 | 7 | 105 | 39 |

## Species of grassland habitats

This ecological group contains species linked to grassland habitats. We distinguish two groups:

**Species of natural grasslands**. Species occurring in natural, not managed grasslands.

**Species of managed grasslands**. Species adapted to different types and intensities of agricultural management of grasslands, adapted or capable of prospering in grasslands under agricultural management.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ecological group** | **Exclusive** | **Preferred** | **Suitable** | **Occasional** |
| **Species of natural grasslands** | 1 | 128 | 319 | 45 |
| **Species of managed grasslands** | 0 | 35 | 265 | 134 |

## Species of heath and scrub habitats

This ecological group contains species living in heath and scrub habitats. We used the same approach as for grassland and distinguish two groups:

**Species of natural heath and scrub habitats**. Species occurring in natural, not managed heaths and scrub habitats.

**Species of managed heath and scrub habitats**. Species adapted to different types and intensities of agricultural management of heaths and scrub habitats, capable of prospering under agricultural management, mostly grazing.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ecological group** | **Exclusive** | **Preferred** | **Suitable** | **Occasional** |
| **Species of natural heath and scrub habitats** | 21 | 147 | 387 | 62 |
| **Species of managed heath and scrub habitats** | 0 | 11 | 154 | 105 |

## Species of forests habitats

### Forest species living on wood

The species living on wood are often related to valuable forests types (old, natural forests or virgin forests) that are either not managed or receive a particular conservation focused management. We split the forest species living on wood into two categories: species living on living, standing trees and species living on dead wood.

**Species living on live, standing trees**. Such species mostly live in old forests with big trunks or crowns. With regard to plant species, this ecological group mostly includes mosses. Animals are represented by species living under bark (mostly insects) or in wood holes (mostly mammals).

**Species living on dead wood.** Species living on fallen trunks and dead wood in different stages of decomposition. These species are typical to virgin forest with all stages of a tree life cycle, non-managed forests or forests managed with the specific aim to keep dead wood. The ecological group predominantly contains mosses and beetles.

|  |  |  |  |
| --- | --- | --- | --- |
| **Ecological group** | **Preferred** | **Suitable** | **Occasional** |
| **Species living on live, standing trees** | 21 | 13 | 3 |
| **Species living on dead wood** | 31 | 2 | 0 |

### Species of old-growth forests

This ecological group contains species that are restricted to old growth, ancient forests. These species either need a specific structure of old-growth forests for their life (old trees, trees of different age classes, spatial heterogeneity with canopy gaps and closed canopy patches etc.) or specific resources like dead trees and decaying wood, nutrient-enriched soils etc. For this ecological group we did not specified a degree of habitat preference, we only recorded if a species is linked to old-growth forests. We recorded 60 such species.

### Insect species in need of mosaic of forest habitats or forest margins

This ecological group contains species living in open woodland. They are bound to a mosaic of woodland and open patches (which is typically present in coppices). This group also comprises a significant number of saproxylic species, which need a combination of dead wood and sunny (open) patches. Other species are linked to the ecotone between forest and adjacent non-forest habitats. We used a similar approach as for the previous group and classified 82 species in this ecological group.

### Forest species adapted to fire

This ecological group contains species adapted to forest fires – species that require regular or occasional forest fires and species that profit from forest fires, usually due to restricted competition after fire or improved resources. This ecological group needs to be explored further – so far, we assigned only two beetle species to it: *Stephanopachys linearis* and S. *substriatus*.

## Species of freshwater habitats

Within the group of freshwater species, we prepared a detailed grouping for non-fish species of two animal groups: dragonflies and mammals.

### Dragonflies and their habitats

The classification of dragonfly species is based on their reproduction habitats. The following categories are distinguished:

**Dragonflies reproducing in standing water**. Species that lay eggs in pools, lakes, water reservoirs and similar habitats and their larvae live in standing water bodies.

**Dragonflies reproducing in running water.** Species that lay eggs in brooks, streams and rivers and their larvae live in running waters.

|  |  |  |  |
| --- | --- | --- | --- |
| **Ecological group** | **Preferred** | **Suitable** | **Occasional** |
| **Dragonflies reproducing in standing water** | 8 | 0 | 2 |
| **Dragonflies reproducing in running water** | 7 | 0 | 1 |

### Aquatic mammals

Only mammals of freshwater habitats are included. This ecological group contains only four species:

*Galemys pyrenaicus* - Pyrenean desman

*Castor fiber* - Eurasian beaver

*Lutra lutra* - Eurasian otter

*Pusa hispida saimensis* - Saimaa ringed seal.

## Species of wetland habitats

This classification contains species that live in habitats with typically wet soils, with the water table close to, or at soil surface at least during part of the year.

**Species of riparian and alluvial habitats**. Species living in the riparian zone of freshwaters – along streams, rivers and other water bodies. This group also includes species typical for the wet parts of river alluvia.

**Species of bogs and mires**. Species typical to bog and mire complexes that are usually acid or neutral, including raised bogs, blanket bogs, acidic fens, transition mires, boreal marsh-fens, aapa, palsa and polygon mires.

**Species of calcareous fens.** Species typical to alkaline wetlands mostly with peat or tufa soils permanently waterlogged, with base-rich, nutrient-poor, often calcareous water supply.

**Species of wet meadows.** Species living in managed or unmanaged grasslands on wet and humid stands.

**Species of inland salt marches.** Species of the fringes and emerged beds of inland permanent or temporary saline, hypersaline or brackish water bodies, including lakes, pools, and springs.

**Species of wet heaths and shrubs.** Species of wetland heaths and scrub habitats like scrub habitats of alluvial and riparian zones, scrubs in the periphery of water bodies, scrub habitats in bogs, marches, and other wetlands.

**Species of wet forests.** Species typical for forests with permanently or temporary wet soils. This includes forests in alluvial and riparian zones, bog forest, forests of marshes and forests of other types of wetlands.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ecological group** | **Exclusive** | **Preferred** | **Suitable** | **Occasional** |
| **Species of riparian and alluvial habitats** | 5 | 68 | 154 | 14 |
| **Species of bogs and mires** | 0 | 9 | 82 | 11 |
| **Species of calcareous fens** | 0 | 10 | 73 | 10 |
| **Species of wet meadows** | 0 | 20 | 98 | 10 |
| **Species of inland salt marches** | 1 | 3 | 12 | 3 |
| **Species of wet heaths and shrubs** | 0 | 6 | 67 | 5 |
| **Species of wet forests** | 0 | 13 | 83 | 5 |

## Species of coastal habitats

This classification includes species specifically linked to coastal areas that live in coastal habitats including dunes, sea cliffs, saltmarshes, etc. This group also includes marine mammals that need coastal habitats for their reproduction – e.g. seals.

### Species of main coast types

The coastal species are classified according to the character of the coast. Following categories are distinguished:

**Intertidal flats.** Species of flat coasts, usually influenced either by tide or high level of water in the soil profile. These areas are often under influence of marine water and they could have a character of salt marshes.

**Rocky shores.** Coasts with stony shores - rocks, cliffs. Some parts of rocky shores are influenced by spraying marine water and there is a group of species (especially plants) adapted to this environment.

**Sandy coast.** Coasts dominated by sand - sandy beaches, sand dunes. This group includes both open habitats without plant cover and sandy habitats with herbaceous, shrubby or woody vegetation.

|  |  |  |  |
| --- | --- | --- | --- |
| **Ecological group** | **Preferred** | **Suitable** | **Occasional** |
| **Intertidal flats** | 5 | 8 | 4 |
| **Rocky shores** | 28 | 27 | 7 |
| **Sandy coast** | 18 | 33 | 16 |

### Coasts of sea systems

This classification entails species living – at least in part of their life cycle – in coastal habitats. The detailed groups are elaborated based on the affinity of species to coasts of individual seas or oceans of Europe. The following categories are distinguished:

* Species of Atlantic coastal habitats
* Species of Baltic coastal habitats
* Species of Mediterranean coastal habitats
* Species of Black Sea coastal habitats
* Species of Macaronesian coastal habitats

This classification focuses on the occurrence of species in coastal areas of a particular sea or ocean. For example, species living in coastal habitats of southwestern Portugal are assigned to the coast of the Atlantic Ocean while in the terrestrial classification the same area belongs to the Mediterranean biogeographical region.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ecological group** | **Exclusive** | **Preferred** | **Suitable** | **Occasional** |
| **Species of Atlantic coastal habitats** | 3 | 32 | 9 | 1 |
| **Species of Baltic coastal habitats** | 0 | 17 | 1 | 0 |
| **Species of Mediterranean coastal habitats** | 4 | 51 | 5 | 0 |
| **Species of Black Sea coastal habitats** | 0 | 15 | 0 | 0 |
| **Species of Macaronesian coastal habitats** | 1 | 17 | 3 | 0 |

## Species of marine habitats

This group contains species living in marine habitats along the coastlines, in lagoons or other parts of the continental shelf. Due to the small number of species of the Habitats Directive attributed to this groups, it is not further divided.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ecological group** | **Exclusive** | **Preferred** | **Suitable** | **Occasional** |
| **Species of marine habitats** | 48 | 24 | 8 | 3 |

## Cross-cutting issues

The classifications in this chapter are based on different criteria and the ecological groups identified can often be combined with ecological groups described in previous chapters.

### Biogeographical distribution of species

Species can be classified on the basis of their occurrence in individual biogeographic regions (see Map 1). Below, we specify the number of species assigned to each biogeographical region:

| **Terrestrial region** | **Number of species** | **Marine region** | **Number of species** |
| --- | --- | --- | --- |
| Alpine region | 507 | Marine Atlantic region | 55 |
| Atlantic region | 306 | Marine Baltic region | 14 |
| Black Sea region | 136 | Marine Black Sea region | 8 |
| Boreal region | 183 | Marine Macaronesian region | 40 |
| Continental region | 529 | Marine Mediterranean region | 46  |
| Macaronesian region | 185 |  |  |
| Mediterranean region | 864 |  |  |
| Pannonian region | 217 |  |  |
| Steppic region | 126 |  |  |

Map 1 Biogeographical map of Europe



**Source**: <https://www.eea.europa.eu/data-and-maps/figures/biogeographical-regions-in-europe-2>

### Range size and endemism

In addition, we classified species according to the size of their range or their degree of endemism. The word “endemism” is a relative term and is usually accompanied with a specification of the geographical area to which the species is endemic. We distinguished following categories:

**Monotopic species**: the species range is very small, up to 50 km2; usually occupied by one local population. This category is sometimes referred in the literature as “punctual endemism”.

**Stenoendemic species**: the species occurs in several sites or in higher number of sites, but its range does not exceed 1,000 km2. Considering the European dimension of our analysis, this category can be related to the term “local endemic species” used in the literature.

**Species endemic to a region**: the species is distributed in a larger area; its range covers part of Europe that could be considered as a region. Typical examples are: species endemic to the Alps, Pyrenean peninsula, Atlantic region, Scandinavia, Dinaric Mountains, Central Europe etc.

**Species endemic to Europe**: the species is distributed in different parts of Europe, but its range does not exceed the boundary of Europe.

**Species sub-endemic to Europe**: the species has its main part of distribution in Europe, but it is also occurring in other (usually neighbouring) areas. Typical groups of these species represent species living in neighbouring regions of Europe, such as in North Africa, Anatolian part of Turkey or in west Siberia. In this category, we also classified species having a small or very small range of distribution, located on the boundary of continents – having one part in Europe and another part in neighbouring continent.

**Non-endemic species**: species with distribution significantly exceeding Europe. This most prominently includes the broad group of circumpolar/circumboreal species, distributed in north part of Europe, north Asia and North America.

|  |  |
| --- | --- |
| **Ecological group** | **Number of species** |
| **Monotopic species** | 153 |
| **Stenoendemic species** | 397 |
| **Species endemic to a region** | 419 |
| **Species endemic to Europe** | 59 |
| **Species sub-endemic to Europe** | 121 |
| **Non-endemic species** | 272 |

The resulting data are available in the Annex 3 of this document or online at <https://tableau-public.discomap.eea.europa.eu/views/1-ecoGrouping_endemism_4/Introduction?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=n>

### Species of other habitats

In this study, species are first classified according to their preference for broad habitat types. In the table below we provide a list of additional habitat categories for which we did not elaborate a detailed grouping.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ecological group** | **Exclusive** | **Preferred** | **Suitable** | **Occasional** |
| **Species of rock habitats** | 124 | 204 | 198 | 11 |
| **Species of ice/polar habitats** | 3 | 3 | 3 | 1 |
| **Species of underground habitats** | 13 | 32 | 10 | 12 |
| **Species of urban habitats** | 2 | 30 | 89 | 59 |
| **Species of mountain habitats** | 136 | 114 | 207 | 20 |

### Grouping of species based on the taxonomical categories

Besides the ecological groups identified in chapter 4 and described in chapter 6, also taxonomical groups can be used to focus the analysis. These are basically the broad taxonomical groups as noted below. In addition, a further split for some groups of invertebrates can be envisaged.

|  |  |  |
| --- | --- | --- |
| **Plants** | **Invertebrates** | **Vertebrates** |
| **Non-vascular plants** | Molluscs | Fishes |
| **Vascular plants** | Arthropods | Amphibians |
|  | Other Invertebrates | Reptiles |
|  |  | Mammals |

Invertebrates are further divided to more narrow taxonomical groups:

|  |  |
| --- | --- |
| **Cnidaria** | Anthozoa |
| **Mollusca** | Gastropoda Lamellibranchia (Bivalia) |
| **Annelida** | Hirudinea |
| **Arachnida** | AraneaePseudoscorpiones |
| **Malostraca** | Decapoda |
| **Crustacea** | Isopoda |
| **Insecta** | OdonataOrthopteraMantodeaHemipteraColeopteraLepidoptera |
| **Echindermata** | Echinoidea |

This allows us to refine an assessment to each distinguished taxonomical group of species, if needed.

# Conclusions

This report provides the results of the ETC/BD activities from 2020 to 2022 aimed at identifying and developing ecological groups of species and habitats that are listed in the annexes of the Habitats Directive. As part of this work, the ecological groups relevant for supporting the legal frameworks and strategy processes in the EU have been identified, the respective definitions were prepared as well as habitats and species were assigned to these groups.

The developed ecological groups were already used in an assessment supporting the preparation of the EEA State of Nature report in 2020 (EEA, 2020).

In the future, a feedback on this proposed grouping should be sought via a consultation with potential users and broader informed public. For this purpose, a dedicated feedback form is proposed and attached as Annex 2 of this report.

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IUCN Red List: <https://www.iucnredlist.org/>

Annex 1: Pressure analysis using ecological grouping for wetlands habitats and species

To demonstrate the use of the ecological groups for targeted pressure assessments we selected the group of wetlands . We used the pressures reported by the EU Member States for the period 2013-2018 under their obligations related to the Article 17 of the Habitats Directive. We only considered pressures of high intensity. We separately assessed pressures to wetland habitat types and to species linked to wetland habitats.

**Pressures to wetland habitats**

We classified the Annex I habitats of wetlands into five ecological groups: bogs and mires, calcareous fens and wet meadows, inland salt marshes, wet heaths and shrubs, and wet forests. The frequencies of pressures reported for these five ecological groups are summarised in Figure 1.

The pressures related to **agriculture** are the most frequently reported group of pressures in all ecological groups except for wet forests. For calcareous fens and wet meadows, they represent almost 40% of all reported pressures. Pressures related to **forestry** are the main pressure group for wet forests - they reached 35% of all reported pressures to wet forests.

Figure 1: Groups of pressures to ecological groups of wetlands

The **modification of water regimes** is important especially for bogs and mires (18.5% of all reported pressures), to lesser extent for calcareous fens and wet meadows (11.8%) and inland salt marshes (11.3%). The pressures related to **urbanisation** are the second most important group of pressures to inland salt marshes (20.7%) and they are also quite important for wet heaths and scrubs (17.3%). The pressures related to **natural processes** seems to be quite important for wetlands - they represent more than 11% of all reported pressures to three ecological groups: bogs and mires; calcareous fens and wet meadows; and wet heaths and scrubs. Pressure related to **invasive alien species** were reported in particular for wet forests (10.9%), but also forwet heaths and shrubs (8.14%) and inland salt marshes (8.18%).

On the level of individual pressures, the most frequently reported pressure for the broad groups of wetland habitats was A09 *Intensive grazing or overgrazing by livestock*. It is also the dominant pressure for wet heaths and scrub and inland salt marshes and one of major pressures for calcareous fens and wet meadows. The most important pressure to wet forests is pressure I02 *Other invasive alien species* followed by K04 *Modification of hydrological flow*. The pressure K02 *Drainage* is the dominant pressure for bogs and mires for other groups it is of lesser importance. For calcareous fens and wet meadows, the most frequently reported pressure was A06 *Abandonment of grassland management*. The second most frequently reported pressure is L02 *Natural succession resulting in species composition change* while it is not dominant for any ecological group, but it belongs to the three most common reported pressures to the following ecological groups: bogs and mires, calcareous fens and wet meadows, and wet heaths and scrubs.

Table 1: The most frequently reported high ranked pressures to ecological groups of wetlands /%/\*

| **Code** | **Pressure name** | **Bogs and mires** | **Calcareous fens and wet meadows** | **Inland salt marshes** | **Wet heaths and scrubs** | **Wet forests** |
| --- | --- | --- | --- | --- | --- | --- |
| A09 | Intensive grazing or overgrazing by livestock | 5.30 | 5.50 | 6.65 | 7.17 | 2.99 |
| L02 | Natural succession resulting in species composition change | 7.33 | 6.53 | 2.30 | 5.86 | 2.18 |
| I02 | Other invasive alien species (other than species of Union concern) | 2.44 | 3.53 | 4.86 | 4.56 | 6.12 |
| K02 | Drainage | 8.04 | 3.29 | 2.81 | 4.23 | 1.97 |
| K04 | Modification of hydrological flow | 5.70 | 3.68 | 2.81 | 1.30 | 5.39 |
| A06 | Abandonment of grassland management  | 1.02 | 7.56 | 4.60 | 2.28 | 0.29 |
| K01 | Abstraction from groundwater, surface water or mixed water | 3.77 | 3.14 | 1.79 | 3.91 | 2.11 |
| F07 | Sports, tourism and leisure activities | 1.73 | 2.01 | 4.60 | 5.21 | 0.80 |
| E01 | Roads, paths, railroads and related infrastructure | 2.04 | 2.06 | 4.35 | 2.93 | 1.89 |
| L01 | Abiotic natural processes  | 2.24 | 2.31 | 3.07 | 3.58 | 0.73 |
| B01 | Conversion to forest from other land uses, or afforestation (excluding drainage) | 3.05 | 2.36 | 0.26 | 4.56 | 0.29 |
| J03 | Mixed source air pollution, air-borne pollutants | 4.38 | 1.77 | 0.26 | 2.61 | 1.02 |
| B27 | Modification of hydrological conditions, or physical alteration of water bodies and drainage for forestry  | 3.97 | 1.23 | 0.00 | 0.65 | 4.08 |
| N02 | Droughts and decreases in precipitation due to climate change | 3.46 | 1.77 | 0.26 | 1.95 | 2.33 |
| A31 | Drainage for use as agricultural land | 2.65 | 2.60 | 2.30 | 0.65 | 0.66 |
| A20 | Application of synthetic (mineral) fertilisers on agricultural land | 1.93 | 2.75 | 2.56 | 0.65 | 0.58 |
| A02 | Conversion from one type of agricultural land use to another (excluding drainage and burning) | 0.71 | 2.50 | 4.35 | 0.65 | 0.15 |
| I01 | Invasive alien species of Union concern | 0.51 | 2.06 | 2.05 | 1.30 | 2.33 |
| I04 | Problematic native species | 1.53 | 2.06 | 1.28 | 2.28 | 1.09 |
| A01 | Conversion into agricultural land  | 1.02 | 1.62 | 1.53 | 1.30 | 2.33 |
| F01 | Conversion from other land uses to housing, settlement or recreational areas  | 0.20 | 1.91 | 3.32 | 0.98 | 0.87 |
| B02 | Conversion to other types of forests including monocultures | 1.12 | 0.34 | 0.00 | 0.65 | 5.03 |
| B09 | Clear-cutting, removal of all trees | 1.32 | 0.88 | 0.00 | 0.00 | 4.44 |
| A33 | Modification of hydrological flow or physical alteration of water bodies for agriculture  | 1.32 | 1.91 | 1.28 | 0.65 | 1.31 |
| C07 | Peat extraction | 5.19 | 0.25 | 0.00 | 0.33 | 0.58 |
| A10 | Extensive grazing or undergrazing by livestock | 0.61 | 1.82 | 1.53 | 1.95 | 0.29 |
| B07 | Removal of dead and dying trees, including debris | 0.81 | 0.00 | 0.00 | 0.00 | 5.32 |

\* percentage of all pressures reported to the respective ecological group

|  |  |
| --- | --- |
| 4.44 | The most frequently reported pressure for the respective ecological group |
| 3.32 | Next two most frequently reported pressures (2-3) |
| 1.12 | Next three most frequently reported pressures (4-6) |

**Pressures to bog and mires habitats in individual biogeographical regions**

The pressures can differ in intensity within different parts of the EU Therefore, it is useful to have the possibility to analyse pressures in individual biogeographical regions. Below we present result of such analysis for one ecological group: bogs and mires.

Table 2 shows the percentage of reported pressures for bog and mires in the individual biogeographical regions. The most frequently reported pressures are more diverse than in the analysis above. The pressure K2 *Drainage* is most frequently reported pressure across biogeographical regions and it is the dominant pressure in Atlantic and Continental biogeographical regions, important also in the Mediterranean, Alpine, and Boreal regions. The second most frequently reported pressure – L02 *Natural succession resulting in species composition change* is dominant in the Pannonian and Alpine regions and important in the Continental and Boreal regions. The pressure K4 *Modification of hydrological flow* does not dominate in any biogeographical region, but it is quite frequently reported in the Alpine and Macaronesian regions. The pressure A09 *Intensive grazing or overgrazing by livestock* is the most frequently reported pressure in the Mediterranean and Macaronesian regions and it is important in the Alpine region as well. In the Pannonian region the pressure L02 (mentioned above) is reported as frequently as the pressure N2 *Droughts and decreases in precipitation due to climate change*. In the Boreal region, the most frequent is the pressure B27 *Modification of hydrological conditions, or physical alteration of water bodies and drainage for forestry*.

Table 2: Pressures to bogs and mires in individual biogeographical regions /%/\*

| **Code** | **Pressure name** | **ALP** | **ATL** | **BOR** | **CON** | **MAC\*\*** | **MED** | **PAN** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| K02 | Drainage | 6.31 | 10.00 | 5.98 | 10.24 | 0.00 | 8.33 | 3.57 |
| L02 | Natural succession resulting in species composition change  | 10.68 | 4.17 | 6.84 | 9.56 | 0.00 | 0.00 | 14.29 |
| K04 | Modification of hydrological flow | 8.25 | 5.00 | 2.56 | 6.14 | 8.00 | 2.08 | 3.57 |
| A09 | Intensive grazing or overgrazing by livestock | 8.74 | 4.58 | 0.00 | 3.07 | 10.00 | 16.67 | 3.57 |
| C07 | Peat extraction | 3.88 | 5.42 | 11.11 | 5.12 | 0.00 | 4.17 | 0.00 |
| J01 | Mixed source air pollution, air-borne pollutants | 2.91 | 7.08 | 0.85 | 6.48 | 0.00 | 0.00 | 0.00 |
| B27 | Modification of hydrological conditions, or physical alteration of water bodies and drainage for forestry (including dams) | 0.97 | 1.67 | 15.38 | 3.75 | 8.00 | 0.00 | 0.00 |
| K01 | Abstraction from groundwater, surface water or mixed water | 0.49 | 7.50 | 0.00 | 4.78 | 0.00 | 8.33 | 0.00 |
| N02 | Droughts and decreases in precipitation due to climate change | 3.40 | 2.08 | 2.56 | 4.10 | 0.00 | 6.25 | 14.29 |
| B01 | Conversion to forest from other land uses, or afforestation (excluding drainage) | 2.43 | 2.50 | 5.13 | 3.75 | 0.00 | 2.08 | 3.57 |
| A31 | Drainage for use as agricultural land | 3.40 | 1.67 | 3.42 | 1.37 | 10.00 | 4.17 | 0.00 |
| I02 | Other invasive alien species (other than species of Union concern) | 0.49 | 5.00 | 0.00 | 1.71 | 8.00 | 2.08 | 3.57 |
| L01 | Abiotic natural processes (e.g. erosion, silting up, drying out, submersion, salinization) | 2.91 | 1.67 | 1.71 | 2.05 | 4.00 | 0.00 | 7.14 |
| E01 | Roads, paths, railroads and related infrastructure | 1.94 | 1.67 | 1.71 | 1.02 | 4.00 | 8.33 | 3.57 |
| A20 | Application of synthetic (mineral) fertilisers on agricultural land | 0.49 | 2.92 | 0.85 | 1.37 | 10.00 | 2.08 | 0.00 |
| A27 | Agricultural activities generating air pollution | 0.00 | 4.58 | 0.00 | 1.71 | 0.00 | 2.08 | 0.00 |
| F07 | Sports, tourism and leisure activities | 3.40 | 0.83 | 2.56 | 0.00 | 4.00 | 4.17 | 3.57 |
| J01 | Mixed source pollution to surface and ground waters (limnic and terrestrial) | 0.97 | 2.92 | 0.85 | 1.02 | 0.00 | 0.00 | 7.14 |
| I04 | Problematic native species | 2.43 | 0.00 | 5.13 | 1.02 | 0.00 | 0.00 | 3.57 |
| A11 | Burning for agriculture | 0.49 | 2.92 | 0.00 | 1.02 | 0.00 | 6.25 | 0.00 |
| B09 | Clear-cutting, removal of all trees | 0.97 | 1.25 | 3.42 | 1.02 | 0.00 | 0.00 | 3.57 |
| K04 | Modification of hydrological flow or physical alteration of water bodies for agriculture  | 0.49 | 1.25 | 2.56 | 0.68 | 8.00 | 0.00 | 0.00 |
| B02 | Conversion to other types of forests including monocultures | 0.97 | 0.42 | 2.56 | 1.37 | 2.00 | 0.00 | 0.00 |
| A06 | Abandonment of grassland management  | 0.97 | 1.25 | 0.85 | 0.68 | 0.00 | 2.08 | 3.57 |
| A19 | Application of natural fertilisers on agricultural land | 1.46 | 0.83 | 0.85 | 1.02 | 0.00 | 2.08 | 0.00 |
| A01 | Conversion into agricultural land (excluding drainage and burning) | 0.97 | 0.83 | 0.00 | 0.34 | 10.00 | 0.00 | 0.00 |
| B29 | Other forestry activities, excluding those relating to agro-forestry | 1.46 | 0.83 | 0.00 | 1.02 | 0.00 | 0.00 | 7.14 |
| A03 | Conversion from mixed farming and agroforestry systems to specialised production | 0.00 | 0.42 | 0.00 | 0.00 | 10.00 | 0.00 | 0.00 |
| G08 | Management of fishing stocks and game | 0.97 | 0.00 | 0.00 | 0.34 | 0.00 | 0.00 | 7.14 |

\* percentage of all pressures reported to bogs and mires in the respective biogeographical region

\*\* due to the low total number of pressures reported in Macaronesian region, there are five most frequently reported pressures: A09 *Intensive grazing or overgrazing by livestock*, A31 *Drainage* *for use as agricultural land*, A20 *Application of synthetic (mineral) fertilisers on agricultural land*, A01 *Conversion into agricultural land*, and A03 *Conversion from mixed farming and agroforestry systems to specialised production*.

**Pressures to species of wetland habitats**

We also assessed the pressures reported for species linked to wetland habitats. Within this broad groups we distinguish six detailed ecological groups: species of bogs and mires; species of calcareous fens; species of inland salt marshes; species of wet meadows; species of wet heaths and scrubs; and species of wet forests. In this analysis, we did not include species for which wetlands represent an occasional habitat, we only worked with species for which the wetland habitats represent exclusive, preferred, or suitable habitat

Figure 2 shows that – similarly to habitats – pressures related to **agriculture** represent the most important group of pressures to wetland species. A specifically high impact was recorded for species of inland salt marshes, where 45.4% of all reported pressures were pressures related to agriculture. For species of other ecological groups of herbaceous habitats the frequency of pressure related to agriculture was still high (above 30%) and for species of woody habitats (wet heaths and scrubs; wet forests) it was higher than 20%. **Urbanisation** represent the second most important group of pressures for wetland species – its frequency varied between 10.7% (for species of wet forests) and 12.8% (for species of wet heaths and scrubs). Pressures related to **forestry** are important especially for species of wet forests (18.6% of all reported pressures) and for species of wet heaths and scrubs (16.2%). Similarly, pressures related to **natural processes** have a quite high importance for species of all wetland habitats - between 7.6% (species of inland salt marshes) and 10.8% (species of calcareous fens) of all reported pressures for individual ecological groups.

Figure 2: Groups of pressures reported to species related to wetlands

It is quite surprising that the pressures related to the **modification of water regime** are not among the most frequently reported pressures to species of wetland habitats with the frequency ranging from 5.0% (species of inland salt marshes) to 8.6% (species of wet forests).

This is the case also when looking at the individual pressures (Table 3), where pressures related to modification of water regime are not represented among the top six pressures (K02 *Drainage* is ranked as 7-th most important pressure followed by K04 *Modification of hydrological flow*). this is possibly the most visible difference compared to the results of pressures reported for habitats. Surprisingly pressures not specific to wetland condition (E01 *Roads, paths, railroads and related infrastructure*, see below) prevail in all groups of wetland species

The pressure E01 *Roads, paths, railroads* *and related infrastructure* was the most frequently reported pressure to species of wetland habitats. It is also the most important pressure for four ecological groups of wetland species: species of bogs and mires, species of wet meadows, species of wet heaths and scrubs, and species of wet forests. This is related to the fact that these wetland groups include many species of amphibians and bats, for which the pressure E01 is one of the main impacts. For species of calcareous fens, the most important pressure was L02 *Natural succession resulting in species composition change* while for species of inland salt marshes the most frequently reported pressure was A09 *Intensive grazing or overgrazing by livestock*. The pressure A06 *Abandonment of grassland management* is the third most frequently reported pressure to wetland species, while it is specifically important for species of non-woody wetlands. Also, pollution is relevant for wetland species - the pressure A21 *Use of plant protection chemicals in agriculture* was reported especially for species of calcareous fens and species of bogs and mires. The pressure N02 *Droughts and decreases in precipitation due to climate change* is among the five most frequently reported pressures to wetland species.

Table 3: The most frequently reported high ranked pressures to species linked to wetlands /%/\*

| **Code** | **Pressure name** | **Species of** |
| --- | --- | --- |
| **bogs and mires** | **calcareous****fens** | **inland salt marshes** | **wet meadows** | **wet heaths scrubs** | **wet forests** |
| E01 | Roads, paths, railroads and related infrastructure | 4.71 | 4.16 | 3.03 | 4.84 | 5.83 | 4.63 |
| L02 | Natural succession resulting in species composition change  | 3.79 | 4.38 | 4.29 | 4.07 | 2.94 | 3.32 |
| A06 | Abandonment of grassland management  | 3.32 | 3.90 | 5.05 | 4.17 | 1.53 | 1.63 |
| A21 | Use of plant protection chemicals in agriculture | 3.37 | 3.50 | 3.03 | 3.16 | 2.66 | 2.81 |
| N02 | Droughts and decreases in precipitation due to climate change | 2.67 | 2.82 | 3.54 | 2.90 | 1.97 | 2.76 |
| A09 | Intensive grazing or overgrazing by livestock | 2.56 | 2.98 | 5.30 | 3.18 | 1.30 | 1.29 |
| K02 | Drainage | 2.65 | 2.80 | 3.28 | 2.60 | 2.27 | 2.37 |
| K04 | Modification of hydrological flow | 3.11 | 2.89 | 0.51 | 2.76 | 2.66 | 3.29 |
| A31 | Drainage for use as agricultural land | 2.05 | 2.23 | 3.79 | 2.59 | 1.45 | 1.59 |
| F07 | Sports, tourism and leisure activities | 2.29 | 2.12 | 1.52 | 1.88 | 3.35 | 2.42 |
| A02 | Conversion from one type of agricultural land use to another  | 1.78 | 2.00 | 3.54 | 2.41 | 1.32 | 1.24 |
| A26 | Agricultural activities generating diffuse pollution to surface or ground waters | 2.11 | 2.51 | 2.02 | 1.77 | 1.79 | 1.82 |
| J01 | Mixed source pollution to surface and ground waters  | 2.19 | 2.26 | 1.77 | 1.82 | 1.86 | 1.82 |
| I02 | Other invasive alien species (other than species of Union concern) | 1.53 | 1.58 | 1.52 | 1.71 | 1.73 | 2.28 |
| A20 | Application of synthetic (mineral) fertilisers on agricultural land | 1.73 | 1.91 | 2.78 | 1.74 | 0.93 | 1.04 |
| L06 | Interspecific relations (competition, predation, parasitism, pathogens) | 1.82 | 1.81 | 0.76 | 2.03 | 1.84 | 1.84 |
| A08 | Mowing or cutting of grasslands | 1.82 | 2.06 | 1.77 | 2.59 | 0.71 | 0.90 |
| F01 | Conversion from other land uses to housing, settlement or recreational areas  | 1.56 | 1.39 | 1.26 | 2.07 | 1.71 | 1.70 |
| A05 | Removal of small landscape features for agricultural land parcel consolidation  | 2.01 | 1.93 | 0.25 | 1.72 | 1.86 | 1.63 |
| I01 | Invasive alien species of Union concern | 1.46 | 1.34 | 1.77 | 1.60 | 1.34 | 1.68 |
| K05 | Physical alteration of water bodies | 1.61 | 1.75 | 0.76 | 1.58 | 1.58 | 1.89 |
| B09 | Clear-cutting, removal of all trees | 1.53 | 1.15 | 0.25 | 0.81 | 2.33 | 2.99 |
| A01 | Conversion into agricultural land | 1.34 | 1.31 | 1.77 | 1.72 | 1.08 | 1.63 |
| L01 | Abiotic natural processes | 1.40 | 1.47 | 1.77 | 1.32 | 1.21 | 1.59 |
| A33 | Modification of hydrological flow or physical alteration of water bodies for agriculture  | 0.95 | 1.14 | 2.78 | 1.18 | 0.99 | 1.04 |
| A30 | Active abstractions from groundwater, surface water or mixed water for agriculture | 0.89 | 1.07 | 3.54 | 1.26 | 0.50 | 0.81 |
| B01 | Conversion to forest from other land uses, or afforestation  | 1.36 | 1.28 | 1.01 | 1.45 | 1.14 | 1.36 |
| A19 | Application of natural fertilisers on agricultural land | 1.26 | 1.42 | 2.27 | 1.26 | 0.48 | 0.55 |
| F02 | Construction or modification (e.g. of housing and settlements) in existing urban or recreational areas | 1.37 | 1.21 | 1.52 | 0.93 | 1.27 | 0.87 |
| B02 | Conversion to other types of forests including monocultures | 1.09 | 0.93 | 0.00 | 0.89 | 1.88 | 1.77 |

\* percentage of all pressures reported to the respective ecological group

**Pressures to species of bog and mires in individual biogeographical regions**

The results of the analysis related to pressures reported for species of bog and mires in individual biogeographical regions are provided in Table 4. The pressure E01 *Roads, paths, railroads and related infrastructure* was the most frequently reported pressure globally and it is also the main pressure in four biogeographical regions: Alpine, Atlantic, Continental, and Mediterranean. The second most frequently reported pressure was L02 *Natural succession resulting in species composition change* that is dominant in Boreal biogeographical region and important in other four regions as well. The pressure N02 *Droughts and decreases in precipitation due to climate change* is dominant pressure in the Pannonian region, pressure A30 *Active abstractions from groundwater, surface water or mixed water for agriculture* in the Black Sea region and pressure F02 *Construction or modification in existing urban or recreational areas* dominates in the Steppic region.

When comparing tables 2 and 4, it can be noticed that there are some specific pressures to bog and mire habitats and others specific to species of bogs and mires. For example, peat extraction is reported as very important for bogs and mires Annex I habitats – it was the fifth most frequently reported pressure. For bog and mire species this pressure is not perceived as important. On the other hand, pressures relate to invasive and alien species as well as natural succession resulting in species composition changes are more often reported for species.

Table 4: Pressures to species of bogs and mires in individual biogeographical regions /%/

| **Code** | **Pressure name** | **ALP** | **ATL** | **BLS** | **BOR** | **CON** | **MAC** | **MED** | **PAN** | **STE** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E01 | Roads, paths, railroads and related infrastructure (e.g. bridges, viaducts, tunnels) | 5.44 | 4.01 | 6.98 | 3.83 | 4.69 | 5.97 | 5.61 | 3.58 | 3.33 |
| L02 | Natural succession resulting in species composition change | 3.42 | 2.61 | 0.00 | 6.93 | 4.02 | 2.99 | 1.21 | 6.84 | 0.00 |
| A21 | Use of plant protection chemicals in agriculture | 3.00 | 3.11 | 6.98 | 1.28 | 3.87 | 0.00 | 4.55 | 2.93 | 1.67 |
| A06 | Abandonment of grassland management (e.g. cessation of grazing or mowing) | 4.05 | 2.71 | 0.00 | 5.29 | 3.48 | 0.00 | 1.82 | 3.26 | 0.00 |
| K04 | Modification of hydrological flow | 2.51 | 3.01 | 0.78 | 3.47 | 3.40 | 7.46 | 3.18 | 3.09 | 3.33 |
| N02 | Droughts and decreases in precipitation due to climate change | 2.86 | 1.80 | 3.10 | 0.55 | 2.11 | 1.49 | 3.18 | 7.33 | 3.33 |
| K02 | Drainage | 2.23 | 2.81 | 0.78 | 5.29 | 2.89 | 0.00 | 1.67 | 1.95 | 0.00 |
| A09 | Intensive grazing or overgrazing by livestock | 3.28 | 2.10 | 2.33 | 1.46 | 2.42 | 5.97 | 2.73 | 2.61 | 3.33 |
| F07 | Sports, tourism and leisure activities | 3.77 | 1.70 | 1.55 | 2.19 | 1.68 | 2.99 | 2.27 | 2.61 | 1.67 |
| J01 | Mixed source pollution to surface and ground waters (limnic and terrestrial) | 2.02 | 2.20 | 0.78 | 2.01 | 2.38 | 0.00 | 4.39 | 0.33 | 0.00 |
| A26 | Agricultural activities generating diffuse pollution to surface or ground waters | 1.54 | 3.11 | 0.00 | 0.55 | 2.58 | 0.00 | 1.52 | 2.77 | 0.00 |
| A31 | Drainage for use as agricultural land | 2.02 | 1.50 | 1.55 | 2.19 | 2.42 | 1.49 | 2.12 | 1.30 | 3.33 |
| A05 | Removal of small landscape features for agricultural land parcel consolidation ) | 1.47 | 2.20 | 1.55 | 0.18 | 2.66 | 2.99 | 1.97 | 2.12 | 0.00 |
| L06 | Interspecific relations (competition, predation, parasitism, pathogens) | 2.02 | 1.50 | 0.00 | 3.28 | 1.84 | 1.49 | 2.12 | 0.81 | 0.00 |
| A08 | Mowing or cutting of grasslands | 1.74 | 1.80 | 1.55 | 0.73 | 2.30 | 0.00 | 1.06 | 2.12 | 1.67 |
| A02 | Conversion from one type of agricultural land use to another (excluding drainage and burning) | 2.02 | 1.90 | 1.55 | 0.55 | 2.19 | 2.99 | 1.21 | 0.98 | 1.67 |
| B19 | Application of synthetic (mineral) fertilisers on agricultural land | 1.05 | 2.20 | 0.00 | 1.46 | 2.66 | 2.99 | 0.61 | 0.33 | 1.67 |
| K05 | Physical alteration of water bodies | 1.33 | 1.60 | 0.00 | 0.36 | 2.07 | 0.00 | 2.42 | 1.30 | 0.00 |
| F01 | Conversion from other land uses to housing, settlement or recreational areas  | 1.61 | 1.90 | 2.33 | 0.55 | 1.45 | 0.00 | 3.03 | 0.81 | 0.00 |
| B09 | Clear-cutting, removal of all trees | 2.02 | 0.90 | 0.78 | 2.74 | 1.33 | 2.99 | 1.36 | 1.30 | 1.67 |
| I02 | Other invasive alien species (other than species of Union concern) | 1.05 | 2.71 | 0.00 | 1.09 | 1.09 | 8.96 | 2.73 | 1.30 | 0.00 |
| I01 | Invasive alien species of Union concern | 0.49 | 2.30 | 0.00 | 1.46 | 1.17 | 1.49 | 3.18 | 2.12 | 0.00 |
| L01 | Abiotic natural processes (e.g. erosion, silting up, drying out, submersion, salinization) | 0.56 | 1.10 | 0.78 | 0.73 | 1.41 | 4.48 | 0.61 | 5.21 | 0.00 |
| F02 | Construction or modification in existing urban or recreational areas | 1.05 | 1.60 | 3.10 | 1.64 | 1.13 | 0.00 | 0.45 | 2.12 | 13.33 |
| A01 | Conversion into agricultural land  | 1.26 | 1.00 | 0.78 | 1.46 | 1.21 | 8.96 | 2.12 | 1.14 | 0.00 |
| B02 | Conversion to other types of forests including monocultures | 1.12 | 0.90 | 0.00 | 1.28 | 1.09 | 7.46 | 0.45 | 1.47 | 0.00 |
| A30 | Active abstractions from groundwater, surface water or mixed water for agriculture | 1.26 | 0.30 | 8.53 | 0.00 | 0.90 | 0.00 | 0.91 | 0.33 | 0.00 |
| B27 | Modification of hydrological conditions or physical alteration of water bodies and drainage for forestry | 0.63 | 0.90 | 0.00 | 4.01 | 0.63 | 0.00 | 0.30 | 0.65 | 0.00 |
| G10 | Illegal shooting/killing | 0.91 | 0.30 | 3.88 | 0.55 | 0.74 | 0.00 | 1.21 | 0.81 | 6.67 |
| Xp | No information on pressures | 0.98 | 0.60 | 0.00 | 3.47 | 0.43 | 0.00 | 0.61 | 0.33 | 0.00 |
| G08 | Management of fishing stocks and game | 0.42 | 0.50 | 0.00 | 0.00 | 0.94 | 0.00 | 0.15 | 3.09 | 0.00 |
| F09 | Deposition and treatment of waste/garbage from household/recreational facilities | 0.91 | 0.20 | 2.33 | 0.91 | 0.43 | 0.00 | 0.45 | 1.63 | 6.67 |
| A11 | Burning for agriculture | 0.98 | 0.20 | 6.98 | 0.36 | 0.59 | 0.00 | 0.45 | 0.65 | 1.67 |
| I04 | Problematic native species | 0.28 | 0.40 | 0.78 | 1.28 | 0.63 | 0.00 | 0.76 | 1.14 | 3.33 |
| A03 | Conversion from mixed farming and agroforestry systems to specialised production | 0.35 | 0.20 | 0.00 | 1.46 | 0.47 | 8.96 | 0.76 | 0.00 | 0.00 |
| E09 | Land, water and air transport activities not referred to above | 0.56 | 0.20 | 3.10 | 0.18 | 0.27 | 0.00 | 0.00 | 0.98 | 8.33 |

\* percentage of all pressures reported to the respective biogeographical region

**Conclusions**

The analyses described above show that the pressures related to agriculture represent the main pressures to wetlands – both to wetland habitats and to wetlands species. Besides them, modification of water regimes, forestry and urbanisation are also important. This means that measures focusing on the restoration of water regime, eliminating negative impacts of agriculture and forestry, or re-establishing the extensive agricultural and forestry practices could significantly improve the conservation status of wetland habitats and species. Pressures related to natural processes and invasive alien species represent another important group of pressures to wetland habitats. For wetland species the most frequently reported pressures were related to agriculture across all identified ecological groups, with the highest proportion for species of inland salt marshes.

Intensive grazing, natural succession and invasive species are three individual pressures to wetland habitats that Member States reported most frequently, followed by drainage and modification of the hydrological flow. In the case of wetland species, only one of these pressures was among the three most frequently reported pressures: natural succession resulting in species composition changes. Further important pressures for wetland species are: transport infrastructure (roads, paths, railroads), abandonment of grassland management, use of chemicals in agriculture, and droughts and decrease in precipitation.

As a part of the analysis, we also demonstrated the regional approach based on the example of bogs and mires. From the results we can see that there are significant regional differences in relation to the importance of individual pressures to habitats and species of bogs and mires. Similar patterns could be expected in other wetland types as well.

The presented analysis is only one example for a targeted analysis of the ecological groups that is based on the information provided in the Article 17 reporting process. The number of defined ecological groups and their possible combinations offer possibilities for many different analyses in the future.

Annex 2: The form for consultations

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Species or habitat name (and code)** | **Ecological group for the habitat or species** | **Current value (field 'val' in the database)** | **Proposed value** | **Justification for the proposed change / addition** | **Author of comment – name****(not obligatory)** | **Author of comment – institution (not obligatory)** | **Author of comment - country** | **Author of comment - e-mail (not obligatory)** |
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1. Breeding, foraging and wintering habitats were distinguished only if deemed relevant. It means, reproducing habitat was distinguished only if 1) species is reproducing in another habitat than its main habitat for other phases of life cycle or 2) if the reproduction is restricted to one particular habitat while otherwise species uses a broad spectrum of habitats. [↑](#footnote-ref-1)
2. The degree of knowledge was assessed for a species globally, or where relevant in relation to different part of its life cycle. [↑](#footnote-ref-2)
3. In future work, this group will be divided into two groups, riparian habitats and alluvial habitats respectively. [↑](#footnote-ref-3)