

European Red List of Habitats Project
Final Report (restructured for publication by EEA)



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Content

In accordance with Regulation (EC) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC, EEA has restructured the current report for publication by deleting all names of experts.

For access to these names please contact the authors of the Final Report.

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1. Introduction

The European Red List of Habitats project (ENV.B.3/SER/2013/0025) was carried out between December 2013 and November 2016 on behalf of the European Commission, DG Environment. The planning was to finish the project in June 2016, but due to delays the finalisation of all deliverables took until November 2016.

The aim of the project was to deliver a comprehensive Red List assessment of all marine, terrestrial and freshwater habitats in Europe¹, both natural and semi-natural. Apart from the Red List assessments themselves, other important information on all habitat types was brought together and stored in an online platform and ACCESS database.

This technical report describes:

- the process that has been followed throughout the project,
- all involved experts in the project,
- an overview of the meetings held,
- the deliverables.

Annex A describes some technical aspects of the approach that have not been described in the publications produced during the project (see paragraph 4), because they are considered too technical for the wider public.

¹ In the project assessments were carried out for the European Union (EU28) and for the so-called EU28+, which is for terrestrial habitats EU28 plus Iceland, Norway, Switzerland and the Balkan countries for terrestrial habitats, and for marine habitats EU28 plus southern Norway, Russia in the Baltic and non-EU countries boarding the eastern Mediterranean and the Black Sea.

2. General process

The project was carried out in several steps, as indicated in Figure 1. The first step involved making a list of habitat types and definitions. Next, the project followed a bottom-up approach, with data gathering for all occurring habitats in regions (countries, seas) by territorial experts. These data were brought together in Habitat Working Groups (HWG), consisting of a few experts, who had received a Red List training and used an online platform for storage of information. The HWG experts carried out the European wide Red List assessments, which were reviewed by a few other experts, resulting in final assessments.

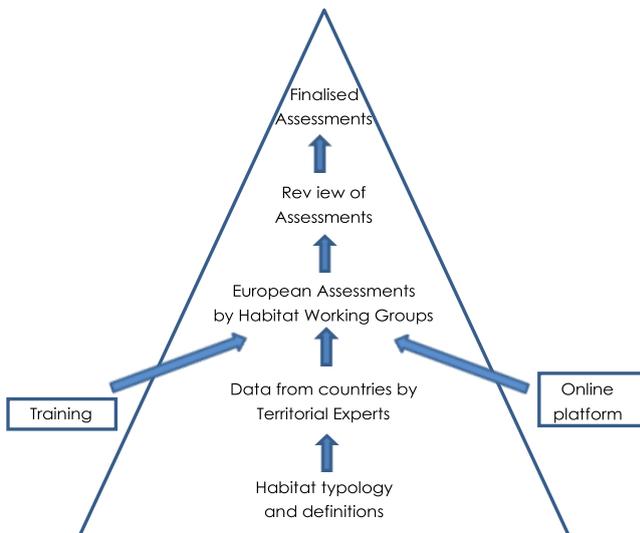


Figure 1. Flow diagram of the general process

The process was managed by a project team consisting of the following persons:

John Janssen (Alterra, Wageningen NL)
Ana Nieto (IUCN, Brussels BE)
Susan Gubbay (private consultant, Ross-on Wye UK)
Tom Haynes (NatureBureau, Newbury UK)
John Rodwell (private consultant, Lancaster UK)
Natalie Sanders (NatureBureau, Newbury UK)
Mariana García (IUCN, Brussels BE).

The project meetings organised during the project are summarised in section 4, and section 5 provides an overview of quality control measures.

3. Experts involved

In total 147 marine and 180 terrestrial and freshwater experts were involved in the project, from a total of 33 countries and four regional seas.

4. Workshops and meetings

The involvement of experts started with a training workshop on the Red List assessment approach and use of the online platform where data and assessments were to be gathered. This took place in June 2014 in Brussels (Belgium). Afterwards, the marine and terrestrial working groups of the project held several meetings with their Habitat Working Group (HWG) members. In the final stage of the project, a synthesis meeting was held in February 2016 in Malaga (Spain) to review the results and act as a check for consistency in the approach taken by the different HWGs. These meetings are briefly described below.

Training workshop

30th June – 4th July 2014, Brussels (Belgium)

Participants: 35 experts (about two experts of each terrestrial and marine HWG).

During the training, the following issues were addressed:

- Project approach and process
- Habitat typology
- The adaptation of the global IUCN Red List of Ecosystems Categories and Criteria to the European Red List of Habitats
- Data gathering process and role of Territorial Experts and HWGs
- Red List Criteria and Categories
- Online platform
- Responsibilities, budgets and timelines

Marine WG meetings

24- 25 April 2014. Newbury (United Kingdom).

Participants: seven experts including the marine project management team, regional representatives and the European Commission. The purpose of the meeting was to discuss the marine typology for each regional sea based on the revised EUNIS.

During 2014-2015, the following meetings were organised for each regional sea:

Baltic Sea. Workshop 1: 28-30 October, 2014, Helsinki (Finland), eight participants.. Workshop 2: 2-3 June 2015, Helsinki (Finland), 13 participants. The first workshop was held to assign roles, draft habitat definitions and address how to align HELCOM HUB assessments and Red List assessments. The second workshop was to resolve all typology issues and formalise the assessment procedure.

Mediterranean. 7-9 January 2015, Málaga (Spain), 10 participants. The typology was reviewed and finalised, a Red List training was provided and the roles assigned for conducting data collection and habitat assessments. A second workshop was not required.

Black Sea. Workshop 1: 18-19 March 2015, Istanbul (Turkey), 9 participants. Workshop 2: 14-16 July 2015, Constanta (Romania), 4 participants. The first

workshop was to train the team on Red List process and collect data, the second workshop was to finalise assessments.

North-East Atlantic. 5-6 August 2015, Newbury (United Kingdom), eight participants. In this workshop, all habitat assessments were drafted. A second Workshop not required

Terrestrial WG meetings

During 2015 the following meetings were organised:

First WG Meeting

26-28 January 2015 in Wageningen (the Netherlands).

Participants: 39

During the training the following issues were addressed:

- Background, process and aims of the workshop
- Habitat Typology
- Categories and criteria
- Available data – territorial data, Article 17 data, maps
- Meetings of Habitat Working Groups
- Online platform and draft assessments
- Further planning and conclusions

Following HWG Meetings

WG Coastal, 27-28 June 2015, Varna (BG); six participants

WG Freshwater, 31 August - 3 Sept. 2015, Brno (CZ); four participants
WG Mires & bogs, May 2015 Krakow (PL); four participants
WG Grasslands, 6-9 July, Tihany (HU); six participants
WG Heathland & scrub, 8-9 September 2015, Bucharest (RO); seven participants
WG Forests, 24-26 August 2015, Bonn (DE); eight participants
WG Sparsely vegetated habitats, 3-4 Sept. 2015, Bratislava (SK); four participants

In these meetings the following issues were discussed: data availability and use, distribution maps, working with the online platform, start of the assessment process, further planning of the assessments.

Synthesis Meeting

9-10 February 2016 in Málaga (Spain).

Participants: 29

The purpose of this workshop was to discuss the preliminary results of the European Red List of Habitats, identify any issues that had arisen from the assessment process and obtain input for the final publications. To this end, a

representative from each of the HWGs delivered a presentation on their results and issues encountered, and a general discussion followed each of the sessions. During the training the following issues were addressed:

- General overview of progress
- Grassland - results & discussion
- Baltic Sea - results & discussion
- Sparsely vegetated habitats - results & discussion
- Black Sea - results & discussion
- Heathland & scrub - results & discussion
- Mires & bogs - results & discussion
- Freshwater - results & discussion
- North East Atlantic - results & discussion
- Forests - results & discussion
- Mediterranean Sea - results & discussion
- Coastal - results & discussion
- General conclusions
- Further planning and conclusions

Management Meetings

Apart from a set of Skype meetings that took place between the management team, a series of progress meetings were held between the management team and the European Commission in Brussels:

2013 December 17th
2014 March 6th
2014 May 19th
2014 December 5th
2015 June 9th
2015 October 16th
2016 May 24th

Other meetings

A presentation of the approach, progress and outputs of the European Red List was also made to the staff of the European Environment Agency (EEA) in Copenhagen, 2016 June 8th.

5. Quality control

The progress of the project has been managed by regular **meetings** with the European Commission (see section 4) and among the Management Team. The project has been well on schedule, and only in the latest stage (June 2016) was delayed during the finalising of all deliverables.

The quality of the deliverables was guaranteed in the following way:

- Firstly, a broad network of **experts** has been involved, from different regions in Europe and covering as much as possible all relevant countries.
- Secondly, a **training workshop** was held for a selection of HWG members, in which the Red List approach was discussed and taught.
- Thirdly, by applying a **bottom-up data flow**, the European assessments were as much as possible based on the status and trends in different countries. For consistency in data, Habitat Definitions were produced in an early stage of the project, and where there were changes in definitions these were communicated with the territorial experts involved, and – if needed- changes were made in territorial data. Territorial data were checked by the assessors and in case of doubt this was communicated with the data providers. For calculating trends from territorial data, formats were provided.
- Fourthly, an **online system** was developed for entering all fact sheet information, including the Red List assessments. This guaranteed consistency of information input. For using the online system and applying the Red List approach a helpdesk was available.
- Further, HWG members were able to comment on all draft assessments of their groups and also distribution maps were discussed within the HWGs. All completed assessments have been **reviewed** by one or more experts and corrections have been made before finalising. Then, all finalised assessments have been checked and corrected for consistency in lay out and text by the coordinators of the marine and the terrestrial project part.

6. Deliverables

The following final products have been delivered:

- Two publications for the wider public.

There is a report of 46 pages on the method and results for marine habitats (Gubbay et al. 2016) and a report of 37 pages on the method and results for the terrestrial and freshwater habitats (Janssen et al. 2016).



The references to these publications are:

Gubbay, S., N. Sanders, T. Haynes, J.A.M. Janssen, J.R. Rodwell, A. Nieto, M. García Criado, S. Beal, J. Borg, M. Kennedy, D. Micu, M. Otero, G. Saunders, M. Calix (2016). *European Red List of Habitats. Part 1: Marine habitats*. European Commission, Brussels.

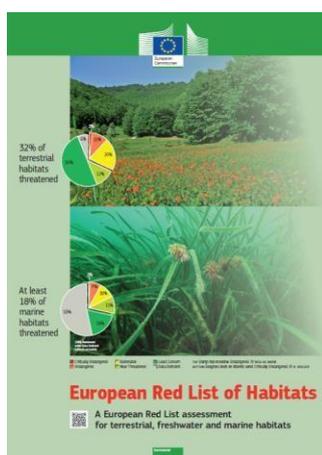
Janssen, J.A.M., J.S. Rodwell, M. García Criado, S. Gubbay, T. Haynes, A. Nieto, N. Sanders, F. Landucci, J. Loidi, A. Ssymank, T. Tahvanainen, M. Valderrabano, A. Acosta, M. Aronsson, G. Arts, F. Attorre, E. Bergmeier, R.-J. Bijlsma, F. Bioret, C. Biță-Nicolae, I. Biurrun, M. Calix, J. Capelo, A. Čarni, M. Chytrý, J. Dengler, P. Dimopoulos, F. Essl, H. Gardfjell, D. Gigante, G. Giusso del Galdo, M. Hájek, F. Jansen, J. Jansen, J. Kapfer, A. Mickolajczak, J.A. Molina, Z. Molnár, D. Paternoster, A. Piernik, B. Poulin, B. Renaux, J.H.J. Schaminée, K. Šumberová, H. Toivonen, T. Tonteri, I. Tsiripidis, R. Tzonev and M. Valachovič (2016). *European Red List of Habitats. Part 2: Terrestrial and freshwater habitats*. European Commission, Brussels.

- PDF fact sheets of the full Red List assessments.

Together these comprise fact sheets of the 257 marine habitats and 233 terrestrial and freshwater habitats, each of about 10 pages on average.



- An **Access database** with all the information from the fact sheets. The information was derived from the online platform used in the project.
- **Territorial Data Sheets** (excel-files). These contain the country/sea information provided by the regional experts for each habitat type (see Annex A). Separate files were made for the marine types and for the terrestrial and freshwater types.
- Geographical Information System (GIS) files of **distribution maps**. These are digital distribution maps of all habitats, together with metadata. Separate files were made for the marine types and for the terrestrial and freshwater types.
- A **photo database**. These include all photos used in the factsheets (for all 490 habitats), stored with habitat type names and author names.
- A **poster**, combining the main results of the marine and terrestrial/freshwater habitats and aimed at attracting a wider public. It includes a link to the EU website for further information. In the project specifications two posters were scheduled, but it was agreed with the European Commission to provide one combined poster and additional flyers.



- Two **flyers**, providing a summary of the project results and links to further details online, for marine and terrestrial/freshwater habitats. These flyers were

not mentioned as deliverables in the project specifications, but have been produced instead of a second poster.



- A PowerPoint presentation with the project results of 19 slides, summarising all results and adaptable for specific purposes.

Annex A. Approach

Annex to the Final Report of the European Red List of Habitats Project

November 2016

Many aspects of the project approach have been discussed in the project publications (Gubbay et al. 2016; Janssen et al. 2016). Some additional points that have not been discussed in detail in these publications will be mentioned here.

A1. Habitat Typology

The typology used for the project was one of the most discussed topics, and even until a late stage in the project some types remained under discussion. For both terrestrial and marine habitats the typology was based on EUNIS, which is itself currently under revision. The formal revision of EUNIS and the development of a typology for the Red List project were integrated as much as possible, but – because of different time schedules and aims – some small differences remain.

Marine habitats

The most recent draft of marine EUNIS (April 2014 – prepared by David Connor following the marine typology workshop and referred to as EUNIS v1405) at level 4 formed the basis of the typology for this project. The fact that this version will see some changes in the future and has still to be agreed by the EUNIS community was recognised. However this approach was considered to be more helpful for future cross-referencing of EUNIS with the Red List project, rather than working with the 2004 version of EUNIS. It was also the case that the latest draft was considered to be fairly stable (i.e. unlikely to change much) up to level 4. However if there are changes to this scheme, it may affect direct comparison with the habitat typology used for this project.

A second typology issue to highlight is that a read-across between EUNIS v1405 and the HELCOM HUB typology (HELCOM 2013a) was derived for the Baltic Sea so that the HELCOM Red List outcomes (HELCOM 2013b) could inform the European Red List assessments. This was also key to ensuring consistency in the typology across all regional seas and assessment at EUNIS level 4. Further refinement of this may be needed in the future, as well as agreed EUNIS codes for the Baltic. The same applies to the Black Sea where the typology was made more comprehensive and therefore some additional EUNIS codes proposed.

Box A1. Codes of habitat types

Marine: the codes correspond largely with EUNIS (v1405) at level 4 of the classification, although there are some additions because of the evolving typology and proposals incorporated during the project for consistency across the regional seas. For example; In the Atlantic, codes with pt in them are the proposed codes from the MeshAtlantic Technical Report No3/2013 (Monteiro et al. 2013) and habitat A3.3X/3.33 has two codes as proposed in the MESH Technical report No 4. (Tempera et al. 2013). Because of differences in the way

the typology of Baltic habitats has been developed by HELCOM and the approach taken in EUNIS typology, Baltic habitats have not been given a level 4 code. The nearest equivalent at level 3, where the two systems are comparable, is provided in the section on classification.

Habitat codes at EUNIS level 4 typically have codes with two digits after the main category (e.g. A1.11). In this scheme some have three digits. This is the outcome of some changing of habitat levels to create consistency across regional seas. For example the *Posidonia* habitat (A5.535) is level 5 in EUNIS 2004 but level 4 in EUNIS v1405; this creates consistency across regional seas where the different species of seagrass/*Posidonia* are now at the same level of the classification.

Terrestrial: the codes correspond largely with the proposal for formal revision of EUNIS habitats at level 3 (Schaminée et al. 2013-2016); they follow the original EUNIS habitat classification, but where types have been split they received a letter a,b,c etc., and also types of which the content has been revised but the coding remained, received an extra digit a (for Example E1.7a).

Terrestrial habitats

Following the Feasibility Study (Rodwell et al. 2013), the Red List project used a modification of the EUNIS habitat classification (Davies et al. 2004) at level 3. This is a typology pitched between the fine scale offered by the alliances of phytosociology and a broad classification of ecosystems (for example in use by IUCN) which is already in widespread use by statutory agencies and NGOs throughout Europe. Highly anthropogenic habitats (i.e. EUNIS classes I Regularly or recently cultivated agricultural, horticultural and domestic habitats & J Constructed, industrial and other artificial habitats) and landscape mosaic types (EUNIS category X) have been excluded, with a few exceptions for types that are equivalent to Annex I-types and one habitat that – in advance – was supposed to be extremely threatened (I1.3 Arable land with unmixed crops grown by low-intensity agricultural methods). Salt marshes (grouped in EUNIS under A Marine habitats) were included with other B Coastal habitats. The existing EUNIS level 3 habitats were reviewed and revised and definitions adapted where EUNIS types were ambiguous, overlapping or of a scale that was considered too broad for Red List assessment across Europe. Many of the proposed Red List habitats were also renamed.

The resultant habitats for Red List evaluation were defined especially for the Red List assessment task and were not intended as an official revision of EUNIS level 3. However, proposals were aligned with the emerging revision of EUNIS by the European Environment Agency (Schaminée et al. 2012, 2013, 2014). The final EUNIS typology aims to include all Europe, but some habitat types were not included in the Red List assessment, as these occur only in Ukraine, Belarus, Moldova, Russia, the Caucasus and/or European Turkey, outside the geographical scope of the Red List project.

Some remaining points worth pointing out on the typology are:

- The Red List typology uses one habitat F9.1 for Boreal and temperate riparian scrub, which is likely to be split for the formal revision of EUNIS into a temperate and boreal type

- The width of the definition of habitat E1.1a has been under discussion for a long period and may be revised in future after a scientific study of the relevant plant communities
- The freshwater typology may profit from some further revision, especially in relation to other typologies, like those of the Water Framework Directive. Some types are defined relatively broadly and may vary largely (especially in their fauna) in different geographical regions.

Crosswalks

In the fact sheets of each habitat, crosswalks are given in relation to several other typologies of vegetation, habitats and ecosystems. The crosswalk between the Red List habitats and the alliances of the newly upgraded EuroVegChecklist (Mucina et al., due for publication 6th December 2016) will be especially widely valued for interpretation of EUNIS and Red List types across Europe and enable more detailed habitat Red Listing to take place in different regions and countries. This is particularly important where the present project suggested the occurrence of sub-types which might be differently threatened than the parent type. With the publication of the EuroVegChecklist, changes in alliance names may occur, affecting the presented relationships. For the relationship with Emerald types, the Third 2015 version has been used. For EUNIS a crosswalk to EUNIS 2004 was provided.

A2. Categories and Criteria

The Red List Criteria applied are a modified version of those applied in the IUCN Red List of Ecosystems (Keith et al. 2013; IUCN 2016), as some adaptations have been made based on the Feasibility Study (Rodwell et al. 2013). These are as follows.

- The criteria have been divided into priority criteria and additional criteria. Data gathering focused mainly on the priority criteria. This decision was made based on the quality of available data and time constraints for receiving them. However, where possible, attempts were made to gather data on all criteria for each assessment.
- Thresholds have been formulated for the Near Threatened (NT) category. These were used mainly for terrestrial habitats, as in marine types rarely sufficient data were available to make such a detailed assessment. The proposed threshold for NT for criterion A1 (-25% decline) was criticised by some of the involved experts, as it is close to the Vulnerable threshold (-30%) and cannot be applied in such a detail because the territorial data contains many uncertainties. A NT threshold of -20% would have resulted in slightly more habitats meeting this criterion.
For criterion C/D1 thresholds have been defined as indicated in Figure A1. It was discussed whether the thresholds between the categories should be more gradual, for example like indicated in Figure A2. In order to be more in line with the IUCN criteria, however, such thresholds for VU and EN were not adapted. Adapting the VU and EN thresholds for C/D1 according to Figure 3 would result in different final results for a few terrestrial habitats.
- Criteria C and D have been combined into one (C/D), although it was possible to use criteria C and D separately if data were available. This adaptation provides a combined assessment of the 'risk of collapse' due to degradation in

abiotic and biotic quality, which is slightly different from the IUCN approach in which one (quantitative) parameter is chosen as an indicator of decline in quality. By combining criteria C and D, we provide an assessment of the overall quality decline, which may have different causes for each habitat in different parts of Europe.

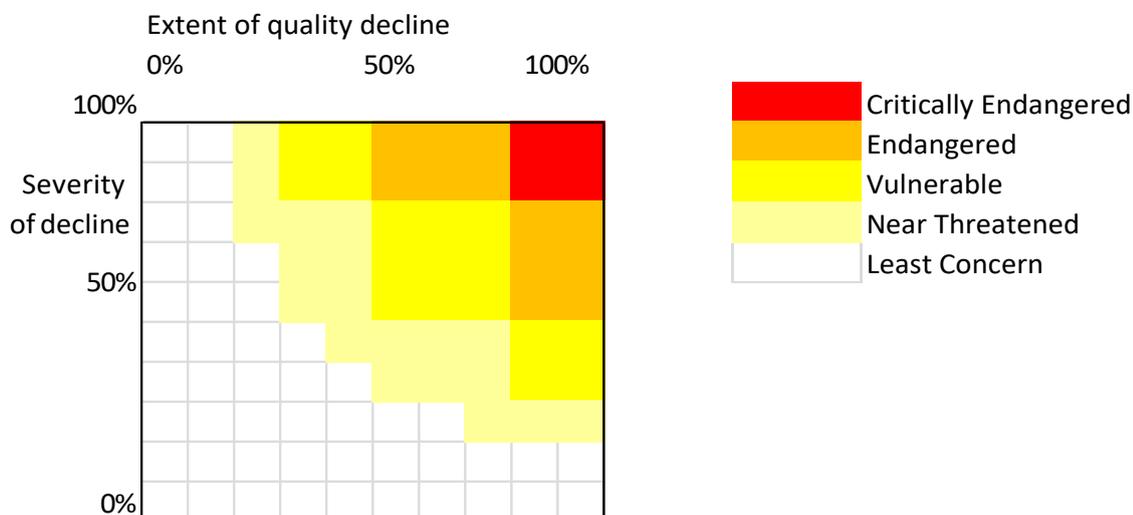


Figure A1. For many terrestrial habitats quantitative data on trends in quality were available for the Red List assessments. For the Near Threatened (NT) category the threshold "close to Vulnerable" originally had been interpreted in different ways, and therefore in the review stage of the project the outcomes have been made consistent by defining and applying quantitative criteria for NT for the two aspects of criterion C/D1 (severity of degradation and extent of degradation). The thresholds are shown in the diagram.

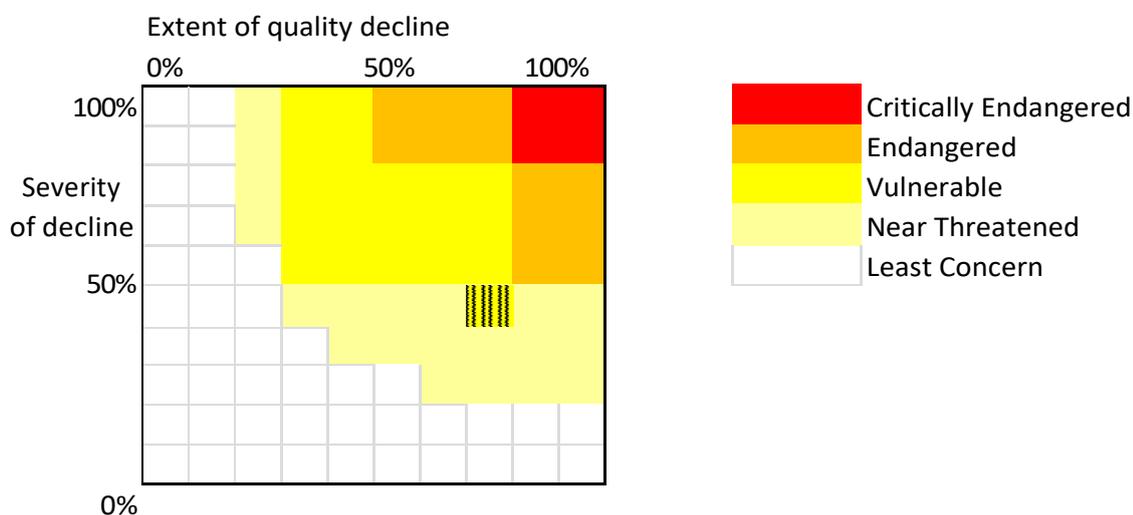


Figure A2. Proposal for adaptation of the IUCN thresholds (indicated by shades) for criteria C1 and D1 to make the transitions from one category to another more gradual.

A3. Territorial data

From national or regional experts different data on habitats in the region/country or sea (so-called territorial data) has been brought together. These territorial data contained information on extent (area), recent and historical trends in

quantity and quality, main pressures and threats, and literature sources for each habitat in a territory. All these data have been recorded in excel files, called Territorial Data Sheets. The fields which had to be filled in the territorial data sheets are listed in Box A2.

Box A2. Fields of territorial data sheet

Aim/criteria	Data field	Data explanation	Data type
General information	Region of assessment	Country/Sea/part of country or sea	Priority data
	Habitat type	Code	Priority data
	Habitat name	(sometimes old names, inconsistencies; use code for selections)	
Quantity (A)	Territorial expert	Name	Priority data
	Current area of habitat (km2)	Year	Priority data
		Area (Km2)	Priority data
Trend at this moment (B)	Current trend in habitat quantity	Stable, increasing, decreasing, unknown	Priority data
Present reduction in Quantity (A1)	Present past area (at date in column F)	Year (ca. 50 years ago)	Priority data
		Area (Km2)	Priority data
	Time scale for trend analysis	# of years	Calculation
Future trend (A2a/A2b)	Present past trend in quantity (over the past 50 yrs)	% area change since date in column G (calculation from column H and F OR to be estimated independently)	Priority data
	Notes	Comments/additional information on present changes in area (over the last ca. 50 years)	Optional
	Estimated future trend in quantity	Provide an estimate of future trends (decrease/increase). If possible, provide quantitative data, including the % decline expected and over which time frame	Optional
Historic reduction in Quantity (A3)	Historic area (at date in column M)	Year (50-250 yrs ago)	Optional
		Area (Km2)	Optional
	Time scale for trend analysis	# of years	Calculation
Present reduction in Quality (C/D)	Long historical trend in quantity (last 50-250 yrs)	% area change since date in column N (calculation from column F and O) OR to be estimated independently)	Optional
	Notes	Comments/additional information on historical changes in extent (area, distribution)	Optional
	Recent trend date	Year (ca. 50 years ago)	Priority data
Trend at this moment (B)	Extent of degradation	% of current area (column F) that is degraded since date in column S	Priority data
	Severity of degradation	Trend in severity of degradation since date in column S (number of stages on scale 1 to 5)	Optional
	Type of degradation in Quality indicators	Abiotic, biotic, both	Priority data
	Notes	Comments/additional information on recent changes in quality	Optional
Continuing decline (B1)	Current trend in habitat quality	Stable, increasing, decreasing, unknown	Priority data
	Continuing decline in quantity or quality	Is there an ongoing decline in quality, expected to continue into the future, in the spatial extent and/or quality? Please specify.	Optional
Future trends (C2, D2)	Estimated future trend in quality	Provide an estimate of future trends in habitat quality. If possible, provide quantitative data, including the future extent projected to be affected (km2 or % of the habitat), the expected severity of degradation, the time period over which this is measured, and the used indicators of degradation (biotic and/or abiotic).	Optional
	Historical trend in quality	Provide a description of historic trends in habitat quality (60-250 years ago). If possible, provide quantitative data, including the extent (km2 or % of the habitat) that has been affected, the severity of degradation, the time period over which this is measured, and the used indicators for degradation (biotic and/or abiotic).	Optional
General information	Pressure 1	Pressure from list	Priority data
	Pressure 2	Pressure from list	Priority data
	Pressure 3	Pressure from list	Priority data
	Notes	Comments/additional information on how the pressures are impacting the habitat quantity and quality	Optional
General information	Confidence in the data provided	Indicate your confidence in all data provided (be as specific as possible, and differentiate between different data sets where possible)	Optional
	Equivalent national/regional types	Please add national/regional habitat types (with reference), as this relation may provide additional information to be used.	Optional
	National or Regional Red Lists	Is the habitat type listed in any national or regional red lists? If yes, provide the category.	Optional
General information	Subtypes	Is there a specific subtype of the habitat (regional, thematic) that is relatively more endangered and deserves special attention from a European nature conservation point of view	Optional
	References	Authors (year); full references should be given on the second worksheet	Optional
	General comments		Optional

Marine habitats

Marine data were available at different geographical scales. Some reports were available for regional seas or sub-basins within them, and in other cases there were national data records. All these data sources have been used and recorded on the territorial data sheets. It should be noted, however, that for the majority of marine habitats, there were very limited data, most especially on recent or historical trends. Expert opinion was used where necessary to inform assessments when no quantitative data were available.

Terrestrial habitats

Terrestrial and freshwater territorial data have been received from almost all countries within the regional scope of the project, which in total resulted in a Territorial dataset of 2,720 rows of habitats in countries. The completeness of data for countries is as follows:

- 85-100% of all potential data have been received from Austria, Croatia, Czech Republic, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Netherlands, Slovenia, Slovakia, Spain, UK,
- 70-85% of all potential data have been received from Estonia, Cyprus, Poland, Slovenia, Latvia, F.Y. Republic of Macedonia,
- Relatively incomplete data (5-20% of the habitats) have been received from Sweden, Norway, Montenegro, Albania, Kosovo; the lack of Scandinavian data is a problem for the overall European assessment of some boreal types (especially C Freshwater, G Forest),
- No data have been received from Serbia and Iceland, although several requests for data have been made; alternatively for some habitats data from literature has been used for these countries;
- No data have been received nor acquired from Russia (Kaliningrad), Luxembourg and Malta.

The data on trends in quality was acquired by providing the following guidelines: (i) a description of different quality stages, as presented in Box A3, for the data providers, (ii) examples of territorial data, and (iii) examples and templates of the calculation of a weighted (by area) trend in quality. Especially for the forest assessments there has been discussion that the delivered 'trend in quality' data were not consistent enough amongst countries, as territorial experts would not have considered trend data on invertebrates.

The Swedish data on mires and bogs has been compiled partly from an exhaustive literature study by T. Tahvanainen.

Pressures and threats

The territorial experts provided for each type in a region a list of the three main pressures and threats. For this they used their own terminology OR referred to the list of codes and/or terms which is used for Article 17 reporting under the Habitat's Directive. The delivered overview of pressures and threats were summarised by the habitat assessors in a list of main pressures and threats for each type in the EU28 and EU28+ using the Art17 list.

Box A3. Stages of Quality Decline

No decline in habitat quality

- A more or less full complement of the characteristic species AND
- Presence of habitat rare species at their typical frequency AND
- No invading species AND
- Stable balance of different life-forms AND
- Intact spatial pattern and vertical structure AND
- No changes in nutrient cycling, disturbance regime, connectivity or other biotic or abiotic processes AND
- Typical variation in species composition between examples of the habitat

Slight decline (30% threshold)

- Some characteristic species lost or reduced in frequency and/or cover AND/OR
- Reduced frequency of habitat rare species AND/OR
- Low frequency and/or cover of invading species AND/OR
- Slight shifts in the proportions of life-forms AND/OR
- Slight changes in spatial patterning, dominance or vertical structure AND/OR
- Some changes in nutrient cycling, disturbance regime, connectivity or other biotic or abiotic processes AND/OR
- Slightly reduced variation in species composition between examples of the habitat.

Intermediate decline (50% threshold)

- Many characteristic species lost or reduced in frequency and/or cover AND/OR
- Complete loss of any habitat rare species AND/OR
- Substantial contingent of invading species at high frequency or cover AND/OR
- Substantial shifts in proportions of life-forms AND/OR
- Substantial changes in spatial patterning, dominance or vertical structure AND/OR
- Substantial changes in nutrient cycling, disturbance regime, connectivity or other biotic or abiotic processes AND/OR
- Substantially reduced variation in species composition between examples of the habitat.

Severe decline (80% threshold)

- Most of the characteristic species lost or reduced in frequency and/or cover AND/OR - Complete loss of many habitat rare species AND/OR
- Very substantial contingent of invading species very often present AND/OR
- Severe shifts in proportions of life-forms AND/OR
- Severe changes in spatial patterning, dominance or vertical structure AND/OR
- Severe changes in nutrient cycling, disturbance regime, connectivity or other biotic or abiotic processes AND/OR
- Severely reduced variation in species composition between examples of the habitat.

Collapsed (100%)

- Characteristic species nearly or totally missing or far exceeded in frequency and cover by species of other habitats AND
- Complete loss of almost all habitat rare species AND/OR
- Dominance of invading species AND/OR
- Completely changed proportions of life-forms AND/OR
- Completely changed spatial patterns, dominances or vertical structure AND/OR
- Completely changed nutrient cycling, disturbance regime, connectivity or other biotic or abiotic processes AND/OR
- Loss of typical variation in species composition between examples of the habitat.

Effectively the habitat is of another type or none.

A4. Distribution maps

Distribution maps (10 x 10 km) have been produced for all habitats based on available data from the sources mentioned in the publications (Gubbay et al. 2016; Janssen et al. 2016). For each map specific sources have been indicated in the fact sheets. Based on these maps, the AOO (Area of Occupancy) and EOO (Extent of Occurrence) have been calculated (see Rodwell et al. 2013). The calculated AOO is the area occupied by a habitat measured in number of 10x10 km grid cells (according to the ETRS grid). EOO is the area (in km²) of the envelope (calculated by a minimum convex polygon) around all occurrences of a habitat.

Marine habitats

Four sources of data were used to create the maps and subsequently used to calculate AOO/EOO. These were:

- **Modelled data** - Modelled habitat distribution data based on the level 3 and 4 EUNIS classifications was acquired from EMODnet (<http://www.emodnet-seabedhabitats.eu/default.aspx?page=2025>). These data were modelled based on a number of physical parameters, such as depth, temperature, salinity etc. Due to the data for the Baltic region being sparse, only level 3 habitat data could be used for this area. Modelled data was distinguished by a different colour on the maps.
- **Survey data** - Data collected from surveys for EMODnet using levels 3 and 4 of the EUNIS classification system during phase 1 of the EMODnet Seabed Habitats project (2009-2012). This project is currently in phase 2 where the coverage of the maps is being extended to include all European seas, and existing maps are also being improved. Survey data was also distinguished with a different colour in the maps.
- **Article 17 data** - Maps showing the distribution of marine and coastal habitat types listed in Annex 1 of the Habitats Directive.
- **Expert knowledge** - Survey/modelled data was unavailable for many areas within Europe, so expert knowledge was therefore used to create habitat distribution maps both individually and collectively during Regional Sea workshops.

To consolidate the data sources, and to ensure consistency, an online tool was designed to convert the distribution data into presence/absence maps based on a 10x10km grid. Experts could use this tool, along with the data acquired from EMODnet (or personal knowledge) to select areas where each habitat was known to occur. The resultant output would produce an .XML file which could then be converted to a .TAB file in order to calculate AOO/EOO using Mapinfo v15.0.

EOO may have been estimated as greater than 50,000 if a habitat is known to occur in each sub-basin even if the actual distribution is unknown. No map is provided in such circumstances. Equally, there are cases when a map is provided but it is known to be very incomplete. In such cases, EOO and AOO were not estimated due to lack of confidence in the sufficiency of the data.

For some habitats, the precise localities were unknown, however these habitats may have been known to be present in certain sub-basins. To represent this situation, sub-basins where the habitat was known to be present were given a

darker shade of blue in the map (see Gubbay et al. 2016, Figure 2.3). The majority of marine maps therefore show the range and main areas of distribution of the habitat types rather than being comprehensive distribution maps.

Terrestrial habitats

The following sources have been used:

Art17: 10x10 km grid data from HD Annex I types as reported in the Article 17 report of 2013;

EVA: detailed point data of vegetation relevés deposited in the European Vegetation Archive (version January 2016; Chytrý et al. 2016), selected based on a set of characteristic plant species for each habitat;

GBIF: 10x10 km grid data of distribution of plant species (version January 2016); for some habitats co-occurrences of a set of characteristic species have been selected;

BOHN: detailed polygon data of the Natural Vegetation Map of Europe (Bohn et al. 2000/2003). The extent of some habitats that form climax vegetation, such as forests and high mountain vegetation, has been used as distribution data, others as potential distribution;

ETM: image file of the European Tree Map, indicating the dominant tree. For a few forest habitats, grids with occurrences have been selected manually, based on these files;

NAT: National Vegetation Data from Spain (National Habitat Map), Hungary (habitat distribution maps from Ánér 2011), Bulgaria (Red Data Book vol 3., Biserkov et al. 2015), Bosnia & Herzegovina (distribution data of Annex I habitats, unpublished), and a Corine map from Finland.

EXP: Grids selected manually, based on occurrences indicated by involved experts.

LIT: Grids selected manually, based on occurrences indicated in literature (many different sources).

AGFOR: Distribution data of 'wooded grasslands'. This map was compiled in the European project AGFORWARD (Plieninger et al. 2015) and was used only for three 'wooded grassland' types (E7).

In few cases, additionally the source 'countries' was used for indicating potential distribution in countries where a habitat is present, but more detailed distribution patterns are unknown.

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