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AND NATURAL HABITATS

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EXPLANATORY NOTES AND GUIDELINES FOR THE PERIOD 2013-2018

PART 2: DEFINITIONS AND METHODS

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CONTENTS

This part of the guidelines provides complementary information to the guidance in Part 1 (The Report format field-by-field guidance). It elaborates on the concepts and gives definitions (for more conceptual assessments, such as Structure and functions, Favourable reference values), assessment methods (e.g. for Future prospects), and, where relevant, worked examples (best practice).

For the first reporting exercise under Resolution No. 8 (2012) over the period 2013 - 2018 the references to taxonomic issues and marine regions will not be considered in these guidelines.

DEFINITIONS AND METHODS FOR SPECIES REPORTING

Species to be reported

Occurrence categories used in the species checklist

The following categories and codes are used for the 2013–2018 reporting:

- **Present regularly (PRE)**

This category applies to species which occur regularly in the region.

- **Occasional (OCC)**

Occasional species are species:

- which do not have a stable and/or regular occurrence in the biogeographical/marine region; and
- for which the number of records is insignificant.

Reproduction within a biogeographical region or marine region is not recorded or is very sporadic. Even if it is not appropriate or possible to assess their conservation status at the Country's biogeographical level at this stage, these species should be reported in order to be duly reflected in the EU biogeographical assessment.

For example:

Nymphalis vaualbum is a species with an Eastern European range and strong migratory behaviour. Outside the centre of its distribution in Russia, it is suspected that the species forms temporary populations or is only present as a vagrant. In Finland this species is considered an occasional migrant with great fluctuations in its occurrence. It has also been known to hibernate. There are records of about 40 specimens before 1990 (first record 1897); after that fewer than ten specimens have been recorded (2001–2011).

Using the 'occasional' category should reflect the history of the species, and its use should be restricted to cases where species have a natural irregular occurrence and also occur in insignificant numbers. The 'occasional' category should not be used for:

- species which were regularly occurring in the past but whose numbers have significantly declined or a reproducing population became extinct due to human pressures, so that at present only occasional or vagrant individuals occur within a biogeographical region. In this case the category 'present' should be used;

- poorly known species with occasional records in the region, but which most likely have a stable or regular occurrence. These should be listed under the category 'present regularly';
- species which occur as vagrant but with important abundance (e.g. marine mammals or turtles in many regions). These species should be listed under the category 'present regularly'.

- **Newly arriving species (ARR)**

Newly arriving species are species that do not represent a permanent component of the fauna or flora of a biogeographical/marine region, but which have started to be recorded recently, within the last 12 years, due to the dynamics of their natural range.

Even if it is not appropriate or possible to assess their conservation status at the Country's biogeographical level at this stage, these species should be reported in order to be duly reflected in the Pan-European biogeographical assessment. For assessing conservation status at the Pan-European biogeographical level it is important to identify the dynamic processes of range, mainly if they appear as a result of climate change, land-use or other changes, and reflect them in the assessment.

This category should not be used for species that already have a stable population within the biogeographical region.

For example:

The Golden jackal (*Canis aureus*) has in the past been recorded as a vagrant in Austria, Slovakia, Slovenia, and the Czech Republic, but an increased number of indices of its presence in recent years suggest that the natural range of the species is extending northwards. The presence status of *Canis aureus* in these countries should therefore be reported as 'newly arriving'.

Sympecma braueri is a species found in the temperate zone and is generally absent from the Boreal region. It was recorded in Finland for the first time only recently and the number of records have increased very rapidly (recorded at about 70 localities in southernmost Finland). Although it started to be recorded only in recent years, it is assumed that it has established a population, so it should be reported under the category 'present'.

If a newly arriving species is not listed in the checklist for the reporting under Resolution No. 8 (2012) for the Country, due to an oversight when the list was prepared, the Country should still report it.

- **Marginal (MAR)**

The category 'marginal occurrence' should be used in situations where the species occurs principally in one region (or Country) with a population extending to a neighbouring region (or Country), where the abundance of the species is insignificant and the occurrence represents a limit of a natural range of a species in a given area. In contrast with occasional species, the occurrence of a marginal species within a region (or Country) is regular. Marginal populations are closely connected to the main population occurring in the neighbouring region or Country (for example, the immigration of individuals) so their favourable status can be achieved only in relation with the main population. It is not expected that the conservation status of the marginal species will be assessed. However, if the conservation status is evaluated the assessment should take into account their marginal position and link to a principal population, for example when estimating the favourable reference population.

For example:

Leucorrhinia pectoralis occurs in Poland as a lowland species almost entirely restricted to areas below 500 m due to the absence of typical habitats at higher altitudes. Three locations are known in the Alpine region on the margin of the natural range of this species in Poland where only single individuals had been recorded for several years.

The use of the 'marginal' category should reflect the history of the species and should be restricted to situations where the species occurs naturally as 'marginal'. The 'marginal' category should not be used for species that were regularly occurring in the past but whose numbers have significantly declined or a reproducing population has become extinct due to human pressures, so that nowadays only individuals originating from a neighbouring population persist. In this case the category 'present' should be used.

- **Species extinct after entry into force of the Bern Convention (EXa)**

This category applies to species for which the last record in a biogeographical or marine region (even if it was a single individual) was noted after the date when the Bern Convention came into force in the Country; these species previously had a permanent/regular occurrence in the region.

In some situations the species has not been recorded for several years, but there is insufficient evidence to conclude that it is extinct. These species should be classified as 'present'.

- **Species extinct prior to entry into force of the Bern Convention (EXp)**

This category includes species for which the last record of the species in a biogeographical or marine region (even if it was a single individual) was before the date when the Bern Convention came into force in the Country but after 1950.

This category also includes species which became extinct in the past (including before 1950) but for which there is a restoration project, or species of a particular conservation interest with recent signs of recolonisation, but for which successful recolonisation or reintroduction cannot yet be concluded.

- **Scientific reserve (SCR)**

The occurrence of the species is uncertain. This category applies when there are only occasional historical records and it is not possible to judge if it occurs in the region regularly in significant numbers (this should only be the case for species which are extremely difficult to survey). Scientific reserve should also be used where there is a recent record of a species in the biogeographical region but its validity remains unresolved.

This category should not be used:

  - for species which were known to occur in a region and for which there were no records of their presence during the current reporting period. These species are to be classified as 'present';
  - where the occurrence of a species is unresolved due to the absence of inventories. Such species should be treated as 'present' and the report should reflect the fact that there are no data available.

- **Not discussed (ND)**

The occurrence of the species could not be discussed during the biogeographical evaluation process but is assumed to be present. The occurrence needs to be confirmed by the countries, using one of the other categories.

Transboundary populations

In some cases, species may have a population which is shared between two or more Contracting Parties, such as the West-Balkan or Caucasus population of Brown bear (*Ursus arctos*). In such instances, Parties are encouraged to undertake a common assessment and to agree on data and assessments, but each Country reports the results for its territory, i.e. a respective proportion of the regional population and range and corresponding trends, information related to habitat for the species, and the Emerald Network, respective pressures and threats and conservation measures. Disintegrating the regional values into Parties proportions will probably result in relatively crude estimates but these are important to understand the impact of pressures and conservation measures, which are likely to be different in each Country and the role of the Emerald Network. The regional (transboundary) values for range and population size can be provided in fields 4.12 and 5.17 'Additional information'.

If joint regional assessment of the conservation status was made the results of this assessment can be provided instead of the Country level assessment. This should be noted under field 13.2 'Transboundary assessment'. Joint assessments between two or more Parties should be done primarily in cases where there is a certain level of cooperation and common understanding of the management needs and approaches for that species (e.g. large carnivore populations). There may also be cases where it is biologically relevant to consider populations in other neighbouring countries. This should be clearly described under field 13.2 'Transboundary assessment'.

Trends

This chapter provides complementary information to the guidance provided on trends and trend periods 'Part 1 Field-by-field guidance for completing 'Annex B' Species reports)'.

The conservation status assessment stresses the importance of trend information: trends are decisive for the assessment of conservation status since usually only stable or increasing trends can result in an overall Favourable conservation status (FCS) conclusion. Therefore, in general, more attention should be paid to the methodology of monitoring schemes to improve the quality of trend information.

Trends are an essential part of assessing all conservation status parameters except Future prospects. A comparison between the overall population trend in good condition in the biogeographical and trends within the Emerald Network is important in assessing the impact of the Emerald Network on conservation status. Trends are usually derived from modelling or existing monitoring schemes which are based on sampling, as complete surveys are exceptional and usually only undertaken for very rare species. Sampling methods should be statistically robust wherever possible. In the absence of dedicated monitoring schemes, trends are usually a result of expert opinion and in that case should be reported only as directions (increasing/decreasing/stable), without absolute values. Unknown trends should be reported as 'unknown'. If the available data are not sufficient to determine trend direction, this can be reported as 'uncertain' (lack of a clear signal).

Trend is a (measure of a) directional change of a parameter over time. Trends (especially of population) should ideally be the result of a statistical regression of a time series. Fluctuation (or oscillation) is not a directional change of a parameter, and therefore fluctuation is not a trend. However, fluctuations can occur within a long-term trend and can affect the measurement of short-term trends, because it is difficult to assess whether there is a real trend in the short-term, or whether there is simply a fluctuation or population cycling effect.

Fluctuation is an intrinsic character of all natural systems and can be observed for all directions of the trend (increasing, decreasing, and stable). However, it is only detectable in regularly surveyed populations. Fluctuations are only likely to be detected when the parameter is measured at least three times within a given time-frame. Ideally, they will be based on more frequent sampling. In reality, this is unlikely to happen in short time-frames (such as 12-year intervals), and setting short-term trends in a long-term context will help to identify where fluctuations are occurring.

Fluctuations in Range or area of Habitat for the species are rarely detectable over a 12-year period and any fluctuation of these values is mostly long term. In summary: Range and Habitat for the species are unlikely to fluctuate in a 12-year period. However, measurement of these parameters can be inexact and longer-term information may be required to detect any real changes, given the range of data availability, sample sizes and possible survey methods.

Short- and long-term trends

The reporting period under Resolution No. 8 (2012) is six years, but estimates of trend are more likely to be statistically robust over longer time periods. It is therefore recommended to estimate short-term trends over two reporting cycles, i.e. 12 years (or a period as close to this as possible), as this should give a more reliable and comparable estimate of the trend; see Table 1). Long-term trends, which are likely to be more statistically robust, can also be reported (in a series of optional fields). The recommended period for assessing longer-term trends is four reporting cycles (24 years). This definition of a long-term period used for reporting of the long-term trends should not be confused with the requirement of the Resolution of maintenance in a 'long-term' of a habitat.

The short-term trend information should be used in the evaluation matrix to undertake the conservation status assessment.

Table 1: Period for assessing trends

Trend	Period to assess trend
Short-term	Two reporting cycles (12 years; or a period as close as possible)
Long-term	Four reporting cycles (24 years; or a period as close as possible)

The trend magnitude reported should be the change over the relevant period (e.g. 12 years for short-term trend). Where magnitude is derived from data covering a different time interval, estimate the change for the reporting period by simple proportion. For example, a change of 150 km^2 over 15 years would be equivalent to 10 km^2 per year or 120 km^2 over the 12-year interval for short-term trend magnitude. If the change appeared at a specific time (for example, as a result of a catastrophe), precise time period or year should be reported and an explanation should be provided in fields 4.12, 5.17, 6.9 or 9.6 'Additional information'.

Favourable reference values

This chapter provides complementary information to the guidance provided on favourable reference values in Sections '5. Range' and '6. Population' (in 'Field-by-field guidance for species reports').

What are favourable reference values?

The concept of favourable reference values (FRVs) is derived from the definition of Favourable conservation status that relates to the 'long-term distribution and abundance' of the populations of species, and for habitats to the 'long-term natural distribution, structure and functions as well as the long-term survival of its typical species' in their natural range. This requires that the species is maintaining itself on a long-term basis as a viable component of its natural habitats. Similarly, the specific structure and functions necessary for the long-term maintenance of habitat types exist and will continue to exist and that its typical species are in favourable status, i.e. are maintaining themselves on a long-term basis. Favourable reference values – 'range' for species and habitats, 'population' for species, and 'area' for habitats – are critical in the evaluation of conservation status. The evaluation matrices (Annexes C and E) of the Report format require Parties to identify favourable reference values for range (FRR) and area for habitats (FRA) and for range (FRR) and population (FRP) for the species. The conservation status assessment then looks at the difference between current values and reference values. Basically, the range, area, and population must be sufficiently large in relation to favourable reference values (as defined in the evaluation matrix) to conclude, alongside other criteria (e.g. trends), whether the parameter is 'favourable' or 'unfavourable'.

The concept of favourable reference values describes the favourable reference range, population and habitat area as follows:

> *Range within which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long-term survival of the habitat/species; favourable reference value must be at least the range (in size and configuration) when the* the Bern Convention came into force *; if the range was insufficient to support a favourable status the reference for favourable range should take account of that and should be larger (in such a case information on historic distribution may be found useful when defining the favourable reference range); 'best expert judgement' may be used to define it in absence of other data.*
>
> *Population in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the species; favourable reference value must be at least the size of the population when the* the Bern Convention came into force*; information on historic distribution/population may be found useful when defining the favourable reference population; 'best expert judgement' may be used to define it in absence of other data.*
>
> *Total surface area of habitat in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability; favourable reference value must be at least the surface area when the* the Bern Convention came into force *; information on historic distribution may be found useful when defining the favourable reference area; 'best expert judgement' may be used to define it in absence of other data.*

Setting the favourable reference values (FRVs) for species

Overview of general principles for setting reference value

Before setting the favourable reference values, it is advisable to collect all the relevant information about a species in order to understand their ecological and historical context. Therefore, ideally data and information on the following factors should, when available, be gathered and used for estimating FRVs for species:

- current situation and assessment of deficiencies, i.e. any pressures/problems;
- trends (short-term, long-term, historical, i.e. well before the Bern Convention came into force);
- natural ecological and geographical variation (including genetic variation, inter- and intra-species interactions, variation in conditions in which species occur);
- ecological potential (potential extent of range, taking into account physical and ecological conditions);
- natural range, historical distribution and abundances and causes of change, including trends;
- connectivity and fragmentation.
- requirements for populations to accommodate natural fluctuations, allow a healthy population structure, and ensure long-term genetic viability;
- migration routes, dispersal pathways, gene flow, population structure (e.g. continuous, patchy, metapopulation).

The following general principles should be taken into account in the process of setting FRVs:

- FRVs should be set on the basis of ecological and biological considerations;
- FRVs should be set using the best available knowledge and scientific expertise;
- FRVs should be set taking into account the precautionary principle and include a safety margin for uncertainty;
- FRVs should not, in principle, be lower than the values when the Bern Convention came into force , as most species have been listed in the Resolutions because of their unfavourable status; the distribution (range) and size (population) at the date the Bern Convention came into force does not necessarily equal the FRVs;
- FRV for population is always bigger than the minimum viable population (MVP) for demographic and genetic viability;
- FRVs are not necessarily equal to ‘national targets’: ‘Establishing favourable reference values must be distinguished from establishing concrete targets: setting targets would mean the translation of such reference values into operational, practical and feasible short-, mid- and long-term targets/milestones. This obviously would not only involve technical questions but be related to resources and other factors’ (European Commission, 2004[1]);
- FRVs do not automatically correspond to a given ‘historical maximum’, or a specific historical date; historical information (e.g. a past stable situation before changes occurred due to reversible pressures) should, however, inform judgements on FRVs;

[1] Assessment, monitoring and reporting of conservation status – preparing the 2001–2007 report under Article 17 of the Habitats Directive (DocHab-04-03/03 ver.3). DG Environment, 2004.

- FRVs do not automatically correspond to the ‘potential value’ (carrying capacity) which, however, should be used to understand restoration possibilities and constraints.

Although FRVs have to be set separately for range and population size, **there is a clear relationship** between range and population size of a species because within the natural range all significant ecological variations must be considered. This calls for an iterative process in setting the FRVs to ensure that one value takes the other one into account, e.g. population large enough with an appropriate range to include and maintain the evolutionary potential of a species or a range sufficiently large enabling to species population to carry out all stages of its life cycle.

FRVs have to be reported at the level of the Country biogeographical region. However, these geographical units may not be appropriate for developing a rationale for FRVs based on biology and ecology of species. Therefore, it is advisable to set FRVs at the most suitable scale (often national, sometimes supranational) and to derive the national biogeographical numbers from this value, e.g. using a proportion based on distribution and/or size/area.

The term ‘current value’ will be used often in these guidelines. It should be interpreted as being the value reported by the Country for the present reporting period, which is to be compared to the favourable reference value.

Model-based and reference-based approach

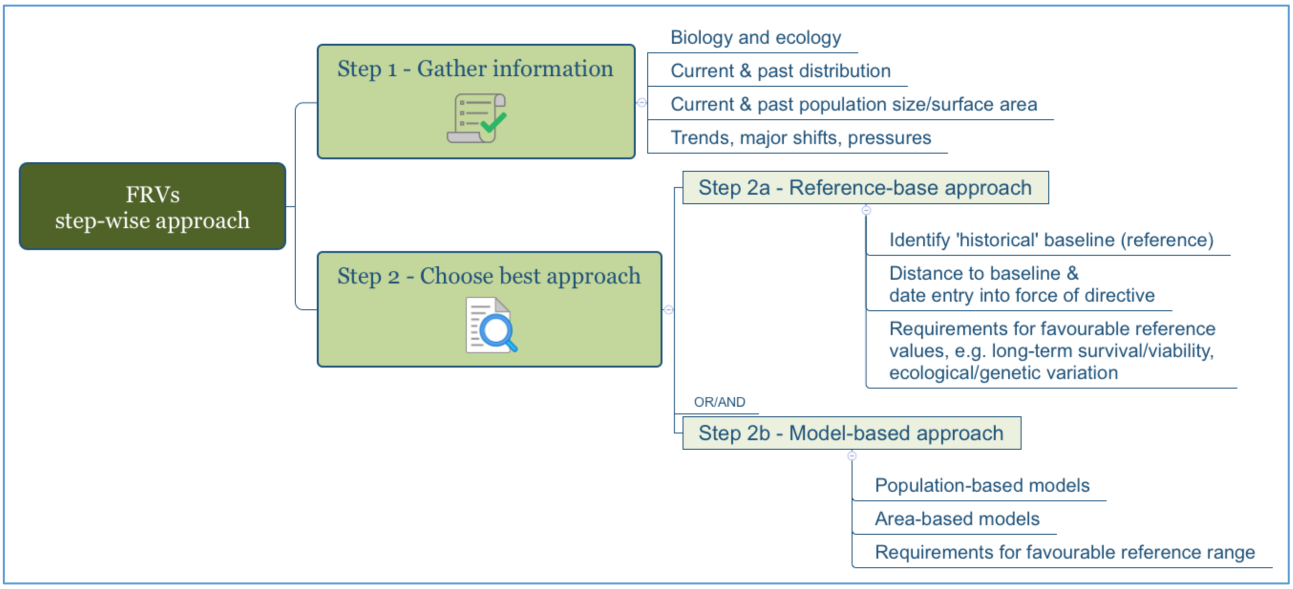
There are basically two approaches to setting FRVs: model-based and reference-based. Model-based methods are built on biological considerations, such as those used in Population Viability Analysis (PVA) or on other estimates of Minimum Viable Population (MVP) size. This approach requires good knowledge about species ecology and biology, and a spreading of viable populations across the species’ natural range. Reference-based approaches are founded on an indicative historical baseline corresponding to a documented (or perceived by conservation scientists) good condition of a particular species or restoring a proportion of estimated historical losses. Both approaches take into account information about distribution, trends, known pressures and declines (or expansions). These approaches are not mutually exclusive and will be further explained in the sections below with practical instructions and examples.

With the objective of developing practical and pragmatic guidance promoting harmonisation between Contracting Parties, while allowing for the needed flexibility (e.g. the best method to be used depends on the data available), a stepwise approach, as summarised in Figure 1 below, is recommended.

The stepwise approach and the specific methods for setting the FRVs are largely dependent on the available data and knowledge for each species. Three generic levels of data availability and knowledge are suggested:

- High: good data on actual distribution and ecological requirements/features; good historical data and trend information;
- Moderate: good data on actual distribution and ecological requirements/features; limited historical distribution data (only trend data available);
- Low: data on actual distribution and ecological requirements/features are sparse and/or unreliable; hardly any historical data available and no trend information.

Figure 1: Illustration of the stepwise approach to set FRVs



The recommended approach involves a certain number of steps that will be further detailed below[2]. In summary, and without detailing all conditions, they are:

- **Step 1: Gather information**
  Collect all relevant information about a species/ necessary to understand their ecological and historical context: biology and ecology; natural range, current and past distribution (including before the Bern Convention came into force) and population size/surface area; trends, their causes and when major changes occurred, pressures.

- **Step 2: Choose best approach**
  Depending on the availability and quality of the data and information gathered, choose the best way of setting the FRVs.

- **Step 2a: Use reference-based approach**
  Compare the current distribution and population size or surface area with those of a past favourable period and at the date the Bern Convention came into force.

  Check if the values above are sufficient to ensure long-term survival and viability, as well as coverage of ecological variations.

  Set values or use operators to qualify how far the current value is from the favourable situation.

- **Step 2b: Use model-based approach**
  Develop population-based models or use available estimates derived from such models to assess the favourable reference population, taking into account the requirements for a favourable reference range.

[2] In order to better understand the practical development of the approaches above (and the steps that will be further detailed), several 'real life' validated examples can be found available on the Reporting Reference Portal. Additionally, elaborated methods and other examples are available from Bijlsma et al., 2017

The favourable reference values for species – FR range and FR population – need to capture the ecological/genetic diversity and the long-term survival of the species.

Firstly, the natural range of the species in the Party(ies) is not to be reduced. The ecological/genetic diversity is often associated with geographical (north–south/east–west) and environmental gradients (e.g. altitudinal, geological, climatic).

The next section elaborates in more detail the issues about long-term viability and survival of the population or populations of a species in its natural range.

Understanding long-term viability/survival

The interpretation of a species being, or maintaining itself, 'viable' in the long term is discussed in many publications on conservation biology or in a broader context of conservation planning and management. For some species, 'action plans' have been prepared, either at local, regional, national or European scale, and although these plans do not use the term 'favourable reference value', they do sometimes consider related concepts and may be a source of ideas and information. For example, the European Commission supports the development of EU action plans for selected species[3] and the Council of Europe has published European action plans for large carnivores[4].

In ecological studies (e.g. Beissinger & McCullogh, 2002), 'viability' of a population is approached via population viability analysis (PVA) and the associated concept of minimum viable population (MVP). MVP size refers to the number of individuals required for a sufficiently high probability of population persistence or for sufficient retention of genetic variation for maintaining evolutionary potential.

However, the most recent publications on this topic emphasise that the viability of a species should not be understood merely as an avoidance of extinction risk, focusing on the demographic viability of populations (often represented as an MVP). For example, the 'role the species plays in the ecosystem (Epstein et al., 2015), ecological functionality allowing a species to respond to changes in a species' communities and resilience achievable through large dynamic metapopulations' (Redford et al., 2011) are equally important. Caughley (1994) distinguished between 'small population' and 'declining populations' paradigms in conservation biology. Whereas Matthews (2016) warns that a narrow focus on population viability can result in a tendency towards 'ecology of the minimal'.

The concept of a viable (meta)population[5] can usefully inform the FRP, but is distinct from the concept of favourable population and needs upscaling: a (meta)population may be viable at a very local scale (e.g. for largely sedentary species) to international scale (e.g. for migratory species), whereas 'favourable population' considers the conservation status of populations across the natural range of the species, which, for the purpose of assessment and reporting, can be divided into references at, for example, Country level and at biogeographical level. The favourable reference value will generally cover many discrete (meta)populations within a Country, or a Country may just

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[3] http://ec.europa.eu/environment/nature/conservation/species/action_plans/

[4] http://www.coe.int/en/web/bern-convention/on-large-carnivores

[5] A metapopulation consists of a group of spatially separated subpopulations of the same species which interact at some level through immigration or exchange of individuals between the distinct subpopulations. While a single subpopulation may not be sufficient to guarantee the long-term viability of a species in a given area, the combined effect of several connected subpopulations may be able to do this.

cover a part of a larger, international (meta)population, in which case a reference value at biogeographical level may be appropriate (see Table 2 below).

The distinction between a minimum viable (meta)population and the concept of Favourable conservation status should be understood as follows: conservation status relates to the 'long-term distribution and abundance of the populations′ of species, aiming for the populations to be maintained or restored at Favourable conservation status in their natural range, so that the species remains a viable component of its natural habitats. It is therefore important for favourable reference populations to reflect the 'long-term viable component of the natural habitat' at the level of the species across its natural range and distribution, rather than solely a minimum viable population.

Stepwise process for setting the favourable reference values for species

Step 1: Gather information about the species

The list below includes examples of data and information about the species biology and ecology that may be relevant:

- life history strategies and dispersal capacity;
- spatial and genetic structure of the population: subpopulations, metapopulations, management units (marine environment);
- habitat requirements for each stage of the life cycle; reproduction, foraging, resting, migration, pollination;
- geographical variation (differentiation) in habitat requirements, migration routes;
- potential range.

Knowledge about the structure of the species' populations is useful to understand the spatial scale at which they function and choose the approach for setting the FRVs (Table 2).

Table 2: Categories of populations in terms of structure and migratory character and indicative level for setting the FRVs

Category of population	Comments and examples
Populations of sedentary (non-migratory) animals, more or less mobile	Large or small sedentary species with more or less exchange at or below Country level; FRVs to be normally set at the Country level (or at the country biogeographical level) or in cooperation with neighbouring countries, depending on the species distribution and if their populations are transboundary or not. • *Barbastella barbastellus* • *Austropotamobius pallipes* • *Carabus olympiae*, *Osmoderma eremita.* Large, more or less mobile sedentary species with only one or a few clearly isolated populations; FRVs to be normally set at the country biogeographical level or at the country level if population(s) is distributed in more than one region. • female *Ursus arctus* • *Monachus monachus* • several *Coleoptera* and *Odonata* • *Margaritifera margaritifera, Unio crassus.* Sedentary, small and mobile animal species; FRVs to be normally set at the country biogeographical level. • many butterflies. Individuals with inherently large home ranges (> 100 km^2 up to > 1 000 km^2); FRVs to be normally set for the whole population (or meta-population) or populations, which may imply cooperation between Parties sharing the same population (meta-population). • *Canis lupus* • several whales and most dolphins.
Populations of sedentary (non-migratory) animal species with low mobility and of plant species	Often with diffuse, scattered distribution or isolated/single distribution; FRVs to be normally set at the country biogeographical level. • terrestrial mammals: *Microtus cabrerae* • amphibians/reptiles: most species • insects: *Apteromantis aptera, Baetica ustulata* • molluscs: all *Gastropoda* • vascular plants, bryophytes, lichens: most species.

Category of population	Comments and examples
Populations of migratory animals	With individuals showing large cyclic, directed movements; FRVs to be normally set through cooperation between country where the species normally occurs at given periods of the year. • several whales • *Caretta caretta* • *Salmo salar*, *Petromyzon marinus.* Partially migratory; FRVs to be normally set at the country or country biogeographical level taking into account possible occurrences in neighboring countries. • *Miniopterus schreibersii* • *Phoca hispida botnica (Pusa hispida botnica)*, several whales and dolphins • freshwater fish and lampreys: most species.

Another set of information to be collected includes data and information on distribution (and therefore range) and population sizes in the historical (far and recent) past, when the Bern Convention came into force and currently (i.e. when the assessment is being done). The far historical past would cover the last two or three centuries (where applicable), and the recent historical past up to about 50 years before the Bern Convention came into force (i.e. 1940s–1950s).

This information is crucial to understand what has been happening to the species and to support the setting of FRVs in the following steps. Where available this evidence should be complemented with information on trends and pressures, to understand which events caused major changes/shifts in the status and trends of species distribution and population size, and when. For example, whales were first hunted intensively from the 1850s onwards, with the most intense period (in the eastern North Atlantic) being between 1900 and the 1960s; protection became widespread in the mid-1980s. The Bottlenose dolphin appears to have been more widespread before 1900, and may also have experienced declines between the 1960s and 1980s; Harbour porpoise also appear to have experienced declines during the twentieth century, particularly the latter half. In both cases, increased pollution may have played a role; in the latter case, additionally, by-catch has almost certainly played a role, whilst prey depletion from overexploitation of fish stocks may well have a role as well.

Step 2a: Use reference-based approach to set FRVs

The availability and quality of the data and information gathered in Step 1 will be very different from species to species, but also for distribution (range) and for population size.

However, it should be possible to use that information in a pragmatic way to have a rough estimation of how far from favourable reference values the current values on range (based on distribution) and population size are (using the operators ‘approximately equal to’, ‘more than’, and ‘much more than’, and possibly set values). When using operators, Parties are encouraged to indicate in the ‘Additional information’ fields (4.12 for FRR and 5.17 for FRP) an estimation of the percentage of how far the current value is from the FRV (e.g. ‘current value around 5 or 6 % below FRR’, ‘current value about 45-50 % below FRP’); this information could be useful when estimating restoration needs for example.

The ‘decision key’ below should be used in general, noting that for several species (e.g. several large carnivores) Step 2b, using the population-based approach, could be more appropriate. In addition, elements from Step 2b may also be used to help estimate the FRP below. Take into account the above sections ‘General principles for setting favourable reference values (FRVs)’ and ‘Understanding long-term viability/survival’.

Point 1

If both distribution and population size have not undergone visible shifts or reductions (trends have been relatively stable) in the past, including in the recent past, AND current population size is large enough to ensure the long-term viability of the species, then the:

- favourable reference range (FRR) should be equal to the current range;
- favourable reference population (FRP) should be equal to the current population size[6].

If the current range is smaller than the past range, ⇨ go to point 2.

If the current population size is smaller than the past population, ⇨ go to point 3.

Point 2

Identify which additional areas should be covered by the species in the future in order to re-establish a (past) range that is large enough and well distributed to accommodate a population or populations that are viable in the long term; this should take into account whether the restoration of the range is technically and ecologically feasible. The availability and quality of the data used to make such an identification and estimation could lead to different ways of expressing the FRR:

- a **value** equal to ‘current range value’ plus ‘additional range area to be restored’;
- an **operator** indicating ‘more than current range’ (i.e. less than 10 % more) or ‘much more than current range’ (i.e. more than 10 %);
- in any case, the estimated FRR should not be smaller than the range at the date the Bern Convention came into force.

[6] Or in exceptional cases (for example of species with overpopulations as result of non-conservation artificially feeding or of species which population is increasing since the Bern Convention came into force and which are harmful to other protected species) the favourable reference population (FRP) should be lower than the current population.

Point 3

Identify how population size can be restored to a (past) favourable level: increase the size of an existing population (or populations) and/or reintroduce a population (or populations) within its natural range. If the current population(s) is viable in the long term, but information on past distribution indicates that one or several populations are locally extinct, the favourable reference population must take this fact into consideration. However, this should consider if the reintroduction is technically and ecologically feasible[7]. Information about past trends, if available, should inform the setting of the FRP. The availability and quality of the data used to make such an identification and estimation could lead to different ways of expressing the FRP:

- a **value** equal to 'current population size' plus 'additional individuals to be restored' (restoration can be through restocking/reintroduction, and/or through natural increase as a result of e.g. removing pressures);
- an **operator** indicating 'more than current population size' (i.e. less than 25 % more) or 'much more than current population size' (i.e. more than 25 %);
- in any case, the estimated FRP should not be smaller than the population size at the date the Bern Convention came into force, except in cases where that population size was due to non-natural conditions, or the species naturally exhibits wide fluctuations in population size and happened to be at a 'population high' (not biologically sustainable).

Point 4

A conclusion of FRR or FRP 'unknown' should only be used in the cases where there is hardly any data about species' current range and population size and no information about the its historical context.

Step 2b: Use population-based approach to set FRVs

There are several species for which a reference-based approach is not possible or appropriate to set the FRVs:

- species for which there is not sufficient historical information about distribution, population size, trends, pressures;
- species for which restoration of range and/or population to some historical levels would not be feasible at all;
- species for which the restoration efforts would not be proportional and reasonable in terms of the conservation objectives of the Directive (e.g. implying large-scale recreation of habitats for the species in currently urbanised areas).

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[7] The IUCN *Guidelines for Reintroductions and Other Conservation Translocations* provides useful information to decide about and plan a reintroduction. https://portals.iucn.org/library/efiles/documents/2013-009.pdf

Box 5: Considerations about population viability analysis (PVA), minimum viable population (MVP) and generalised genetic rules

Population viability analysis (PVA) and the concept of minimum viable population (MVP) can be useful tools to inform favourable reference values. However, FRP is always bigger than the minimum viable population (MVP) for demographic and genetic viability (see also above 'General principles for setting favourable reference values (FRVs)').

PVA is a quantitative modelling method that uses demographic and abundance data of species and incorporates identifiable threats to population survival to estimate the probability of extinction or loss of genetic variation (Beissinger & McCullough, 2002). PVA uses models of population dynamics which incorporate causes of fluctuations in population size in order to predict probabilities of extinction, and to help identify the processes which contribute to a population's vulnerability. PVA requires a lot of biological data. Some recent examples of applied PVA are available for Scandinavian wolf, bear, lynx, wolverine (Nilsson, 2013; Bruford, 2015), Woodland brown butterfly (Bergman & Kindvall, 2004), pool frog and Glanville fritillary (Sjögren-Gulve & Hanski, 2000). Brambilla et al. (2011) provided favourable reference population figures based on PVA for populations of Italian breeding birds of fewer than 2,500 pairs. The use of PVA in plant conservation is reviewed by Brigham & Schwarz (2003) and Zeigler (2013). However, PVA analyses have not been done for most of the species listed in the Annexes of the Directive.

In PVA, metapopulation viability can be assessed and modelled either through demographic and/or genetic models or by the structurally simpler occupancy models. The occupany models project the patterns of local extinction and (re)colonisation, respectively, of local populations into the future. Very simple models may build on quite unrealistic assumptions, but the more sophisticated spatially explicit patch occupancy models (SPOMs), which allow for multiple environmental and spatial factors to influence the metapopulation dynamics, can make projections, given plausible environmental scenarios, so that risks and long-term trends can be assessed and evaluated.

Generalised genetic rules, derived from population genetic analyses and PVA, recommend general thresholds for viable population sizes ('genetic viability'). A much used and debated generalisation is the '50/500 rule', which states that an effective population size N_e = 50 is sufficient to prevent inbreeding depression in naturally outbreeding species in the short term, and $N_e \geq 500$ to retain evolutionary potential (Franklin, 1980; Jamieson & Allendorf, 2012). Frankham et al. (2014) proposed revised recommendations including a '100/1000,rule' instead, but also more recent papers still use the '50/500,rule' (e.g. Laikre et al., 2016). Species which have very large fluctuations in population size and a high reproduction rate generally require an effective population size much higher than 500. Based on the meta-analysis by Traill et al. (2007), the MVP for 99 % persistence for 40 generations for a typical outbreeding species may be in the order of several thousands (N) (Frankham et al., 2014: 6.3).

Generalised genetic rules have been used in the last reporting round under Nature Directives in setting FRPs, e.g. by Belgium (Flanders) and the Netherlands.

As the name indicates, this approach is to be used to set the FRP. However, the FRR can be derived from the FRP requirements if it cannot be derived from the reference-based approach: FRR should have sufficient connectivity and be large enough to accommodate the FRP, cover possible ecological variations, etc.

Consider using population viability analysis (PVA), available estimates of minimum viable population (MVP) size from literature, or generalised genetic rules (see Box 5).

The population-based approach described below was adapted from Bijlsma et al. (2017).

Point 1

Determine or infer the minimum viable population size (MVP) considering evolutionary potential ('genetic MVP') and the population's genetic connectivity with other relevant conspecific populations.

- If high data quality: perform a Population Viability Analysis (PVA).
- If moderate/low data quality: use MVP estimates from a) species-specific literature, b) generalised genetic rules corresponding to an effective population size Ne ≥ 500 (long-term 'genetic MVP') or other effective population size adequate for the species reproduction rate and population dynamics or c) population-based proxies for MVPs.

Point 2

Determine a factor to scale MVP size up to FRP level.

Given an MVP estimate, the required favourable population size or the number of required more or less isolated (favourable) populations will at least depend on ecological and genetic variations within the natural range of the species and often on known trends as well. Several (not always independent) approaches are available for upscaling an MVP estimate to FRP level.

For all approaches: take into account: 1) ecological/genetic variations within the (historical) natural range, i.e. geographical, climatological, geological and altitudinal gradients as well as significant differences in historical land use, and 2) technical/ecological feasibility.

Possible approaches:

- If high data quality: use models for potential range and habitat suitability or available estimates of population density, amount of suitable area and maximum dispersal distance to constrain the number of required populations or the spatial extent of one mixing population.
- If high data quality: use population trends to determine an MVP multiplier.
- If low data quality: consider ecological/genetic variations within the historical range and find the minimum number of populations (connected or isolated) needed to cover this variation.
- For migratory species and species with large home ranges: consider structured populations according to management units (e.g. marine mammals and turtles).

Point 3

Determine FRP.

- If the scaling factor can be estimated with sufficient confidence:
  - FRP equal to MVP multiplied by scaling factor (number of required populations or multiplier); in any case, the calculated FRP cannot be lower than the population size at the date the Bern Convention came into force .
- If the scaling factor can only be estimated qualitatively, use operators:
  - if MVP is much smaller than the size of the population at the date the Bern Convention came into force , then the FRP should be equal to the latter value;
  - if MVP is approximately equal to or bigger than the size of the population at the date the Bern Convention came into force, and scaling factor is relatively low, then FRP should be bigger than the latter value;
  - if MVP is approximately equal to or bigger than the size of the population at the date the Bern Convention came into force , and scaling factor is relatively high, then FRP should be bigger than the latter value.

Point 4

Consider consequences for setting the FRR.

If FRP is bigger or much bigger than the size of the population at the date the Bern Convention came into force , determine how much additional range is necessary (or not) to include the FRP.

2 Maps

This chapter provides complementary information to the guidance provided in Section '2 Maps' (in 'Field-by-field guidance for species reports').

Distribution maps

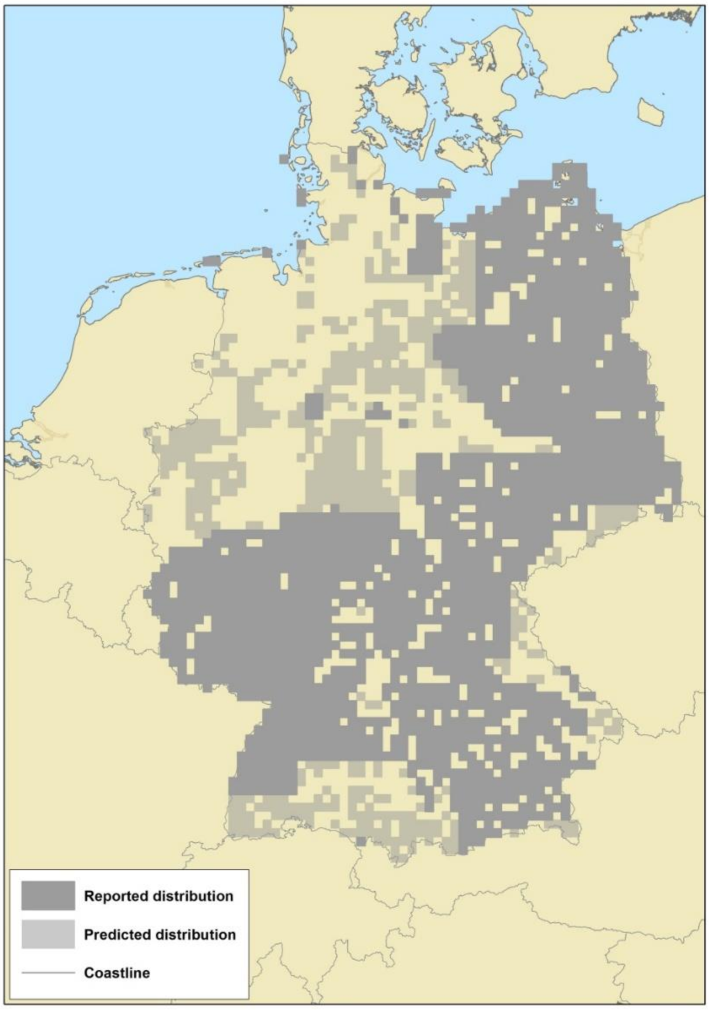
Submission of maps of the distribution of all Resolution No. 6 (1998) species present in a Country is a basic requirement of the reporting. Principal requirements for distribution maps are described in Section '2. Maps' (in 'Field-by-field guidance for species reports') and further technical specifications are provided on the Reporting Reference Portal.

Ideally the distribution map should provide complete and up-to-date information about the actual occurrence of the species based on the results of a comprehensive mapping programme/initiative/project/inventory or a statistically robust model.

In many cases field data will only cover part of a species' actual distribution or only relatively old data will be available. In this situation the Reporting format foresees that the distribution map is derived from a model or extrapolation. Parties are encouraged to report a more up-to-date or complete distribution by remapping the available distribution using other data, such as the results of a monitoring programme or data on a suitable habitat.

In some cases, even with the use of extrapolation, the resulting distribution map will be highly incomplete when compared with presumed species distribution (see Figure 2). The Parties are encouraged to provide even the incomplete distribution map, but if the reported distribution map obtained as a result of comprehensive mapping, modelling or extrapolation or expert interpretation covers less than 75 % of the presumed actual species distribution (the resulting map is incomplete in relation to the presumed species distribution), the 'Method used' should be reported as '(d) Insufficient or no data available'.

Figure 2: Hypothetical distribution map of a species in Germany with predicted (presumed) and reported distribution. Reported distribution represents less than 75 % of a presumed distribution, so the 'Method used' should be evaluated as '(d) Insufficient or no data available'.



Some issues related to distribution maps (in relation to range calculation)

Occasional occurrences, outlying occurrences

The range is shown as an external envelope around the species distribution. The size and shape of the range is therefore to a large extent determined by the occurrences of the species on the outer limits of the distribution. The area of distribution is used as a weighting parameter in the biogeographical assessment when information on population is not available.

Species are occasionally recorded beyond their usual area of distribution, but these occasional records should not influence the shape and size of the range, nor should they be counted when weighting by the species distribution during the biogeographical assessment. Therefore, the distribution map is based only on regular occurrences of the species (except for maps of 'occasional' or ‘newly arriving’ species; see Section ‘Occurrence categories used in the species checklist’ (in ‘Species to be reported’ chapter in ‘Definitions and methods for species reporting’ part). On the other hand, particularly on the boundaries of the natural geographical range, species may occur in limited numbers in typical conditions. These outliers should be included in the distribution of the species if they represent regular and/or stable occurrences, as they are important for calculating the range.

Metapopulations

Many species have a metapopulation structure, which is characterised by local extinctions and (re) colonisations (e.g. Warren 1994). Although the distribution map should provide information on the actual species distribution, the localities with repeatedly recorded absence of the species (if known) but where suitable habitat is still present and recolonisation is expected should be included in the distribution map, if they form part of the area used by the metapopulation.

Highly mobile or migratory species

Some highly mobile or migratory species can occupy large territories during their life cycle. For example, the home range of the Eurasian lynx or wolf can exceed 100 km^2 under some conditions (in northern Europe the wolf territories are around 800–1 000 km^2, territories of lynx females are around 400 km^2 and of males over 1 000 km^2) or the home ranges of harbour porpoise can vary from 7700 to 70000 km^2. For these species, distribution is mostly mapped on their home-range basis or as a territory used by a population. In these situations the distribution map represents a space that is used regularly by the population(s) of species.

For anadromous fish and lampreys often recorded only in a few localities in the river systems, e.g. the spawning grounds or at fish passes, the complete migration route in the rivers from the mouths in the sea to the highest know stretches should be included in the distribution.

Distribution map of occasional and newly arriving species and species extinct prior to the date the Bern Convention came into force.

Unlike the distribution of regularly occurring species, the distribution of occasional and newly arriving species will consist of all grids where the occurrence of a species was recorded (including occasional occurrences).

A map of species extinct prior to the date the Bern Convention came into force should contain grids with the reintroduction location(s) (if there is a reintroduction project) and/or known occurrences (for species with signs of recolonisation).

4 Range

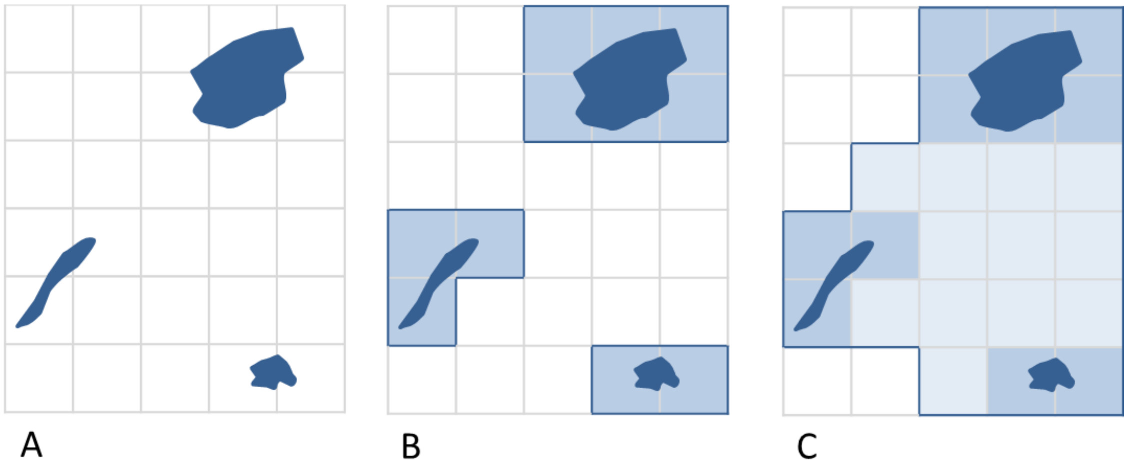
This chapter provides complementary information to the guidance provided in Section '4. Range' (in 'Field-by-field guidance for species reports').

Concept of range

Range is defined as 'the outer limits of the overall area in which a species is found at present and it can be considered as an envelope within which areas actually occupied occur'. It is a dynamic parameter allowing the assessment of the extent of and the changes in the species' distribution.

Range is a spatial generalisation of distribution, which is a representation of the species occurrences in the 10 x 10 km grid. The relationship between species occurrence, distribution and range is illustrated in Figure 3.

Figure 3: Relationship between occurrence of species, distribution and range. 'A' occurrence of species, usually a polygon, point or a linear feature ; 'B' distribution – occurrence in 10 x 10 km grids; 'C 'range – spatial generalisation of the distribution



The range can be described as follows:

> *The natural range describes roughly the spatial limits within which the habitat or species occurs. It is not identical to the precise localities or territory where a habitat, species or sub-species permanently occurs. Such actual localities or territories might for many habitats and species be patchy or disjointed (i.e. habitats and species might not occur evenly spread) within their natural range. If the reason for disjunction proves to be natural i.e. caused by ecological factors, the isolated localities should not be interpreted as continuous natural range, for example for an alpine species the range may be the Alps and the Pyrenees, but not the lower area between. The natural range includes however, areas that are not permanently used: for example for migratory species 'range' means all the areas of land or water that a migratory species inhabits, stays in temporarily, crosses or overflies at any time on its normal migration[8]. Vagrant or occasional occurrences (in the meaning of accidental, erratic, unpredictable) would not be part of the natural range.*

[8] See also Article 1 of the Bonn Convention.

Natural range as defined here is not static but dynamic: it can decrease and expand. Natural range can also be in an unfavourable condition for a habitat or a species i.e. it might be insufficient to allow for the long-term existence of that habitat or species.

When a species or habitat spreads naturally (on its own) to a new area/territory or when a re-introduction of a species into its former natural range has taken place, this territory has to be considered a part of the natural range. Similarly restoration/recreation or management of habitat areas, as well as certain agricultural and forestry practices can contribute to the expansion of a habitat or a species and therefore its range. However, individuals or feral populations of an animal species introduced on purpose or accidentally by man to places where they have not occurred naturally in historical times or where they would not have spread to naturally in foreseeable future, should be considered as being outside their natural range and consequently not covered by Resolution No. 6 (1998).

Calculation of range

Bearing in mind the dynamics of the range as defined above, the range should be calculated based on the map of the actual (or presumed if also modelling, extrapolation of expert opinion were used) distribution used for each reporting period. The calculation should involve a standardised method. A standardised process is needed to ensure repeatability of the range calculation in different reporting rounds and for comparison of results between Parties. It will also allow for estimating range trends.

The standardised process proposed in these guidelines consists of two steps:

1. Creating an envelope(s) around the distribution grids. This spatial calculation is done using the procedure of 'gap closure' where a predefined set of rules specify where two distribution points/grids will be joined together to form a single range polygon, and where an actual gap in the range will be left.
2. Excluding unsuitable areas. After the automated calculation, areas which are not appropriate, such as marine areas in the range of a terrestrial species, should be excluded.

Step 1: Creating an envelope(s) around distribution grids

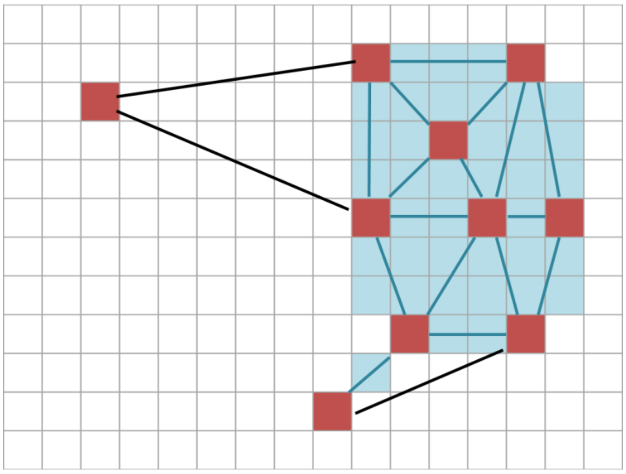
What is a gap distance?

Most of the basic principles for the range estimation, including the size of gaps which will represent a discontinuity in the range, were established during the 2000–2006 Nature Directives reporting period and will still be valid. Range should exclude major discontinuities that are natural, i.e. caused by ecological factors. What is considered as a natural discontinuity is largely dependent on the ecological characteristic of the species and the character of the surrounding landscape. Ideally, the criteria for the range discontinuities should be defined separately for each species in each particular landscape, but this is practically impossible. The guidelines for reporting provide a generalised and simplified approach to range discontinuities.

In the process of calculating a range the natural discontinuities are represented by a 'gap distance'. A gap distance should be understood as the distance between two distribution grids that will not be joined together to form a single range polygon but will be shown as discontinuities in a range (see Figure 4).

Figure 4: A schema illustrating use of the gap distance in calculating range. If the distance between two occupied distribution grids (red grids) is smaller than the gap distance (blue lines),

the distribution grids are joined to form a range (blue grids). If the distance between two distribution grids is higher than the gap distance (black lines), two distribution grids are not joined and represent a discontinuity in the range.

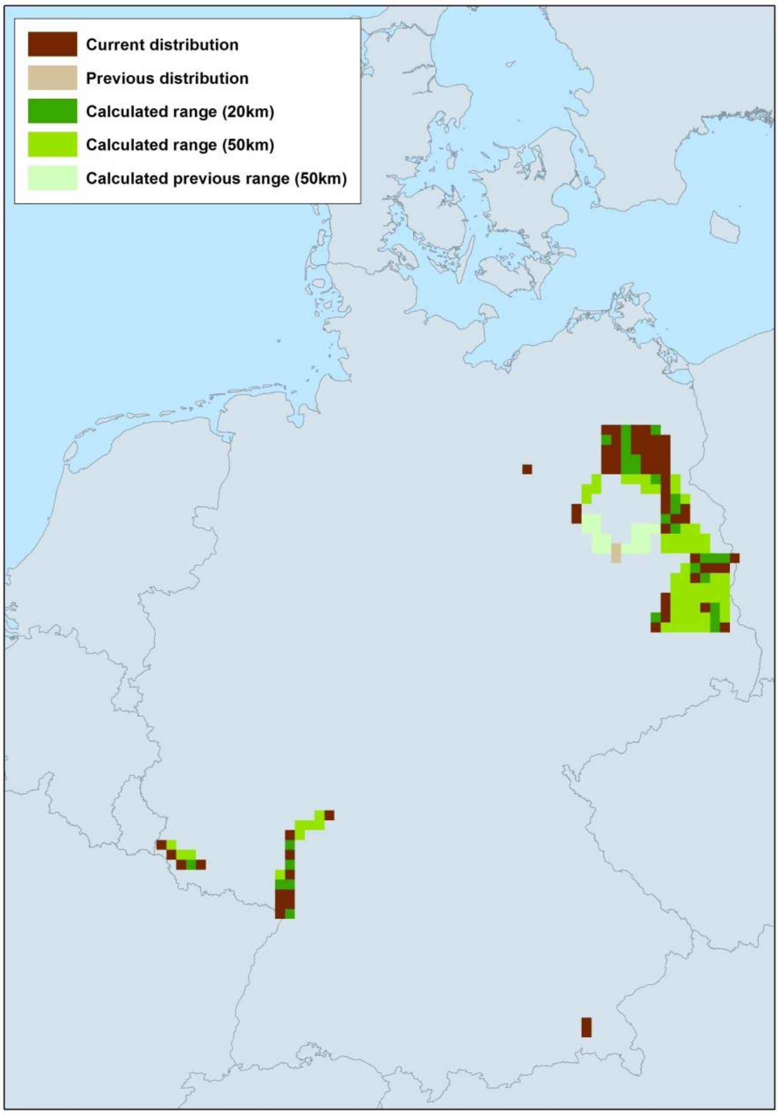


Constraints for selecting the gap distance

The gap distance should correspond to the definition of range (as an envelope generalising the distribution with major discontinuities excluded) and it should allow the calculation of range polygons, which are capable of detecting large-scale changes in the distribution. A range that is calculated with larger gap distances (i.e. 40–50 km) is more sensitive to changes at the margins of the distribution and large-scale changes within the outer limit of the distribution. On the other hand, range calculated with smaller gap distances (e.g. 20 km) is sensitive to small-scale changes (see Figure 5).

A discontinuity of at least 40–50 km (depending on species group) is considered a gap in the range of species.

Figure 5: An example of range maps created using different gap distances. This map shows the difference between the range calculated with 20-km and 50-km gap distances. Where a single marginal population occupying two 10 x 10 km grids on the map is lost (Previous distribution) the range calculated with 50-km gap distance (Calculated range 50 km) will decrease by more than 15 % of its original area (Calculated previous range 50 km). Using the gap distance of 20 km, where this marginal population will remain isolated from the main range polygon (Calculated range 20 km), the decline in the range area will be around 3 % of its original area. With a 12-year reporting period the same situation would lead to different conclusions: 'unfavourable-bad' for the range with a 50-km gap and 'unfavourable-inadequate' for the range with a 20-km gap.



The gap distance should, on the other hand, reflect the ecological characteristic of the species. This means that for mobile species the range will be calculated using larger gaps and, conversely, smaller gaps will be used for less mobile species. Precise knowledge about the dispersal capacity of many species is still lacking, and in addition the possible dispersal distance will be greatly influenced by the quality of the surrounding landscape matrix. The proposed gap distances are rather broad and reflect major ecological differences between broad species groups. The recommended gap distances for each species group are outlined in Table 3, but other gap distances can be used if based on detailed knowledge of the species within the Country.

Table 3 Recommended maximum gap distance for major species groups

Species group	Gap distance
Lower plants	40 km
Higher plants	40 km
Invertebrates	40 km
Fish and lampreys	50 km
Terrestrial mammals	40–90 km[9], depending on dispersal ability and movement
Amphibians	50 km
Terrestrial reptiles	50 km
Marine mammals and reptiles	90 km[10]

For very rare and/or localised species occurring in particular environmental conditions, the range may be equal to the distribution.

For small countries or for other small territories for which the distribution map is provided using the 1 x 1 km grid or 5 x 5 km grid (see Section '2. Maps' (in 'Field-by-field guidance for species reports')) the gap distances can be adapted accordingly (e.g. a gap distance of 4 grids = 4 km can used for plants instead of 40 km recommended in Table 3).

Step 2: Excluding unsuitable areas

Technically, range is calculated by filling in the unoccupied grids between the cells of distribution. The following types of unsuitable areas should be excluded from the calculated range:

- marine areas automatically included in the range of terrestrial species;
- areas beyond national boundaries;
- areas identified by the range tool as part of the range falling in the adjacent biogeographical region for which the species is not noted on the checklist;
- areas without water bodies for freshwater species and vice versa.

Although the distinction between suitable and unsuitable areas is very coarse, the purpose of this step is to correct only the most important contradictions resulting from automated calculation. Technically, the process described in this step should be simple and applicable across all Contracting Parties.

5 Population

This chapter provides complementary information to the guidance provided in Section '5. Population' (in 'Field-by-field guidance for species reports').

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[9] The gap distance in range calculation for highly mobile species should be adapted to reflect the movements of the species. These, on contrary to any changes in the range should not affect calculated range trends.

[10] For some species the gridded distribution will approximate the range because the distribution was derived from the large scale surveys, modelling and/or expert extrapolation or will be mapped as area used by the population. In these cases the range calculation is not relevant. The gap distance in range calculation for highly mobile species should be adapted to reflect the movements of the species and can be larger than 90km.

Population size units

Population is one of the four parameters needed for the assessment of the conservation status of species as part of the reporting. The evaluation matrix requires that in order to be assessed as 'favourable', the population size of a species should not be lower than its favourable reference population and population dynamics and structure should not deviate from normal.

Each Country has its own tradition of species monitoring. One of the main purposes of these national monitoring schemes (where they exist) is to assess the population trend and the trend magnitude of the monitored species. Many different types of units are used by Countries in their monitoring in order to estimate the size of population and/or species trends; these include individuals, localities, area occupied (possibly based on a buffer zone around individual records) and number of occupied ponds or groups of adjacent ponds (with a suggested distance of less than 500 m between ponds) for amphibians such as newts. In order to monitor species trends, relative units such as abundance, density, or number of records per unit of effort are often used.

To assess the conservation status of a given species at biogeographical level, there is a need to compare the population size of the species in the different Countries within the same biogeographical region. It is therefore essential that the population size reported by each Country is made available in a unit that allows this comparison. Weighting by population is the preferred method for producing the pan-European assessments, but this is only possible if all Countries in a region use the same unit.

These needs are reflected in the reporting of population size. The Reporting format asks for:

- population size in the reporting unit (for biogeographical assessments and other or biogeographical statistics) (field 5.2);
- additional population size, using population size unit other than the reporting unit, e.g. the unit used for assessment at national level (field 5.4).

Population size in the reporting unit for all species, except species restricted to a single country, must be reported using the population size unit given in the species checklist available on the Reporting Reference Portal. This will be one of the following:

- individuals or pairs (birds);
- number of occupied 1 x 1 km grids;
- other agreed population unit (only for certain species as agreed in the species checklists, e.g. "cmales", calling males for breeding populations for Crex crex)

Reporting population size in individuals

In general, 'individuals' (mature individuals) should be used for mammals (excluding most bats and small mammal species), vascular plants (excluding exceptions).

For mobile species such as mammals or marine turtles, spatial surrogates do not represent a suitable population unit for aggregating data at the biogeographical level, as these species often occupy large territories and spatial surrogates are often poorly correlated with actual population size.

Plants are sedentary organisms that occur in discrete locations, so counting the individuals (or stems, see definition of mature individual below) is generally not excessively cost-demanding. Some plant species should, however, be reported using the 1 x 1 km grids, as agreed in the species checklist for reporting.

Box 6: Mature individuals

Although no strict definition of 'mature individual' is available, in general, adult individuals are included, i.e. those known or thought to be capable of reproducing, but plant seedlings, for example, are not. For most animal species, individuals are quite easy to delineate and understand. However, for some plants it is more problematic. For several species (e.g. clonal populations with vegetative reproduction) it is not possible to distinguish individuals from each other above ground, while ferns (e.g. *Trichomanes speciosum (Vandenboschia speciosa)*) may have both gametophyte and sporophyte generations. As a pragmatic solution it is recommended to treat shoots or tufts as individuals. This guidance is in line with the IUCN guidelines[11] for estimating number of mature individuals, which states that reproducing units within a clone should be counted as individuals, except where such units are unable to survive.

Reporting population size in 1 x 1 km grids

Spatial surrogates for population size (1 x 1 km grids) are used for species where technically robust methods for estimating species population size do not exist or are excessively costly and/or destructive. This applies, for example, to species with high fluctuations, where counting individuals gives biased estimates of population size (e.g. some amphibian species). Precise counts of the total biogeographical population of abundant and widespread species (such as some amphibian, reptile or mammal species) are often not needed in order to access the population dynamics. They are also very difficult to obtain and so they are rarely collected as part of a species monitoring programme. Cryptic and dispersed or mobile species (such as fish or some saproxylic beetles) are extremely difficult to count as number of individuals.

Unlike individuals, the use of 1 x 1 km grids is not restricted to mature individuals. Many species (i.e. groups), for which the 1 x 1 km grid is the reporting unit, are monitored throughout their different life stages (e.g. larva and exuviae for dragonflies) that can be valid for 1 x 1 km grids assessment.

It should be noted that reporting population size as the number of occupied 1 x 1 km grids does not imply that monitoring should be done at that scale, nor that the distribution maps at that scale need to be made or provided. This standard unit (1 x 1 km) is proposed to facilitate comparison and aggregation of data that otherwise would not be possible to aggregate or could have very different interpretations. For instance, if a population size is expressed as 'number of localities', there is no common definition of 'locality'. Therefore, converting the number of localities into a number of 1 x 1 km grid cells for each locality allows a better comparison of 'sizes' between different countries.

Plant species to be reported in 1 x 1 km grids

In the majority of cases the population size for vascular plants should be estimated as the number of individuals, except for:

- species growing in dense stands or forming colonies where individuals cannot be easily separated visually, e.g. aquatic plants or bryophytes;
- species occurring in defined sites where it is difficult, dangerous or very expensive to collect adequate population data, such as ponds, fens, single trees and cliffs;

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[11] http://www.iucnredlist.org/documents/RedListGuidelines.pdf

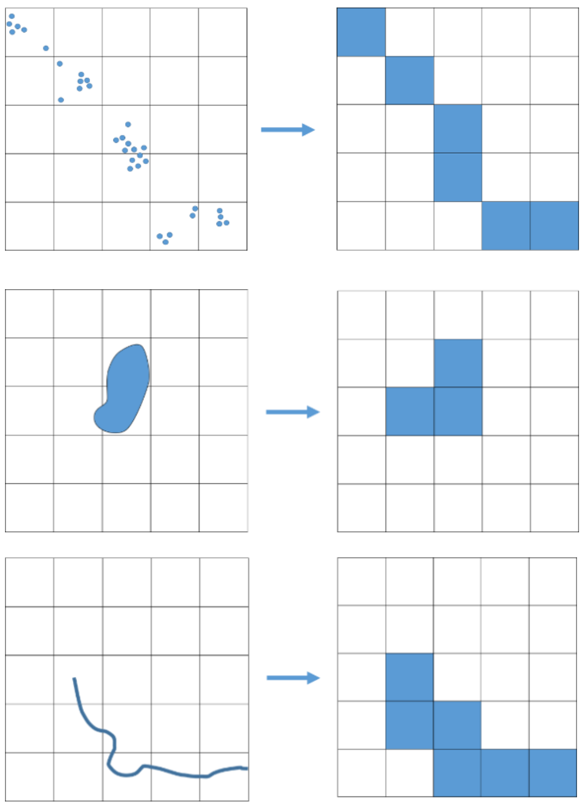
Guidance for converting nationally used (monitoring) units into 1 x 1 km grids

Where the information concerning the number of occupied 1 x 1 km grids is not directly available, it will be extrapolated from the available data. The following paragraphs are giving some guidance for the main cases.

- **Converting monitoring units to the number of occupied 1 x 1 km grids**

The rules detailed in Figure 6 for converting monitoring units to the number of occupied 1 x 1 km grids should be applied to relatively well-known species:

Figure 6: Converting monitoring units to a number of occupied 1 x 1 km grids



a) The monitoring unit involves **point data**
   - Each 1 x 1 km grid in which a point occurs should be counted, in this case 6 grids

b) The monitoring unit involves **polygon data**
   - Each 1 x 1 km grid in which the polygon occurs should be counted, in this case 3 grids

c) The monitoring unit is a **linear feature**
   - Each 1 x 1 km grid in which a segment of the linear feature occurs should be counted, in this case 6 grids

a) Point data: This approach can be used for relatively well-known and more or less sedentary species occurring (at least for part of their life cycle) in discrete localities, which are represented in the monitoring schemes by a point location. The population size at the Country biogeographical level can often be estimated as the number of localities. This applies to many insect or mollusc species in many parts of Europe, to some amphibians (where the monitoring unit is a breeding pond), and to some rare species of reptiles.

b) Polygon data: This approach can be used for cases where localities have been delineated as polygons. The locality or polygon can be delineated from the distribution of peripheral points (records of a species' occurrence) or can be delineated as a suitable habitat of a species (for example, in cases where limited observations exist but the species is probably present in the wider area; this can be the case for some saproxylic beetle or amphibian species).

c) Linear features: This approach can be used for species linked to rivers (or other linear features) where a locality often represents a stretch of a river with recorded species occurrence.

- **Converting distribution to number of occupied 1 x 1 km grids**

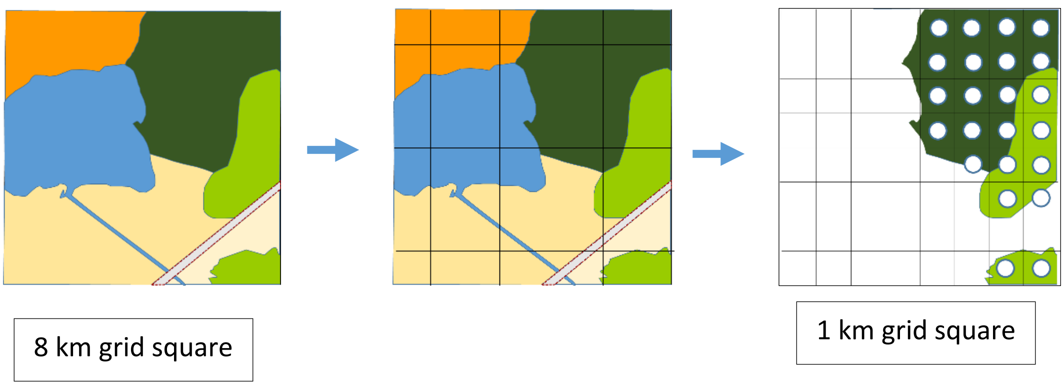
There are a number of cases where information is only available as a presence in a large grid (e.g. 5 x 5 km or 10 x 10 km). This concerns species that are abundant and widespread (e.g. amphibians, reptiles) and/or poorly known (e.g. cave-dwelling species, saproxylic beetles, bats).

As a general rule, a direct conversion of large grids into smaller grids (e.g. one 10 x 10 km grid equals one hundred 1 x 1 km grids) should not be used. Where possible, Parties should provide the number of grids potentially occupied.

This information can be obtained, for example, through intersecting the distribution data with other spatial data with information related to suitable ecological conditions for the species, such as land cover, habitat/vegetation maps and/or elevation models. Depending on the ecology of the species, there are often a number of grids (within a 10 x 10 km grid) where the species is most likely to be absent (e.g. unsuitable habitat types, artificial land cover, and fragmentation), which should be excluded when converting the distribution data into a population size estimated as number of 1 x 1 km grids. Methods used for downscaling the species' distribution may be useful, if they exist. Where possible, the methods and the thresholds applied to assess the probability of the absence and/or presence of a species in a 1 x 1 km grid in the procedure described above should be statistically robust.

The number of occupied grids can be estimated by the elimination of grids where the occurrence of a species is unlikely. Figure 7 provides an example for a forest species. First a 1 x 1 km grid is intersected with a land-cover map. The species is presumed to be only present in forest habitats (corresponding to green = forest polygons). Then the 1 x 1 km grids, which are not intersected with forest areas, are eliminated. In addition, a 100-m buffer was applied to the forest polygons to eliminate the edges where the species is assumed to be absent.

Figure 7: Proposed method for converting distribution to the number of occupied 1 x 1 km grids (green polygons = forest; blue = aquatic habitats; orange = agricultural land; grey = roads; white circles = occupied 1 x 1 km grids)



Population size in reporting units and Additional population size in assessment of conservation status

The reporting units (i.e. the number of individuals or number of 1 x 1 km grids) should allow the quantification of the species' population within the Country's biogeographical region and a comparison of the population size of the species in different Countries within the same biogeographical region. The use of a common reporting unit does not imply that monitoring or assessment of the species' status (including short-term population trend and distance to the favourable reference population) at the Country level needs to be done using this unit.

The population size in reporting units can be obtained via a conversion of the population size estimated in the units used nationally (monitoring and assessment units). In some cases, the reporting units can imply a loss of information and/or introduce errors, for example, when the population size is monitored as a number of individuals but is reported as number of 1 x 1 km grids. The population size in local units can therefore be reported under the field 'Additional population size'.

Ideally, the monitoring and assessment of the species' status at the country level is done using the most appropriate unit to capture the population trend and is also biologically suitable for expressing the favourable reference population.

Population structure and genetics

Although Annex B does not require information on population structure (age, classes, etc.), some knowledge of the population structure is needed for the assessment of population in Annex C.

In general, the absence of or unnaturally low recruitment would indicate an unfavourable population structure. Similarly, an unnaturally high mortality rate for all or certain age classes can lead to an unfavourable population structure. The lack of young individuals in many monitored local populations may also indicate an unfavourable population structure. In those situations the conservation status should be regarded as 'unfavourable' even though the population trend is stable or increasing and current population size is not lower that the reference population.

Similarly, it may be relevant to consider the genetic structure of a species. In many cases only sparse information is available, although some genetic studies have focused on particularly rare species, such as *Borderea chouardii* (Segarra-Moragues et al. 2005) and *Dracocephalum austriacum* (Dostálek et al. 2009). The importance of genetics in the evaluation of conservation status is discussed in more detail in Laikre et al. (2009).

Population and genetic structure are closely related to long-term viability of a species which is an essential part of the assessment of Favourable reference values. Section 'Favourable reference values' (in 'Definitions and methods for species reporting') gives more information on how the population and genetic structure should feed into the process of setting the reference values.

6 Habitat for the species

This chapter provides complementary information to the guidance provided in Section '6. Habitat for the species' (in 'Field-by-field guidance for species reports').

Definition of the 'habitat for a species'

To survive and flourish a species needs a sufficiently large area of habitat of suitable quality and spatial distribution. This is assessed in the parameter 'Habitat for the species' which is based on the definition of Favourable conservation status (FCS) for a species which reads: 'There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long term basis'. The habitat of a species is also defined as: 'an environment defined by specific abiotic or biotic factors, in which the species lives at any stage of its biological cycle'. Although it is not possible to give a detailed definition of habitat of a species that will be valid for all the species listed in Resolution No. 6 (1998), some general principles can be established and 'habitat for the species' should be interpreted to take into account the following:

- physical and biological requirements of the species; this includes prey, pollinators, etc.;
- all stages of its life cycle are covered and seasonal variation in the species' requirements is reflected.

'Habitat for the species' uses habitat in its original meaning of the resources (biological and physical) used by a species during its life. This is sometimes referred to as the ecological niche of a species. It is important to note that the meaning of 'habitat' in 'Habitat for the species' is different to 'habitat type' defined under Resolution No. 4 (1996) and 'habitat' for habitat classifications such as EUNIS, which are more accurately biotopes (or in many cases biotope complexes).

Habitat of the species may be mostly abiotic. For example, the mammal *Crocidura sicula* makes use of crevices in rock and dry stone walls, and many fish need gravel of an appropriate size for spawning. In some cases a species can be dependent on another, either as prey or as a host. For example, the Freshwater pearl mussel (*Margaritifera margaritifera*) spends its larval stage attached to the gills of salmonid fish while the moss *Dicranum viride* grows on trees.

Many species use different biotopes at different times of the year or at different stages of their life cycle. 'Habitat for the species' should include all of these. For example, a butterfly may use different habitats during its larval, pupal and adult stages. For hibernating animals, such as bats, habitat for both winter (hibernation sites) and summer (foraging and roosting sites) must be considered. For example, the Long-fingered bat *(Myotis capaccinii*) in France requires suitable roosting sites (often caves and tunnels which in winter are usually between 4 and 6°C) together with foraging areas with suitable prey (small insects flying over wetlands, often with scrub and/or riparian woodland; Anon., 2002).

For some highly mobile species (for example marine mammals or turtles) the actual habitat for the species will often equal range.

Area, quality and spatial organisation – elements for assessing the habitat for a species

There are three key elements for assessing habitat for a species: area, quality and spatial organisation (Hodgson et al., 2011). The questions in field 6.1 ('Are area and quality of **occupied** habitat sufficient (for long-term survival)?' and 'If NO, is there a sufficiently large area of **unoccupied** habitat of suitable quality (for long-term survival)?' aim to identify if habitat, in its broadest sense, is the factor limiting a species from being in a Favourable conservation status by asking if the combination of habitat area and quality is sufficient. For example, a species may have a small, potentially non-viable, population which cannot expand because of a lack of suitable habitat or of a particular element of its habitat, such as suitable nesting sites. As different combinations of habitat quality and habitat area could be equally suitable for a given species, the question in field 6.1

addresses the overall combination but it is likely that national monitoring schemes will be addressing these issues separately, so the results will need to be combined in order to answer the question in field 6.1.

There is increasing evidence that habitat quality plays an important role in determining the distribution and dynamics of species, both for plants and animals (Mortelliti, Amori & Boitani, 2010), and it can be defined in several ways, as reviewed by Johnson (2007). Habitat quality should be understood as the 'ability of the environment to provide conditions appropriate for individual and population persistence' (Hall et al., 1997). The habitat quality should be assessed in relation to the species' requirements. Quality must be understood as an adequacy or suitability for the species (sometimes for a particular life stage of a species), and not as habitat condition as such without taking into account the particular requirements of the species (at its particular life stage). Habitat quality is a continuous variable (from high to low) and refers to resources available for survival, reproduction and population persistence.

Although 'Habitat for the species' should cover all physical and biological requirements of the species throughout all stages of its life cycle and in any season, special emphasis should be given to key habitats such as reproduction or hibernation sites in the assessment of sufficiency of habitat area and quality.

Indices/measures of the habitat quality

Habitat quality is frequently related to reproductive success, although information on population dynamics related to habitat selection is likely to be unavailable for many species listed in Resolution No. 6 (1998). Although abundance or density has been used as a relatively simple way of measuring habitat quality, this may be misleading where abundance or density in a given site is controlled by factors elsewhere, perhaps in a different season for migratory species (Van Horne, 1983). Many studies have used vegetation as a proxy for habitat quality and, although this has been criticised (e.g. Mathewson & Morrison, 2015), this may be the only method available for poorly known species. Sometimes knowledge of the species allows population dynamics to be linked to vegetation. Wehn & Olsson (2015) measured a number of population parameters for the plant *Primula scandinavica* allowing comparison of different vegetation types for the species, and found that semi-natural vegetation, such as heath or grassland, was of higher quality for this species than forest, although the species did occur in all.

Spatial organisation and fragmentation

Spatial arrangement of habitat patches has been shown to be less important than area or quality (Hodgson et al., 2011) although fragmentation of habitat is frequently cited as a threat. If habitat patches are close, colonisation and genetic exchange between subpopulations is more likely to occur, although corridors allowing the movement of individuals through the landscape may also play a role. Also the quality of surrounding environment ("matrix") may have significant effect and populations, for example by increasing habitat patch isolation or through edge effects. However, disentangling the relative role of quality and spatial organisation may often be difficult (Mortelliti, Amori & Boitani, 2010), so for the reporting the two have effectively been grouped together.

Generalists and specialists

When assessing 'Sufficiency of area and quality of occupied habitat' (field 6.1(a) and (b)) it is necessary to have an understanding of the species' biology in order to identify the species' key requirements and type of areas (habitats) potentially suitable for it. Species are frequently considered as habitat specialists or generalists, although in reality there is a wide spectrum (see e.g. Devictor et al., 2010) and a species may be both a generalist and a specialist at different parts of its life cycle. A broad grouping into habitat generalists and specialists may help in determining the key elements for assessing the sufficiency of the habitat area or quality.

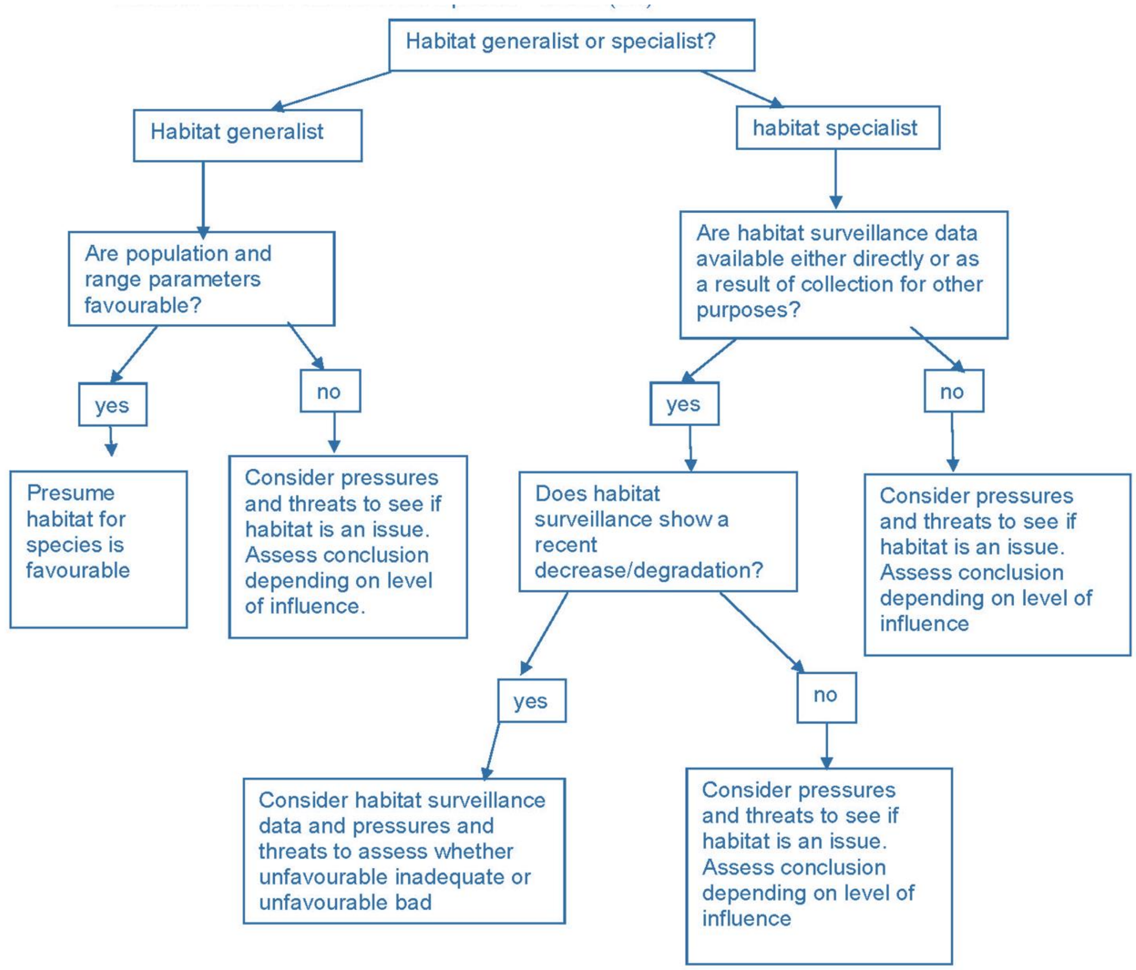
Some species are known to be restricted to particular habitats. For example, the Resolution No. 6 (1998) beetle *Agathidium pulchellum* is dependent on the slime mould *Trichia decipiens* living on dead wood in Boreal forests (Laaksonen et al., 2009), while the larvae of the Resolution No. 6 (1998) beetle *Stephanopachys linearis* lives in burnt pine trees in the Boreal region and in damaged larch trees in the French Alps (Brustel et al., 2013). Therefore, Boreal forests with sufficient quality and quantity of dead wood can be considered a suitable habitat for *Agathidium pulchellum*, and pine forests with natural (or controlled) fire dynamics as a suitable habitat for *Stephanopachys linearis* in the Boreal region. A species is expected to prosper if the extent of these habitats is sufficient and the functions of the habitat, which correspond to key requirement of a species (dead wood, fire), are well preserved.

For some species the requirements are well known. For example, many saproxylic insects are dependent on old trees. However, these may be features that can be found in many habitats, such as woods, hedgerows and parks. In this situation the assessment of the sufficiency of the habitat quality should mainly target the quantity and quality of the specific features (exposed old trees) in the landscape, and the precise area of habitat is not the decisive factor for the species status.

For species which use a wide range of habitats, often termed ‘generalists’, it is difficult to identify the area used with any precision, and factors such as availability of prey (which represents the qualitative aspects of the habitat for a species) are often more important than the extent of the habitat. For the generalist species it is less likely that the ‘habitat area’ is a limiting factor controlling the population size or reproduction than for a ‘specialist’ species dependent on one or a limited number of habitats (habitat types). So the assessment of the ‘Sufficiency of area and quality of occupied habitat’ (field 6.1(a) and (b)) should mainly focus the ‘habitat quality’.

In many cases it will be enough to assess the ‘Sufficiency of area and quality of occupied habitat’ (field 6.1(a) and (b)) in relation to the reported pressures. The direct measurement of the physical quality of the species’ environment will not be necessary (Box 7 shows the example of the decision tree used in the UK).

Box 7: A flow chart to help assessments of habitat of species, developed by JNCC and used in previous reporting rounds by the UK, which may be useful, particularly when data are limited. It outlines different approaches used in the assessment of the habitat for the species, for habitat generalists and specialists.



For many species, the exact requirements are not well understood, so it is difficult to know if the areas currently unoccupied are really suitable. This is demonstrated in a recent study of the reintroduction of Bison (*Bison bonasus*) to the Carpathians (Ziółkowska et al., 2016)

Availability of unoccupied habitat

In many cases the habitat requirements for a species are known, and areas which are not currently occupied can be identified. For example, the wolf (*Canis lupus*) and the otter (*Lutra lutra*) are both recolonising parts of their former ranges from which they have been absent for many years and it is clear that further suitable, but as yet unoccupied, habitat occurs. It may be possible to model the habitat used by a species, for example Kuemmerle et al (2011) show how the habitat for *Bison bonasus* can be modelled and is much larger than currently used.

Field 6.1(b) asks if unoccupied habitat of suitable quality is available. For some species where the requirements are well known this may be relatively easy to answer. An example of how the habitat for a species can be identified is given in Box 8. However, for many species our lack of knowledge may mean that the only response is ‘unknown’.

Box 8: Defining suitable but unoccupied habitat for a species – the snail *Vertigo geyeri* in Ireland

Vertigo geyeri is strict in its requirement of saturated water conditions in calcareous, groundwater-fed flushes that are often limited in size to a few metres square. Their habitats often occur in mosaics of suitable patches within wider fen macrohabitats, that in Ireland can themselves fall within habitats as diverse as raised bog laggs, transition mires, lake shores, hill or mountain slopes, and wetlands associated with coastal dunes and machair. Within these macrohabitats, however, the snail is consistent in where it lives, within the saturated and decaying roots of small calcareous sedges (particularly *Carex viridula* ssp. *brachyrrhyncha*), associated fen mosses (particularly *Drepanocladus revolvens* and *Campyllium stellatum*). The greatest indicator of optimum *V. geyeri* habitat is the presence of a tufa-forming spring.

Source: Moorkens & Killeen (2011).

The potential unoccupied habitat may not include all occurrences of a potential habitat within the biogeographical region, but only areas that can be recolonised by the species. If, for example, there are stretches of rivers inaccessible to the species’ populations due to waterfalls or barriers, these should not be included under potential unoccupied habitat as it is unlikely that they can be recolonised by the species, even though they are of suitable quality.

7 Main pressures and threats

This chapter provides complementary information to the guidance provided in Section ‘7. Main pressures and threats’ (in ‘Field-by-field guidance for species reports’).

Although the information on pressures and threats is required for the conservation status assessment, the importance of pressures and threats goes beyond their use in the assessment. They provide information on the main drivers related to results of the conservation status assessment. They can help to identify actions required for restoration and they are essential to communicate the results of the status assessment to various stakeholders.

For the reporting, pressures are considered to be factors which have acted within the current reporting period, while threats are factors expected to be acting in the future (in the future two reporting periods, i.e. within 12 years following the end of the current reporting period). It is possible for the same impact to be both a pressure and a threat if it is having an impact now and this impact is likely to continue.

The pressures are classified into 15 categories corresponding to the main sectoral driver (see Table 4) with an emphasis on reducing to a minimum pressures which can be attributed to several sectors (for example, pollution or hydrological modification of water bodies).

Table 4: Pressure categories in the list of pressures and threats

Pressure code	Pressure category	Note
A	**Agriculture**	Includes pressures and threats caused by agricultural practice.
B	**Forestry**	Includes pressures and threats caused by forestry activities, including thinning, wood harvesting, pest control in trees.
C	**Extraction of resources (minerals, peat, non-renewable energy resources)**	Includes pressures related to extraction of materials, such as mining or quarrying, pollution or waste disposal.
D	**Energy production processes and related infrastructure development**	Includes pressures related to production of energy, e.g. the construction and operation of power plants, water use for energy production, waste from energy production, activities and infrastructure related to renewable energy.
E	**Development and operation of transportation and service corridors**	Includes pressures related to transportation of materials or energy, such as construction of infrastructure, pollution and disturbances or increased mortality due to traffic.
F	**Development, construction and use of residential, commercial, industrial and recreational infrastructure and areas.**	Includes pressures related to development, construction and use of residential, commercial, industrial and recreational infrastructure, e.g. infrastructural changes on existing built areas, expansion of built areas, land use and hydrological changes for urban or industrial development, disturbances or pollution due to residential, commercial, industrial, or recreational infrastructure. Includes also pressures related to sport, tourism and leisure activities and infrastructure.
G	**Extraction and cultivation of biological living resources (other than agriculture and forestry)**	Includes pressures linked to uses of biological resources other than agriculture and forestry.
H	**Military action, public safety measures, and other human intrusions**	Includes pressures related to public safety and other human intrusions.
I	**Invasive and problematic species**	Includes pressures related to problematic inter-specific relationships with non-native species which cannot be associated with other pressure categories. Includes also problematic relationships with native species, which came out of balance due to human activities.
J	**Mixed source pollution**	Includes pollution which cannot be associated with other pressure categories.

Pressure code	Pressure category	Note
K	**Human-induced changes in hydraulic conditions**	Includes hydrological and physical modifications of water bodies, which cannot be associated with other pressures categories.
L	**Natural processes (excluding catastrophes and processes induced by human activity or climate change)**	Includes natural processes, such as natural succession, competition, trophic interaction, erosion.
M	**Geological events, natural catastrophes**	Includes pressures such as natural fires, storms, tsunamis.
N	**Climate change**	Includes pressures related to climate change.

Note that this table is only illustrative since it uses draft pressure categories that may not be retained as such in the final list of pressures and threats.

Further information on the list of pressures and practical guidance on how to use it for reporting on pressures and threats can be found on the Reporting Reference Portal.

8 Conservation measures

This chapter provides complementary information to the guidance provided in Section '8. Conservation measures' (in 'Field-by-field guidance for species reports').

Conservation measures are defined as 'a series of measures required to maintain or restore the natural habitats and the populations of species of wild fauna and flora at a favourable status'.

The main purpose of reporting on conservation measures is to obtain information allowing for a 'broad-brush' overview of the conservation measures: whether measures have been taken and if so which measures, their location (inside/outside the Emerald Network), and their impact on the conservation status of species. Information on conservation measures feeds into the evaluation of the contribution of the Emerald Network to the conservation status of the species listed in Resolution No. 6 (1998). This information can further help to understand any trends in conservation status globally and is important for communicating the results of the conservation status assessment to different stakeholders.

The conservation measures should be reported using the codified list of measures. The list of conservation measures mirrors the list of pressures and threats, and the conservation measures are principally understood as an action to mitigate the impact of past and present pressures. The measures are classified into 13 categories corresponding to the main pressure categories (see Table 5). The list of measures contains additional category for measures related to management of target and other native species.

Table 5: Categories of conservation measures

Categories of conservation measures
Measures related to agriculture and agriculture-related habitats
Measures related to forestry and forest-related habitats
Measures related to resources exploitation and energy production
Measures related to development and operation of transport systems
Measures related to residential, commercial, industrial and recreational infrastructures, operations and activities
Measures related to the effects of use and exploitation of species
Measures related to military installations and activities and other specific human activities
Measures related to alien and problematic native species
Measures related to natural processes, geological events and natural catastrophes
Measures related to climate change
Measures outside the Country
Measures related to mixed source pollution and human-induced changes in hydraulic conditions for several uses
Measures related to management of species from the Resolution No. 6 (1998)and other native species

Note that this table is only illustrative since it uses draft measure categories that may not be retained as such in the final list of conservation measures.

Further information on the list of conservation measures and practical guidance on how to use it for reporting can be found on the Reporting Reference Portal.

9 Future prospects

This chapter provides complementary information to the guidance provided in Section '9. Future prospects' (in 'Field-by-field guidance for species reports').

What are future prospects?

Assessments of conservation status must take into account the likely future prospects of the species; as for favourable conservation status, it is required that:

- *population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;*
- *the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future;*
- *there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.*

The parameter 'Future prospects' focuses on the requirement for the long-term maintenance of population of the species and the need for habitat and range to be and to remain stable or increase in the foreseeable future. The definition of the Favourable conservation status of species presumes 'long-term maintenance' of population and sufficiency of range and habitat in the 'foreseeable future'. For the assessment of Future prospects this should be interpreted as meaning the two future reporting cycles, i.e. the next 12 years. The common perspective towards the future is important in harmonising the Parties' assessments, but some flexibility is permitted and the Future prospects can be assessed over longer future periods than the proposed 12 years. For example, for certain well-studied threats, such as climate change, reasonably robust models are available much further than the next 12 years, indicating bad perspective for a species. For some species, for example species with long generation lengths, it is unlikely that any positive future impact will be measurable within a 12-year period and possibly longer periods are needed to estimate future improvement. In any case, a common framework for the assessment is needed in order to harmonise the assessment of Future prospects. Also, for these particular cases the Future prospects should be evaluated taking into account the next 12-year period.

The Future prospects parameter should reflect the anticipated future improvements and deteriorations of the conservation status[12] which correspond to future trends in the assessment. The anticipated future improvements and deteriorations should be assessed in relation to the current conservation status. For example, the impact of future deterioration on the assessment of Future prospects will be different if the current status is 'favourable' or, on the other hand, 'unfavourable-bad'.

Assessing future prospects

Future prospects should be evaluated by individually assessing the expected future trends and subsequently future prospects of each of the other three parameters, taking primarily into account the current conservation status of the parameter, threats (related to the parameter assessed) and the conservation measures being taken or planned for the future. Once the future prospects of each of the other three parameters have been evaluated, they should be combined to give the overall assessment of Future prospects. The assessment can be divided into three steps:

- Step 1: Future trends of a parameter.
- Step 2: Future prospects of a parameter.
- Step 3: Assessing overall Future prospects for a species.

The method described here relies to some extent on expert judgement, but within a clear framework allowing comparability between assessments from different Countries. It should also help to standardise assessments within countries where several teams are involved, each dedicated to a particular species group.

[12] The Future prospects parameter should reflect the anticipated future improvements and deteriorations of the conservation status regardless of how far the future status is likely to be from the reference situation captured via favourable reference values.

Step 1: Future trends of a parameter

Future prospects of each of the other three parameters should principally reflect the future trends which are the result of balance between threats and conservation measures as described in Table 6.

Future trends of a species are dependent on the identified (known and likely) threats which will have a negative impact and any action plans, conservation measures and other provisions which will have a positive impact. For example, climate change, land-use scenarios and trends in certain policies are aspects that will influence future trends. The measures should be restricted to those anticipated to have a positive impact in the next 12 years (regardless of whether they were already being implemented during the current reporting period or not). Threats are reported in Section 8 'Main pressures and threats' of the Reporting format and the existing measures are reported in Section 9 'Conservation measures'.

In most cases, positive (management actions, policy changes, etc.) and negative influences (threats) will simultaneously affect the species. The assessment of future trends therefore has to take into account whether the sum of positive and negative influences (threats) will balance out for the parameter under consideration, or whether either the positive or negative effects are likely to be stronger.

In some cases threats or measures may affect the three parameters differently. For example, the measure 'restoration of forest habitat' might increase the area of a habitat for a species relatively quickly, but may have little impact on the range or population within a 12-year period. Only threats and conservation measures related to the specific parameter should be considered.

In many cases it will be difficult to foresee whether the influence of threats and conservation measures on the status of the parameter will balance out and whether the resulting trend will be negative, positive or stable. It can therefore be helpful to interpret the current trend in relationship to the impact of current pressures and measures and to assess the future trend on the basis of potential improvement, deterioration or continuation of the current situation.

Establishing whether the future trend is negative or very negative (or positive/very positive) will be difficult in most cases, although it may be easier if the current trend and trend magnitude are known or in cases of dominating pressures or measures. To differentiate between negative and very negative (and positive or very positive) trends the threshold of 1 % per year, meaning approximately 12 % in 12 years, is recommended. This threshold is used in the assessment matrix for current trends to distinguish between inadequate and bad status for range and population. In theory this threshold should represent a difference between a slight and moderate (< 1 % per year) deterioration/improvement and important (> 1 % per year) deterioration/improvement. The trend in habitat for the species has both quantitative and qualitative components. The assessment matrix does not request an exact measure of trend magnitude for Habitat for the species. For this parameter the difference between negative and very negative (and positive or very positive) trends should follow the same logic as for the two other parameters and should reflect the difference between slight/moderate and important future deterioration/improvement.

Table 6: Assessing the future prospects of a parameter (Steps 1 and 2)

Step 1 Future trends of parameters

Step 2 Future prospects of a parameter

Balance between threats and measures	**Predicted future trend reflects balance between threats and measures**	**Current conservation status of parameter**	**Resulting future Prospects of parameter (over next 12 years)**	
Balance between threats acting on the parameter (mostly threats with insignificant impact [13] and/or Medium impact threats) and conservation measures; no real change in status of the parameter expected	overall stable	Favourable	good	
		Unfavourable-inadequate	poor	
		Unfavourable-bad	bad	
		Unknown	unknown	
Threats expected to have negative influence on the status of the parameter (mostly High or Medium impact threats), irrespective of measures taken	negative / very negative	Favourable	poor (negative)	bad (very negative)
		Unfavourable-inadequate	poor (negative)	bad (very negative)
		Unfavourable-bad	bad	
		Unknown	poor (negative)	bad (very negative)
None (or only threats with insignificant impact[14]) and/or effective measures taken: positive influence on the status of the parameter expected	positive / very positive	Favourable	good	
		Unfavourable-inadequate	poor (positive)	good (very positive)
		Unfavourable-bad	poor (positive)	good (very positive)
		Unknown	poor (positive)[15]	good (very positive)
Threats and/or measures taken unknown or interaction not possible to predict	unknown	Favourable	unknown	
		Unfavourable-inadequate		
		Unfavourable-bad		
		Unknown		

[13] The impact of threats reported in field 8.1 should be evaluated as 'High' or 'Medium'. Only threats with Medium or High impact (see definition of impact categories in section '7. Main pressures and threats' (in 'Field-by-field guidance for species reports')) should be reported, but potentially the species is affected by other pressures and threats not having a significant impact on its conservation status.

[14] See the previous footnote.

[15] Unknown is considered as not being favourable, therefore the assessment of Future prospects of a parameter is as for unfavourable inadequate or bad.

Step 2: Future prospects of a parameter

The future prospects of a parameter are assessed by taking into consideration, principally, the future trends and current conservation status. Deciding between the two options proposed for each combination of future trends and current conservation status will mainly depend on the potential trend magnitude (negative/very negative or positive/very positive). This is a pragmatic and mechanistic approach aimed at simplifying and harmonising the assessment of Future prospects.

Step 3: Assessing overall Future prospects for a species

Once the future prospects of each of the other three parameters have been evaluated, they should be combined to give the overall assessment of Future prospects using the rules in Table 7.

Table 7: Combining the evaluation of the three parameters to give Future prospects for a species

Assessment of Future prospects	Favourable	Unfavourable-inadequate	Unfavourable-bad	Unknown
Prospects of parameter: Range, Population and Habitat for the species	All parameters have 'good' prospects OR prospects of one parameter 'unknown', the other prospects' good'	Other combination	One or more parameters have 'bad' prospects	Two or more 'unknown' and no parameter with 'bad' prospects

Box 9: Assessing Future prospects of *Euphydryas aurinia*

Range is stable; Population and Habitat for the species are both declining; and the following pressures and threats are recorded.

Code	Activity	Impact of pressure	Impact of threat
A06	Mowing or cutting of grasslands	medium	
A08	Overgrazing by livestock	medium	
AXX	Application of natural fertilisers (e.g. manure, slurry)	medium	
A14	Application of synthetic fertilisers	medium	medium
B01	Conversion to mixed forest from other land uses, or afforestation (excluding drainage)	medium	medium
A17	Removal of small landscape features (hedges, stone walls, rushes, open ditches, springs, solitary trees, etc.) and agricultural land parcel consolidation	high	high
K05	Reduced fecundity / genetic depression (e.g. inbreeding or endogamy)	high	high
A03	Abandonment of grassland management (absence of grazing, absence of mowing)	high	high

The only measure from the measure list that is implemented is ‘CA03 Adapt/manage mowing and grazing’. This measure is expected to counteract some of the ‘medium’-ranked pressures acting on habitat quality, but other ‘high’-ranked threats having an impact on both habitat quality and area as well as population are expected. So the population and habitat for the species trends will most likely remain decreasing.

Parameter	Assessment of parameter	Expected future trend	Future prospect
Range	Favourable	Stable	Good
Population	Unfavourable-inadequate	Decreasing	Poor
Habitat for the species	Unfavourable-inadequate	Decreasing	Poor

By using the combination rules in Table 7, two ‘poor’ conclusions and one ‘good’ conclusion lead to an overall assessment for Future prospects of ‘unfavourable-inadequate’.

Note that the example is only illustrative since it uses draft codes that may not be retained as such in the final list of pressures and threats.

10 Emerald Network coverage for species listed in Resolution No. 6 (1998)

This chapter provides complementary information to the guidance provided in Section ’11. Emerald Network coverage for Resolution No. 6 (1998) species’ (in ‘Field-by-field guidance for species reports’).

The evaluation of the contribution of the Emerald Network (candidate and adopted Emerald Network sites) to the conservation status of species has three principal components:

1. evaluation of the relevance of the network for different species (based on the proportion of the population within the network);
2. possible differences in trends (population trends) within the network compared to the general trend (overall species population trend including populations inside and outside the network);
3. understanding what type of conservation/management measures have been implemented (see Section ‘8. Conservation measures’ (in ‘Definitions and methods for species reporting’)).

The contribution of the Emerald Network to the conservation status of a species is likely to vary in relation to the dependence of the species on sites, the coverage by the network, and site management. Therefore, the population size included in the network for each given biogeographical region should be provided.

Another element to be taken into consideration when evaluating the contribution of the network is the possible difference in trends both within the network and globally (mainly for species where a significant proportion of a species’ population occurs outside the network). For species, this should be expressed by comparing the trend of the population size in the biogeographical region with the trend of the population size inside the Emerald Network in that same biogeographical region.

The information on conservation measures completes and helps to understand the potential differences between the trends within the network and global trends.

DEFINITIONS AND METHODS FOR HABITAT REPORTING

Habitats to be reported

Occurrence categories used in the habitat checklist

This chapter provides complementary information to the guidance provided in Section ‘’ (in ‘Field-by-field guidance for habitat reports’).

The following categories and codes are used for the 2013–2018 reporting:

- **Present regularly (PRE)**

This category applies to habitats which occur in the region.

- **Marginal (MAR)**

The category ‘marginal occurrence’ should be used in situations where the habitat occurs principally in one region (or Country) but extends to a neighbouring region (or Country), where the area of habitat is insignificant and the occurrence represents a limit of a natural range of a habitat in a given area. It is not expected that the conservation status of the marginal habitat will be assessed. However, if the conservation status is evaluated the assessment should take into account their marginal position, for example when estimating the favourable reference area or when assessing structure and functions.

The ‘marginal’ category should reflect the history of the habitat in a given area and its use should be restricted to cases where habitat occurs naturally as ‘marginal’. The ‘marginal’ category should not be used for habitats that were more common in the past in a given area and where the marginal status is a result of past declines due to human pressures. In this case the category ‘present‘ should be used.

- **Scientific reserve (SCR)**

For habitats, this category applies if it is not possible to judge whether or not a habitat occurs in the biogeographical region due to problems with interpretation of the habitat definition in the Interpretation Manual.

This category should not be used in situations where:

- interpretation of the habitat is unclear or ambiguous;
- where the occurrence of the habitat is unresolved due to the absence of inventories. Such a habitat should be treated as ‘present’ and the report should reflect the fact that there are no data available.

Overlapping habitats

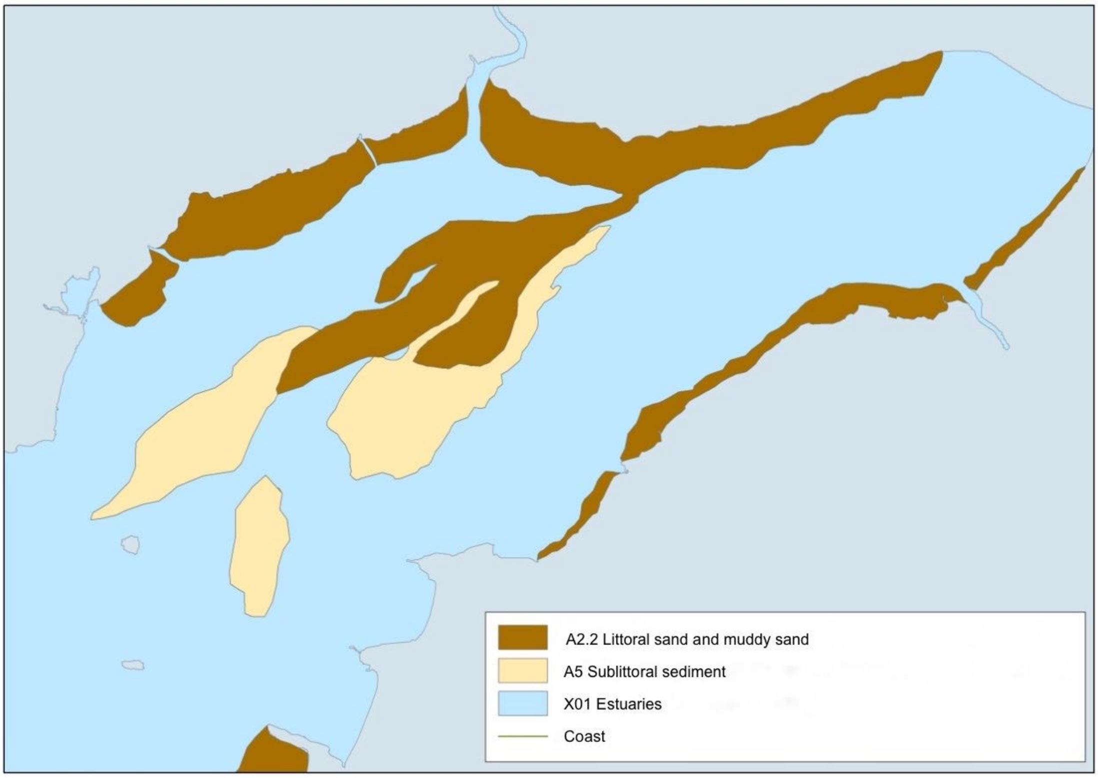
This section provides complementary information to the guidance provided in Section 'Habitats to be reported' and '5. Area covered by habitat' (in 'Field-by-field guidance for habitat reports').

Habitats listed in Resolution No. 4 (1996) can be either biotopes or biotope complexes and sometimes one habitat listed in Resolution No. 4 (1996) is a component of another habitat. As a result patches of one or several habitats listed in Resolution No. 4 (1996) can occur within another habitat (see examples in Table 8).

Table 8: Examples of overlapping habitats

'X01 Estuaries' could include areas of: • A2.2 Littoral sand and muddy sand • A5 Sublittoral sediment • A2.2 Littoral sand and muddy sand
'7110 Active raised bogs' often have small areas of: • C1.4 Permanent dystrophic lakes, ponds and pools • D2.3 Transition mires and quaking bogs

Figure 8: How to treat overlapping habitats Note: The area to be reported for 'X01 Estuaries' (blue) will also include the areas of 'A5 Sublittoral sediment' (yellow) and 'A2.2 Littoral sand and muddy sand' (brown*).*



Where this happens each habitat should be reported in its entirety. Therefore some areas may have contributed to two or more assessments, as illustrated in Figure 8. This will allow an effective estimate of the total area of the different habitats for each Country and region.

Sources of information for assessing habitat types

As is the case for species, Parties are committed to monitor the status of habitats under Resolution No. 8 (2012).

In many Countries there are also existing inventories of certain habitat types (e.g. forests or grasslands) which have been produced for a variety of purposes. These may not use the same classification of habitats as Resolution No. 4 (1996), but in many cases they can be reinterpreted, possibly with the aid of further information such as soil or geological maps. Many Countries have published 'translations' between various habitat classifications and the typology used in Resolution No. 4 (1996)) and the Palaearctic classifications (Devillers & Devillers-Terschuren, 1996). The ETC/BD developed the EUNIS Habitat Classification that provides a tool for making comparisons between different land-use, habitat and vegetation classification systems.

Where no map of habitat range exists it may be possible to model the range from other sources of data, such as maps of potential natural vegetation (e.g. Bohn et al., 2004), distribution of key species, soil and geological maps, climate data or topographical maps.

Several Countries have monitoring schemes based on stratified random sampling, such as the Countryside Survey[16] in the United Kingdom or the Nationell Inventering av Landskapet i Sverige (NILS)[17] project in Sweden. Although these methods cannot give detailed information on distribution of detailed habitat types, they can give good estimates of habitat type area and trends in area. Similarly, information collected for national forest inventories or repeated phytosociological surveys may be important sources of information if they can be linked to habitats listed in Resolution No. 4 (1996). There have been several seabed mapping projects, such as Balance[18] and Mesh[19], and these were brought together and extended in the EUSeaMap project (2)[20].

Remote sensing techniques are a rapidly developing field and many projects have used them to both map and assess quality of habitat types. However, such techniques are mostly still experimental and are not yet suitable for operational use for most habitats listed in Resolution No. 4 (1996).

Trends

This chapter provides complementary information to the guidance provided on trends and trend periods in 'Part 1: Field-by-field guidance for completing 'Annex D' Habitat reports').

The conservation status assessment stresses the importance of trend information: trends are decisive for the assessment of conservation status since usually only stable or increasing trends can result in an overall Favourable conservation status (FCS) conclusion. Therefore, in general, more attention should be paid to the methodology of monitoring schemes to improve the quality of trend information.

Trends are an essential part of assessing all conservation status parameters except Future prospects. A comparison between the overall trend of habitat area in good condition in the biogeographical

[16] http://www.countrysidesurvey.org.uk
[17] http://nils.slu.se/
[18] http://www.balance-eu.org
[19] http://www.searchmesh.net/
[20] http://www.jncc.gov.uk/page-5020

region and trends within the Emerald Network is important in assessing the impact of the Emerald Network on conservation status.

Trends are usually derived from modelling or existing monitoring schemes which are based on sampling, as complete surveys are exceptional and usually only undertaken for very rare habitats. Sampling methods should be statistically robust wherever possible. In the absence of dedicated monitoring schemes, trends are usually a result of expert opinion and in that case should be reported only as directions (increasing/decreasing/stable), without absolute values. Unknown trends should be reported as 'unknown'. If the available data are not sufficient to determine trend direction, this can be reported as 'uncertain'.

Trend is a (measure of a) directional change of a parameter over time. Trends should ideally be the result of a statistical regression of a time series. Fluctuation (or oscillation) is not a directional change of a parameter, and therefore fluctuation is not a trend. However, fluctuations can occur within a long-term trend (of some habitats) and can affect the measurement of short-term trends because it is difficult to assess whether there is a real trend in the short term, or whether there is simply a fluctuation effect.

Fluctuation is an intrinsic character of all natural systems and can be observed for all directions of the trend (increasing, decreasing, and stable) However, it is only detectable in regularly surveyed habitats. Fluctuations are only likely to be detected when the parameter is measured at least three times within a given time-frame. Ideally, they will be based on more frequent sampling. In reality, this is unlikely to happen in short time-frames (such as 12-year intervals), and setting short-term trends in a long-term context will help to identify where fluctuations are occurring.

Fluctuations in Range or Area covered by habitat are rarely detectable over a 12-year period and any fluctuation of these values is mostly long term. However, measurement of these parameters can be inexact and longer-term information may be required to detect any real changes, given the range of data availability, sample sizes and possible survey methods.

Short- and long-term trends

The reporting period is six years, but estimates of trend are more likely to be statistically robust over longer time periods. It is therefore recommended to estimate short-term trend over two reporting cycles, i.e. 12 years (or a period as close to this as possible), as this should give a more reliable and comparable estimate of the trend; see Table 9). Long-term trends, which are likely to be more statistically robust, can also be reported (in a series of optional fields). The recommended period for assessing longer-term trends is four reporting cycles (24 years). The short-term trend information should be used in the evaluation matrix to undertake the conservation status assessment.

Table 9 Period for assessing trends

Trend	Period to assess trend
Short-term	Two reporting cycles (12 years; or a period as close as possible)
Long-term	Four reporting cycles (24 years; or a period as close as possible)

The trend magnitude reported should be the change over the relevant period (e.g. 12 years for short-term trend). Where magnitude is derived from data covering a different time interval, estimate the change for the reporting period by simple proportion. For example, a change of 150 km^2 over 15 years would be equivalent to 10 km^2 per year or 120 km^2 over the 12-year interval for short-term trend magnitude. If the change appeared at a specific time (for example, as a result of a catastrophe) precise time period or year should be reported and an explanation should be provided under the field 'Additional information'.

Favourable reference value

This chapter provides complementary information to the guidance provided on favourable reference values in Sections '4. Range' and '5. Area covered by habitat' (in 'Field-by-field guidance for habitat reports').

What are favourable reference values?

The concept of favourable reference values (FRVs) is derived from the definition of Favourable conservation status that relates to the 'long-term distribution and abundance' of the populations of species, and for habitats to the 'long-term natural distribution, structure and functions as well as the long-term survival of its typical species' in their natural range. This requires that the species is maintaining itself on a long-term basis as a viable component of its natural habitats. Similarly, the specific structure and functions necessary for its long-term maintenance exist and will continue to exist and that its typical species are in favourable status, i.e. are maintaining themselves on a long-term basis. Favourable reference values – 'range' for species and habitats, 'population' for species, and 'area' for habitats – are critical in the evaluation of conservation status. The evaluation matrices (Annexes C and E) of the Report format require Parties to identify favourable reference values for range (FRR) and area for habitats (FRA) and for range (FRR) and population (FRP) for the species. The conservation status assessment then looks at the difference between current values and reference values. Basically, the range, area, and population must be sufficiently large in relation to favourable reference values (as defined in the evaluation matrix) to conclude, alongside other criteria (e.g. trends), whether the parameter is 'favourable' or 'unfavourable'.

The concept of favourable reference values describes the favourable reference range, population and habitat area as follows:

> *Range within which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long-term survival of the habitat/species; favourable reference value must be at least the range (in size and configuration) when* the Bern Convention came into force *; if the range was insufficient to support a favourable status the reference for favourable range should take account of that and should be larger (in such a case information on historic distribution may be found useful when defining the favourable reference range); 'best expert judgement' may be used to define it in absence of other data.'*

> *Population in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the species; favourable reference value must be at least the size of the population when* the Bern Convention came into force *; information on historic distribution/population may be found useful when defining the favourable reference population; 'best expert judgement' may be used to define it in absence of other data.*

> *Total surface area of habitat in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary*

areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability; favourable reference value must be at least the surface area when the Bern Convention came into force *; information on historic distribution may be found useful when defining the favourable reference area; 'best expert judgement' may be used to define it in absence of other data.*

Setting favourable reference values (FRVs) for habitat types

Overview of general principles for setting reference value

Before setting the favourable reference values, it is advisable to collect all the relevant information about a habitat in order to understand their ecological and historical context. Therefore, ideally data and information on the following factors should, when available, be gathered and used when estimating FRVs for habitats:

- current situation and assessment of deficiencies, i.e. any pressures/problems;
- trends (short-term, long-term, historical, i.e. well before the Bern Convention came into force);
- natural ecological and geographical variation (including variation in species composition, variation in conditions in which habitats occur, variation of ecosystems);
- ecological potential (potential extent of range, taking into account physical and ecological conditions, contemporary potential natural vegetation);
- natural range, historical distribution and abundances and causes of change, including trends;
- connectivity and fragmentation.
- dynamics of the habitat type;
- requirements of its typical species.

The following general principles should be taken into account in the process of setting FRVs:

- FRVs should be set on the basis of ecological/biological considerations;
- FRVs should be set using the best available knowledge and scientific expertise;
- FRVs should be set taking into account the precautionary principle and include a safety margin for uncertainty;
- FRVs should not, in principle, be lower than the values when the Bern Convention came into force , as most habitats have been listed in the Resolutions because of their unfavourable status; the distribution (range) and size (area) at the date the Bern Convention came into force does not necessarily equal the FRVs;
- FRVs are not necessarily equal to ‘national targets’: ‘Establishing favourable reference values must be distinguished from establishing concrete targets: setting targets would mean the translation of such reference values into operational, practical and feasible short-, mid- and long-term targets/milestones. This obviously would not only involve technical questions but be related to resources and other factors’ (European Commission, 2004[21]);
- FRVs do not automatically correspond to a given ‘historical maximum’, or a specific historical date; historical information (e.g. a past stable situation before changes occurred due to reversible pressures) should, however, inform judgements on FRVs;

[21] Assessment, monitoring and reporting of conservation status – preparing the 2001–2007 report under Article 17 of the Habitats Directive (DocHab-04-03/03 ver.3). DG Environment, 2004.

- FRVs do not automatically correspond to the ‘potential value’ (maximum possible extent) which, however, should be used to understand restoration possibilities and constraints.

Although FRVs have to be set separately for range and surface area, **there is a clear relationship** between range and surface area of a habitat, because within the natural range all significant ecological variations must be considered. This calls for an iterative process in setting the FRVs to ensure that one value takes the other one into account, e.g. habitat stands/parcels large enough with an appropriate range to include all its structural components and a characteristic functioning.

FRVs have to be reported at the level of the Member State biogeographical region. However, these geographical units may not be appropriate for developing a rationale for FRVs based on ecology of habitats. Therefore, it is advisable to set FRVs at the most suitable scale (often national, sometimes supranational) and to derive the national biogeographical numbers from this value, e.g. using a proportion based on distribution and/or size/area.

When setting FRAs it should be remembered that several habitats potentially can occupy the same site, e.g. a given area of land, depending on history and current management, could be a grassland, a heathland or a forest[22]. Care should be taken to ensure that the combined FRAs do not exceed the area of the region.

The term ‘current value’ will be used often in these guidelines. It should be interpreted as being the value reported by the Member State for the present reporting period, which is to be compared to the favourable reference value.

Model-based and reference-based approach

There are basically two approaches to setting FRVs: model-based and reference-based. Model-based methods are built on biological considerations. This approach requires good knowledge about the habitat type ecology and and its structure and functions. Reference-based approaches are founded on an indicative historical baseline corresponding to a documented (or perceived by conservation scientists) good condition of a particular habitat or restoring a proportion of estimated historical losses. Both approaches take into account information about distribution, trends, known pressures and declines (or expansions). These approaches are not mutually exclusive and will be further explained in the sections below with practical instructions and examples.

With the objective of developing practical and pragmatic guidance promoting harmonisation between Contracting Parties, while allowing for the needed flexibility (e.g. the best method to be used depends on the data available), a stepwise approach, as summarised in Figure 9 below, is recommended.

The stepwise approach and the specific methods for setting the FRVs are largely dependent on the available data and knowledge for each habitat. Three generic levels of data availability and knowledge are suggested:

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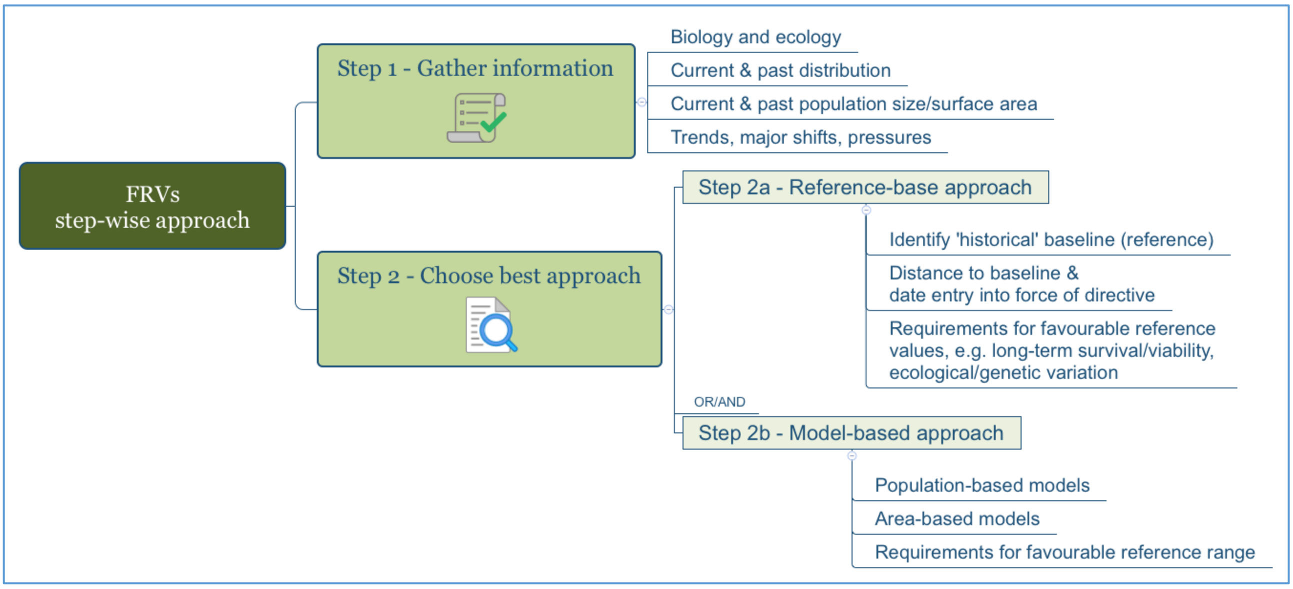
[22] For example, these three habitat types typical of limestone areas in much of Europe:
E1.12 Euro-Siberian pioneer calcareous sand swards
F3.16 *Juniperus communis scrub*
G1.6 Fagus woodland (subtype: G1.66 = Medio-European limestone beech forests of the Cephalanthero-Fagion

- High: good data on actual distribution and ecological requirements/features; good historical data and trend information;
- Moderate: good data on actual distribution and ecological requirements/features; limited historical distribution data (only trend data available);
- Low: data on actual distribution and ecological requirements/features are sparse and/or unreliable; hardly any historical data available and no trend information.

Figure 9: Illustration of the stepwise approach to set FRVs



The recommended approach involves a certain number of steps that will be further detailed below[23]. In summary, and without detailing all conditions, they are:

- **Step 1: Gather information**
  Collect all relevant information about a habitat type necessary to understand their ecological and historical context: biology and ecology; natural range, current and past distribution (including before the Bern Convention came into force) and population size/surface area; trends, their causes and when major changes occurred, pressures.

- **Step 2: Choose best approach**
  Depending on the availability and quality of the data and information gathered, choose the best way of setting the FRVs.

[23] In order to better understand the practical development of the approaches above (and the steps that will be further detailed), several ‘real life’ validated examples can be found on the Reporting Reference Portal.

- **Step 2a: Use reference-based approach**
  Compare the current distribution and surface area with those of a past favourable period and at the date the Bern Convention came into force.

  Check if the values above are sufficient to ensure long-term survival and viability, as well as coverage of ecological variations.

  Set values or use operators to qualify how far the current value is from the favourable situation.

- **Step 2b: Use model-based approach**
  Develop area-based models or use available estimates derived from such models to assess the favourable reference area, taking into account the requirements for a favourable reference range.

The favourable reference values – FR range and FR area – need to capture the ecological diversity (subtypes) within the habitat type natural range and the structure and functions necessary for its long-term maintenance and the favourable status of its typical species.

The ecological diversity, one of the requirements for a Favourable conservation status, is often expressed along geographical (north–south/east–west) and other environmental gradients (e.g. altitudinal, geological, climatic) and is frequently reflected in changes in floristic composition.

Stepwise process for setting the favourable reference values for habitats

Step 1: Gather information about the habitat type

The list below includes examples of data and information about the habitat type, linked to its definition, which may be relevant in setting the FRVs:

- physical and ecological conditions;
- variation in species composition and abundance across geographical regions, environmental gradients (e.g. altitude, depth) and land use or other impacts of human activities;
- physical structure, dynamics and possible successional stages;
- characteristic structure and functions;
- typical species, their range and conservation status.

Another set of information to be collected includes data and information on distribution (and therefore range) and surface area of the habitat type in the historical and recent past, when the Bern Convention came into force , and currently (i.e. when the assessment is being done). The historical past would go up to the last two or three centuries (where applicable), and the recent past up to about 50 years before the Bern Convention came into force (i.e. 1940s –1950s).

This information is crucial to understand what has been happening to the habitat type and support the setting of FRVs in the following steps. This evidence should be complemented with information on trends and pressures, to understand which events caused major changes/shifts in the status and trends of habitat distribution and area covered by habitat, and when. For example, semi-natural habitats depending on extensive agricultural management, experienced cultivation, severe intensification and fragmentation in most parts of Europe after World War II have caused serious declines in their quantity and quality. For some habitat types, useful information can be found in the Interpretation Manual of Habitats[24] listed in Resolution No. 4 (1996).

Step 2a: Use reference-based approach to set FRVs

The availability and quality of the data and information gathered in Step 1 will vary from habitat to habitat, but also for distribution (range) and for habitat areas.

However, it should be possible to use that information in a pragmatic way to have a rough estimation of how far from 'favourable reference values' the current values on range (based on distribution) and area are (using the operators 'approximately equal to', 'more than', and 'much more than') and possibly set values. When using operators, Parties are encouraged to indicate in the 'Additional information' fields (4.12 for FRR and 5.15 for FRA) an estimation of the percentage of how far the current value is from the FRV (e.g. 'current value around 5 or 6 % below FRR', 'current value about 45-50 % below FRA'); this information could be useful when estimating restoration needs for example.

The 'decision key' below should be used in general, noting that for many habitat types (e.g. most forest types) Step 2a, using the area-based approach, could be more appropriate. In addition, elements from Step 2b may also be used to help estimate the FRA below. Take into account the above section 'General principles for setting favourable reference values (FRVs)'.

Point 1

If both distribution and surface area of the habitat have not undergone visible shifts or reductions (trends have been relatively stable) in the past, including in the recent past, AND current area of the habitat is large enough to ensure long-term viability of the habitat and its typical species, then the:

- favourable reference range (FRR) should be equal to the current range;
- favourable reference area (FRA) should be equal to the current surface area.

If the current range is smaller than the past range, ⇨ go to point 2.

If the current habitat area is smaller than the past area, ⇨ go to point 3.

If there is not sufficient historical information or if this is not useful (e.g. many forest habitats), go to Step 2b (area-based approach).

Point 2

Identify which additional areas, within its natural range, should be covered by the habitat type in the future in order to re-establish a past range that is big enough and well distributed to accommodate viable areas in the long term; this should consider whether the restoration of the range is technically and ecologically feasible. The availability and quality of the data used to make such an identification and estimation could lead to different ways of expressing the FRR:

- a **value** equal to 'current range value' plus 'additional range area to be restored';

[24] https://rm.coe.int/16807469f9

- an **operator** indicating 'more than current range' (i.e. less than 10 % more) or 'much more than current range' (i.e. more than 10 %);
- in any case, the estimated FRR cannot be smaller than the range at the date the Bern Convention came into force.

Point 3

Identify what needs to be done to restore the habitat area (or to allow for recovery) to a past level; this should consider whether the restoration/recreation is technically and ecologically feasible. Information about past trends, if available, should inform the setting of the FRA. The availability and quality of the data used to make such an identification and estimate could lead to different ways of expressing the FRA:

- a **value** equal to 'current habitat area' plus 'additional area to be restored/recreated';
- an **operator** indicating 'more than current habitat area' (i.e. less than 10 % more) or 'much more than current habitat area' (i.e. more than 10 %);
- in any case, the estimated FRA cannot be smaller than the habitat area at the date the Bern Convention came into force.

Point 4

A conclusion of FRR or FRA 'unknown' should only be used in the cases where there is hardly any data about habitat's current range and surface area and no information about the its historical context.

Step 2b: Use area-based approach to set FRVs

There are some habitat types for which a purely reference-based approach is not possible or inappropriate to set the FRVs, particularly the favourable reference area, e.g. for forest types with very small areas in the recent past. In this case the concept of 'minimum dynamic area' (MDA) can be used to establish a minimum area for proper functioning of the habitat and to buffer against natural disturbance and anthropogenic impacts. Next, this area must be scaled up to a favourable area by considering historical distribution and ecological variations in the natural range.

In general, if there are typical species whose conservation status is clearly related to the area of a habitat listed in Resolution No. 4 (1996), an evaluation of the status of those species may help setting a value for favourable reference area.

In addition to the considerations above, the fact that many habitat types listed in Resolution No. 4 (1996) are semi-natural and their existence is largely dependent on human activities (e.g. extensive agriculture, including grazing and mowing, traditional forest management such as cork production or coppicing) may require a combination of reference-based and area-based approaches to derive the FRVs. Therefore, Step 2a and Step 2b should be considered in an iterative way, and elements from one step used in the other step.

There are a few habitats that are closely linked to a single species and for which the approach described above for species could be appropriate (with modification to get area), for example for habitats 'F3.16 *Juniperus communis*' and 'F5.171 *Zyziphus*'.

2 Maps

This chapter provides complementary information to the guidance provided in Section '2. Maps' (in 'Field-by-field guidance for habitat reports').

Distribution maps

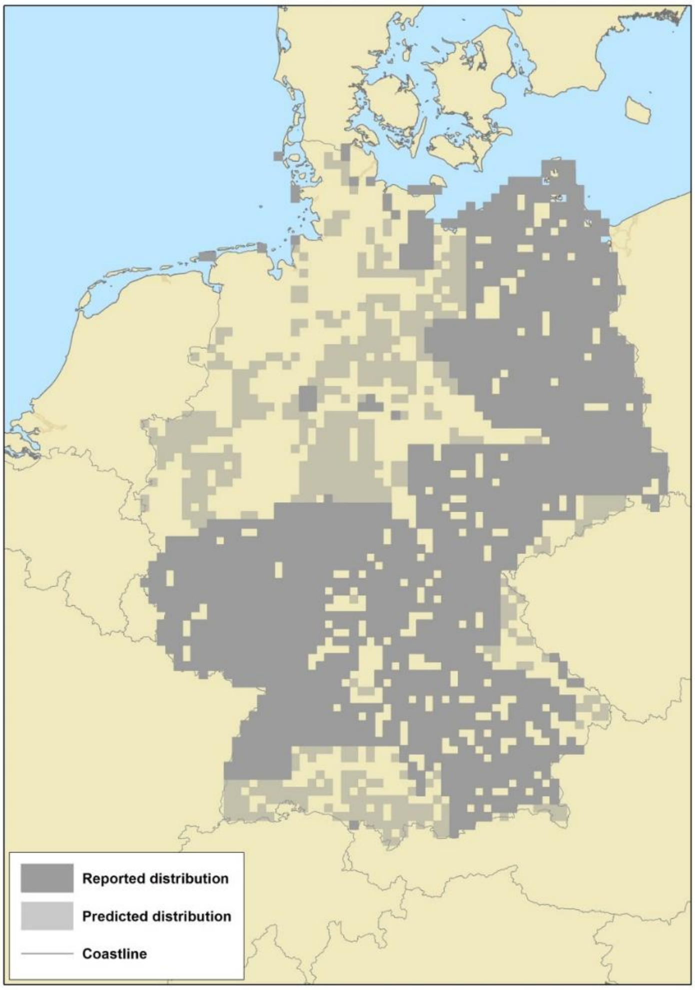
Submission of maps of the distribution of all Resolution No. 4 (1996) habitats present in a Country is a basic requirement of the reporting. Principal requirements for distribution maps are described in Section ‘2. Maps’ (in ‘Field-by-field guidance for habitat reports’) and further technical specifications are provided on the Reporting Reference Portal.

Ideally the distribution map should provide complete and up-to-date information about the actual occurrence of the habitat based on the results of a comprehensive mapping programme/initiative/project/inventory or a statistically robust model.

In many cases up-to-date field data will only cover part of a real habitat distribution or only relatively old data will be available. In this situation the Reporting format foresees that the distribution map is derived from a model or extrapolation. Parties are encouraged to report a more up-to-date or complete distribution by remapping the available distribution using other data, such as the results of a monitoring programme or data on potential vegetation.

In some cases, even with the use of extrapolation, the resulting distribution map will be highly incomplete when compared with presumed habitat distribution (see Figure 10). The Parties are encouraged to provide the incomplete distribution map. If the reported distribution map obtained as a result of comprehensive mapping, modelling or extrapolation or expert interpretation covers less than 75 % of the presumed actual species distribution (the resulting map is incomplete in relation to the presumed species distribution), the ‘Method used’ should be reported as ‘(d) Insufficient or no data available’.

Figure 10: Hypothetical distribution map of a habitat in Germany with predicted (presumed) and reported distribution. Reported distribution represents less than 75 % of a presumed distribution, so the 'Method used' should be evaluated as '(d) Insufficient or no data available'.



4 Range

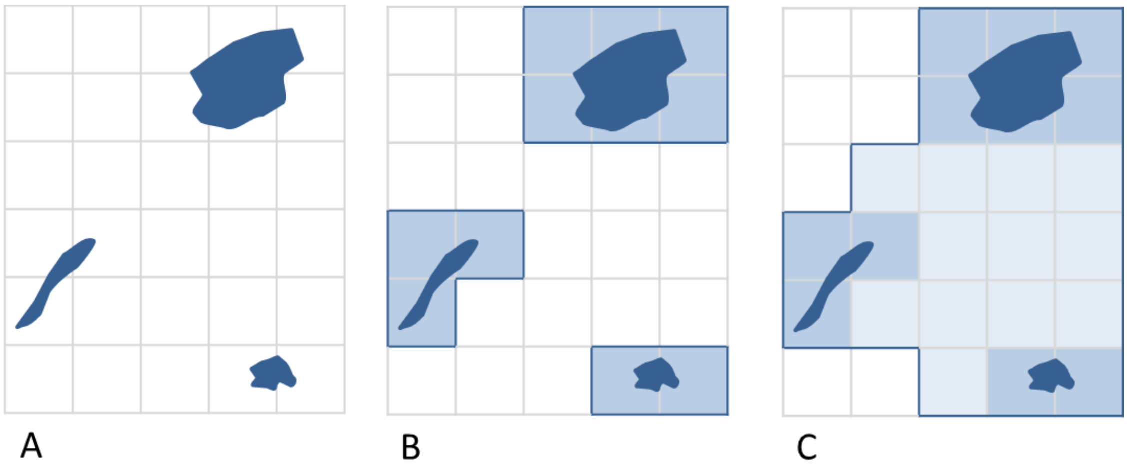
This chapter provides complementary information to the guidance provided in '4. Range' (in 'Field-by-field guidance for habitat reports').

Concept of range

Range is defined as 'the outer limits of the overall area in which a habitat is found at present and it can be considered as an envelope within which areas actually occupied occur.' It is a dynamic parameter allowing the assessment of the extent of and the changes in the habitat distribution.

Range is a spatial generalisation of distribution, which is a representation of the habitat occurrences in the 10 x 10 km grid. The relationship between habitat occurrence, distribution and range is illustrated in Figure 11.

Figure 11: Relationship between occurrence of habitat, distribution and range. 'A' occurrence of habitat, usually a polygon, point or a linear feature (the total area of polygons is reported as a Surface area covered by habitat, field 5.2); 'B' distribution – occurrence in 10 x 10 km grids; 'C 'range – spatial generalisation of the distribution



The range can be described as follows:

The natural range describes roughly the spatial limits within which the habitat or species occurs. It is not identical to the precise localities or territory where a habitat, species or sub-species permanently occurs. Such actual localities or territories might for many habitats and species be patchy or disjointed (i.e. habitats and species might not occur evenly spread) within their natural range. If the reason for disjunction proves to be natural i.e. caused by ecological factors, the isolated localities should not be interpreted as continuous natural range, for example for an alpine species the range may be the Alps and the Pyrenees, but not the lower area between. The natural range includes however, areas that are not permanently used: for example for migratory species 'range' means all the areas of land or water that a migratory species inhabits, stays in temporarily, crosses or overflies at any time on its normal migration[25]. Vagrant or occasional occurrences (in the meaning of accidental, erratic, unpredictable) would not be part of the natural range.

Natural range as defined here is not static but dynamic: it can decrease and expand. Natural range can also be in an unfavourable condition for a habitat or a species i.e. it might be insufficient to allow for the long-term existence of that habitat or species.

When a species or habitat spreads naturally (on its own) to a new area/territory or when a reintroduction of a species as referred to in the Chapter V, Article 11 of the Bern Convention and the Recommendation No. 158 (2012) has taken place of a species into its former natural range, this territory has to be considered a part of the natural range. Similarly restoration/recreation or management of habitat areas, as well as certain agricultural and forestry practices can contribute to the expansion of a habitat or a species and therefore its range. However, individuals or feral populations of an animal species introduced on purpose or accidentally by man to places where they have not occurred naturally in historical times or where they would

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25 See also article 1 of the Bonn Convention.

not have spread to naturally in foreseeable future, should be considered as being outside their natural range and consequently not covered by Resolution No. 4 (1996).

Calculation of range

Bearing in mind the dynamics of the range as defined above, the range should be calculated based on the map of the actual (or presumed if also modelling, extrapolation of expert opinion were used) distribution used for each reporting period. The calculation should involve a standardised method. A standardised process is needed to ensure repeatability of the range calculation in different reporting rounds and for comparison of results between Parties. It will also allow for estimating range trends.

The standardised process proposed in these guidelines consists of two steps:

1. Creating an envelope(s) around the distribution grids. This spatial calculation is done using the procedure of 'gap closure' where a predefined set of rules specify where two distribution points/grids will be joined together to form a single range polygon, and where an actual gap in the range will be left.
2. Excluding unsuitable areas. After the automated calculation, areas which are not appropriate, such as marine areas in the range of a terrestrial habitat, should be excluded.

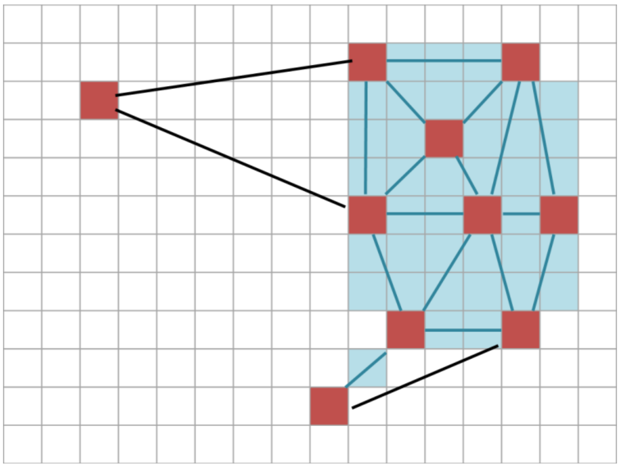
Step 1: Creating an envelope(s) around distribution grids

What is a gap distance?

Most of the basic principles for the range estimation, including the size of gaps which will represent a discontinuity in the range, were established during the 2000–2006 Nature Directives reporting period and will still be valid. Range should exclude major discontinuities that are natural, i.e. caused by ecological factors. What is considered as a natural discontinuity is largely dependent on the ecological characteristic of the habitat and the character of the surrounding landscape. Ideally, the criteria for the range discontinuities should be defined separately for each habitat in each particular landscape, but this is practically impossible. The guidelines for reporting provide a generalised and simplified approach to range discontinuities.

In the process of calculating a range the natural discontinuities are represented by a 'gap distance'. A gap distance should be understood as the distance between two distribution grids that will not be joined together to form a single range polygon but will be shown as discontinuities in a range (see Figure 12).

Figure 12: A schema illustrating use of the gap distance in calculating range. If the distance between two occupied distribution grids (red grids) is smaller than the gap distance (blue lines), the distribution grids are joined to form a range (blue grids). If the distance between two distribution grids is higher than the gap distance (black lines), two distribution grids are not joined and represent a discontinuity in the range.



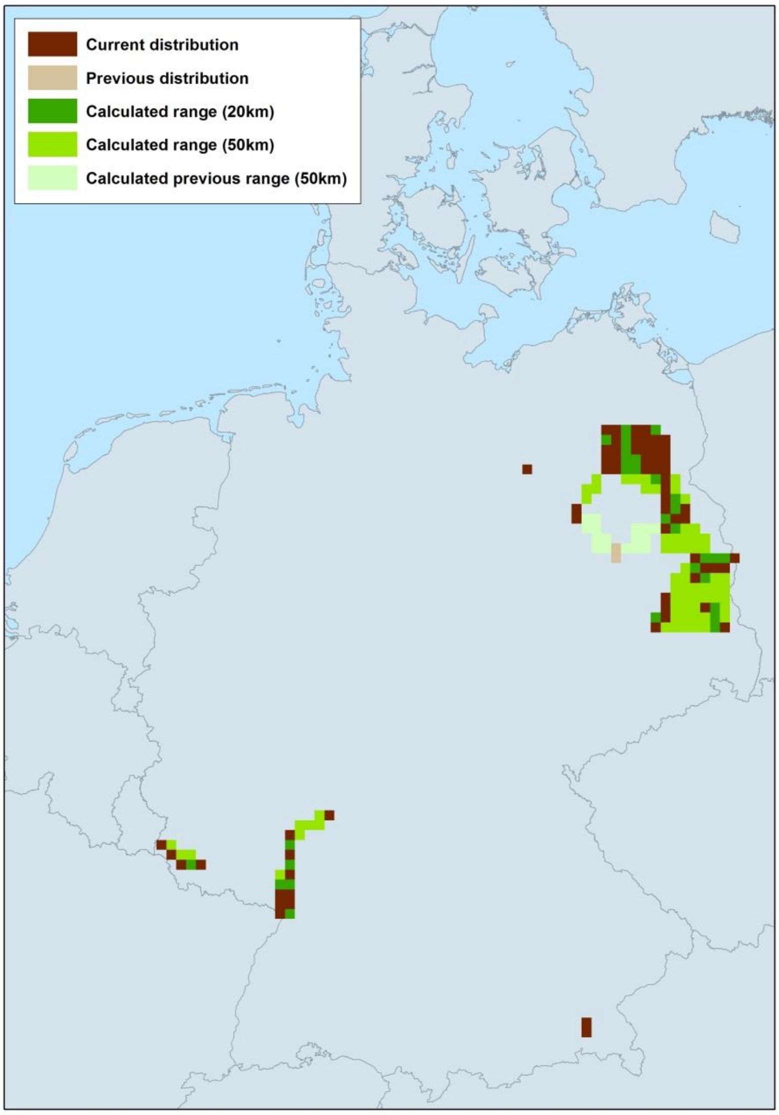
Constraints for selecting the gap distance

The gap distance should correspond to the definition of range (as an envelope generalising the distribution with major discontinuities excluded) and it should allow the calculation of range polygons, which are capable of detecting large-scale changes in the distribution. A range that is calculated with larger gap distances (i.e. 40–50 km) is more sensitive to changes at the margins of the distribution and large-scale changes within the outer limit of the distribution. On the other hand, range calculated with smaller gap distances (e.g. 20 km) is sensitive to small-scale changes (see Figure 13).

A discontinuity of at least 40–50 km (depending on whether the habitat is rare and localised or common and widespread) is considered a gap in the range of habitat. For relatively localised habitat types a gap distance of 40 km is recommended, which is equal to the recommended gap distance for plant species which represent the main structural components of the majority of the habitats. However, for widespread habitats which are structurally similar to the surrounding landscape matrix the gap distance could be increased to 50 km.

For small Countries or for other small territories for which the distribution map is provided using the 1 x 1 km grid or 5 x 5 km grid (see Section ′2. Maps' (in 'Field-by-field guidance for habitat reports')) the gap distances can be adapted accordingly (e.g. a gap distance of 4-5 grids = 4-5 km can used instead of 40-50 km recommended above).

Figure 13: An example of range maps created using different gap distances. This map shows the difference between the range calculated with 20-km and 50-km gap distances. Where a single marginal population occupying two 10 x 10 km grids on the map is lost (Previous distribution) the range calculated with 50-km gap distance (Calculated range 50 km) will decrease by more than 15 % of its original area (Calculated previous range 50 km). Using the gap distance of 20 km, where this marginal population will remain isolated from the main range polygon (Calculated range 20 km), and the decline in the range area will be around 3 % of its original area. With a 12-year reporting period the same situation would lead to different conclusions: 'unfavourable-bad' for the range with a 50-km gap and 'unfavourable-inadequate' for the range with a 20-km gap.



For very rare and/or localised habitats occurring in particular environmental conditions, the range should be equal to the distribution.

Step 2: Excluding unsuitable areas

Technically, range is calculated by filling in the unoccupied grids between the cells of distribution. The following types of unsuitable areas should be excluded from the calculated range:

- marine areas automatically included in the range of terrestrial habitats;
- areas beyond national boundaries;
- areas identified by the range tool as part of the range falling in the adjacent biogeographical regions for which the habitat is not noted on the checklist;
- areas more than 20 km from coastline for coastal habitats;
- areas without water bodies for freshwater habitats and vice versa.

Although the distinction between suitable and unsuitable areas is very coarse, the purpose of this step is to correct only the most important contradictions resulting from automated calculation. Technically, the process described in this step should be simple and applicable across all Member States.

6 Structure and functions (including typical species)

This chapter provides complementary information to the guidance provided in Section '6. Structure and functions' (in 'Field-by-field guidance for habitat reports').

Structure and functions is one of the four parameters used for assessing the conservation status of habitat types when reporting under Resolution No. 8 (2012). The parameter is based on part of the definition of Favourable conservation status of a habitat type which reads 'The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future.'

Structures are considered to be the physical components of a habitat type. These will often be formed by assemblages of species (both living and dead), e.g. trees and shrubs in a woodland, corals in some forms of reef, but can also include abiotic features, such as gravel used for spawning. Functions are the ecological processes occurring at a number of temporal and spatial scales and they vary greatly between habitat types. For example, tree regeneration and nutrient cycling are important functions in woodland habitats. It is clear that fragmentation can disrupt the functioning of habitats which are not naturally fragmented and is a factor that should be taken into account when assessing Structure and functions.

The composition of a given habitat type may vary geographically. For instance, the species composition of a widely distributed habitat type such as 'G1.6 *Fagus woodland* ' will differ; in France alone 13 subtypes have been recognised (Bensettiti et al., 2001), reflecting regional variation. However, for a given habitat type, the associated functions will be similar throughout its range. Structure is relatively simple to observe/measure but functions are usually more difficult. However, as functions are often related to a particular species or species groups, the presence of certain species can indicate that functions are favourable.

For a habitat type to be considered as being at Favourable conservation status, its structure and functions should be favourable and its 'typical species' be at Favourable conservation status. Given the wide range of habitat types listed in Resolution No. 4 (1996) and their inherent variability, it is not possible to give detailed guidance for each individual habitat type, but clearly the various ecological processes essential for a habitat type have to be present and functioning well for the habitat type to be considered as being at Favourable conservation status.

The assessment of Structure and functions is carried out for each biogeographical region of a Country. In many cases it is not necessary for all components of the structures or functions to be present on all sites where a habitat type occurs. For example, although all age classes of a woodland type, from saplings and young (natural) regrowth to senescent trees and natural decay phases, need to be present at a regional scale, together with sufficient regeneration, it is not necessary for every stand site to have all the age classes. A single site can be considered to be in 'good' status even if not all age classes, etc. are present if the various stages are well represented in the habitat at a regional scale.

Condition of habitat type

It has been agreed to report the area in 'good condition', 'not-good condition', and 'not known' (field 6.1 'Condition of habitat') together with the short-term (12 years) trend direction in the area assessed as 'good'. The direction of the trend ('stable', 'increasing', 'decreasing', 'uncertain', 'unknown') will help measure progress towards Favourable conservation status and towards achieving Target 1 of the 2020 Biodiversity Strategy. The trend direction replaces the qualifier (which was optional) for the parameter Structure and functions as used in previous reporting cycles.

Several countries have published detailed guidance on assessing the condition of habitats at the site/stand level (see Table 10). Maciejewski et al. (2016)[26] review many of the concepts necessary for evaluating the condition of habitats at the site scale.

Table 10: Examples of detailed guidance on assessing habitat condition

Spain	AUCT. PL. (2009) *Bases ecológicas preliminares para la conservación de los tipos de hábitat de interés comunitario en España*. Ministerio de Medio Ambiente, y Medio Rural y Marino. Madrid. ISBN 978-84-491-0911-9. http://www.magrama.gob.es/es/biodiversidad/temas/espacios-protegidos/red-natura-2000/rn_tip_hab_esp_bases_eco_acceso_fichas.aspx
Italy	Angelini, P., Casella, L., Grignetti, A. & Genovesi, P. (2016) *Manuali per il monitoraggio di flora, fauna e habitat di interesse comunitario (Direttiva 92/43/CEE) in Italia: gli habitat*. ISPRA, Serie Manuali e Linee Guida. www.isprambiente.gov.it/it/servizi-per-lambiente/direttiva_habitat/
United Kingdom	See Article 17 'UK Approach' document http://jncc.defra.gov.uk/pdf/A17_2013_UKApproach.pdf and Common Standards Monitoring guidance: http://jncc.defra.gov.uk/page-2217

Although it may be possible to have information for every occurrence of a very rare habitat with a small total area, for most habitat types considered some form of sampling will be required. Ideally, such sampling should be based on statistical principles, for example stratified random sampling. There is a large literature on sampling methodologies; a recent publication which focuses on habitats is Brus et al. (2011).

[26] Maciejewski, Lise; Lepareur, Fanny; Viry, Déborah; Bensettiti, Farid; Puissauve, Renaud; Touroult, Julien (2016) État de conservation des habitats : propositions de définitions et de concepts pour l'évaluation à l'échelle d'un site Natura 2000. *Revue d'Écologie* 71 (1): 3–20.

The evaluation matrix states that if more than 25 % of the habitat type area in the region being assessed is considered 'unfavourable' (i.e. not in good condition), then the status of Structure and functions is 'unfavourable-bad'. However, it does not give numerical criteria for 'favourable' or 'unfavourable-inadequate'. Ideally, the entire area of a habitat type should be in good condition for Structure and functions to be considered 'favourable'. However, this is hardly achievable in practice and it could be acceptable to have part of the habitat type in 'not-good' condition, but still consider Structure and functions to be assessed as 'favourable'.

It is recommended to use an indicative value of 90 % of the habitat type area (field 6.1) in 'good' condition as the threshold to conclude on 'favourable' Structure and functions. If a Country uses a different value, this should be noted and explained in field 10.8 'Additional information'. This indicative value could, for example, be adapted according to the rarity/abundance of the habitat type: closer to 100 % for rare habitat types with a restricted area (e.g. many grasslands with only a few tens of km^2 in the biogeographical region) and less than 90 % for very common and widespread habitat types (e.g. several forest types with several thousand km^2 in the biogeographical region). In the special case where a particular habitat type is managed to restore another habitat type (e.g. natural succession is not prevented), lower thresholds than 90 % can be used. If a different threshold than the recommended 90 % is used, this should be noted in field 10.8 'Additional information'.

It is important to note that regardless of the threshold used, the trend must be stable or increasing for the conclusion on Structure and functions to be considered 'favourable'.

Typical Species

Although the Reporting format uses the term 'typical species', it does not give a definition, either for use in reporting or for use in impact assessments. As it would mean a considerable increase in the necessary work to undertake an assessment of the conservation status of each typical species, the assessment of typical species is included as part of the assessment of the Structure and functions parameter.

The list of potential 'typical species' for most habitat types is very long and the selection of 'typical species' for the reporting should reflect favourable structure and functions of the habitat type, although it will not be possible to associate species with all aspects of structure and functions. Given the ecological and geographical variability of the habitat types, it is not realistic to have recommended lists of typical species, even for a biogeographical region. Indeed, even within one Country different species may be present in different parts of the range of a habitat type or in different subtypes.

Given the variability of habitat types across their range, even within a single biogeographical region, it is very unlikely that all typical species will be present in all examples of a given habitat type, particularly in large Countries. The sum of sites and occurrences of each habitat type should, however, support viable populations within the region being assessed of the typical species on a long-term basis for Structure and functions to be favourable. Many species may be typical for several habitats (including habitats which are not listed in Resolution No. 4 (1996)) and not dependent on a single habitat type. Such species may be threatened (e.g. red-listed) at a national or regional scale even though they are thriving in the habitat and region being assessed.

It is only natural that there will be a turnover in the species pool, so that local loss and recolonisation of distinct species out of the selected group of typical species will occur. As long as these processes balance over the long term for each typical species, the Structure and functions of the habitat type should be regarded as 'favourable'. If several typical species are red-listed, i.e. threatened to some degree by extinction at country or biogeographical level, this would indicate that typical species are not in a good condition[27] and Structure and functions cannot be 'favourable'. Examples of how species can be linked to Structure and functions per habitat group can be found on the Reporting Reference Portal.

When choosing typical species for reporting, the following considerations should be taken into account (it is not expected that the chosen species should qualify for all of these criteria):

- 'typical species' should be species which occur regularly at a high constancy (i.e. are 'characteristic') in a habitat type or at least in a major subtype or variant of a habitat type;
- 'typical species' should include species which are good indicators of favourable habitat quality, e.g. by indicating the presence of a wider group of species with specific habitat requirements. They should include species sensitive to changes in the condition of the habitat ('early warning indicator species');
- species which can be monitored easily by non-destructive and/or inexpensive means should be favoured.

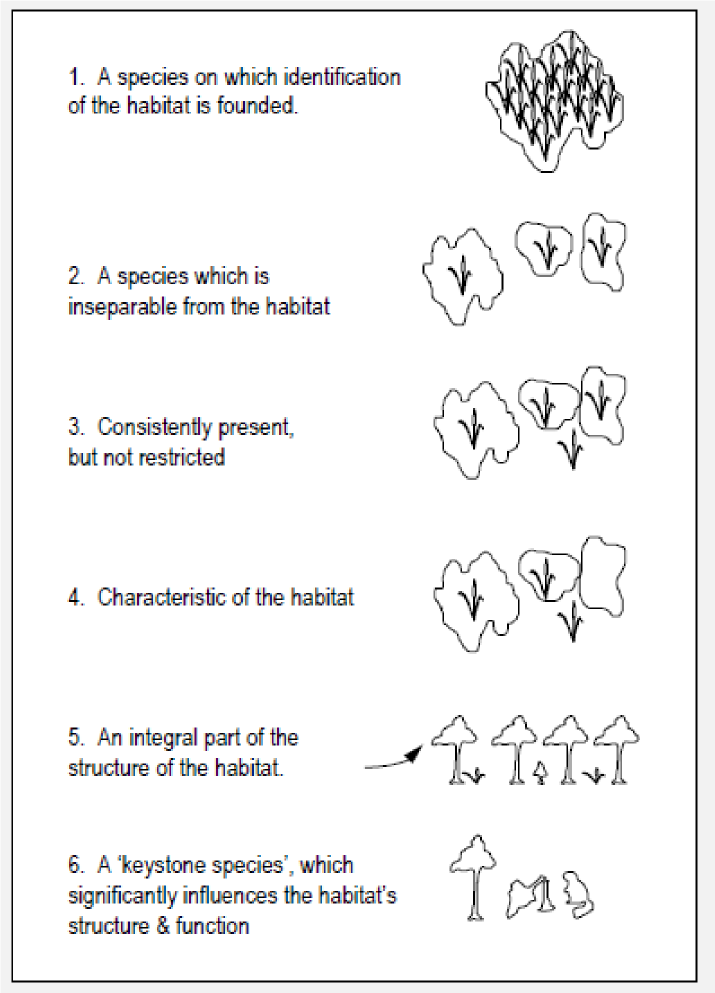
Further examples of potential measures of habitat condition per habitat group and their links with potential typical species can be found on the Reporting Reference Portal.

The list of 'typical species' chosen for the purpose of assessing conservation status should ideally remain stable over the medium to long term, i.e. across reporting periods. Characteristic species listed in the *Interpretation Manual of Habitats*, although chosen to help identify habitats, may be used as typical species if they meet one or more of the criteria noted above. In some habitats there are key species which often form a major element of the structure, such as dominant trees in a forest habitat. However, the dominant species may not necessarily be a good typical species. For example, beech (*Fagus sylvatica*) is usually dominant or co-dominant and forms an important part of the canopy in the habitat type 'G1.6 *Fagus woodland*', but using *Fagus sylvatica* as a typical species does not give any additional information on Structure and functions. Box 10 gives a graphical representation of groups of potential typical species and how to select those appropriate for assessing Structure and functions.

Box 10: Options for selecting 'typical species'

Potential typical species can be grouped, they may be 'keystone' species or may, for example, require specific conditions essential to the maintenance of the habitat (e.g. occurrence of fire), or may themselves have a significant role to play in maintaining the structure and function of the habitat.

[27] This does not apply to species which are red-listed due to naturally very small and restricted population (partly IUCN Red List criterion D).



Assuming that the habitat's area, and structure and function are already being monitored, it is unlikely that options 1 and 5 would provide any useful additional information. Similarly, the effects of keystone species would be revealed through monitoring habitat structure directly. Monitoring of 'typical species' selected under options 2–4 would more likely yield meaningful information, with option 2 representing the ideal: species whose ecological requirements are met only by the habitat in question. Accordingly, the following working definition of 'typical species' is proposed:

Adapted from Shaw & Wind (1997)[28]

Typical species may be drawn from any species group and consideration should be given to also selecting lichens, mosses, fungi, and animals, including birds. Many important functions, such as pollination and litter decomposition, rely mainly on invertebrates, and their exclusion may lead to incomplete assessments of function. The choice of species should not be restricted to listed species.

Invasive species, either alien or native, but not normally occurring in the habitat type, are often very good indicators of poor habitat condition. Examples of this are the invasive plants *Paspalum distichum*, *Ludwigia peploides* and *L. grandiflora*, which are considered as negative indicators for some of the subtypes of habitat 'C3.4 Species-poor beds of low-growing water-fringing or amphibious vegetation' in France (Grillas et al. 2004), while *Rhododendron ponticum is considered an*

[28] http://bd.eionet.europa.eu/publications//publications/SNH_NERI_1997.pdf

invasive alien in many woodland habitat types in the British Isles. However, these species cannot be considered as ‘typical species’, but where appropriate they should be reported under Pressures and threats.

A full assessment of the conservation status of each typical species is not required. The Reporting format only requires a list of species which have been considered as well as a brief description of the method used to assess their conservation status globally as part of the overall assessment of Structure and functions, which may be based on expert judgement, Red Lists, or general surveys. The list of typical species should be provided as an additional spreadsheet according to the template in the Reporting Reference Portal as indicated under Section 6.6 of the Reporting format Annex D.

7 Main pressures and threats

This chapter provides complementary information to the guidance provided in Section ‘7. Main pressures and threats’ (in ‘Field-by-field guidance for habitat reports’).

Although the information on pressures and threats is required for the conservation status assessment, the importance of pressures and threats goes beyond their use in the assessment. They provide information on the main drivers related to results of the conservation status assessment. They can help to identify actions required for restoration and they are essential to communicate the results of the status assessment to various stakeholders.

For the reporting, pressures are considered to be factors which have acted within the current reporting period, while threats are factors expected to be acting in the future (in the future two reporting periods, i.e. within 12 years following the end of the current reporting period). It is possible for the same impact to be both a pressure and a threat if it is having an impact now and this impact is likely to continue.

The pressures are classified into 15 categories corresponding to the main sectoral driver (see Table 11) with an emphasis on reducing to a minimum pressures which can be attributed to several sectors (for example, pollution or hydrological modification of water bodies).

Table 11: Pressure categories in the list of pressures and threats

Pressure code	Pressure category	Note
A	**Agriculture**	Includes pressures and threats caused by agricultural practice.
B	**Forestry**	Includes pressures and threats caused by forestry activities, including thinning, wood harvesting, and pest control in trees.
C	**Extraction of resources (minerals, peat, non-renewable energy resources)**	Includes pressures related to extraction of materials, such as mining or quarrying, pollution or waste disposal.
D	**Energy production processes and related infrastructure development**	Includes pressures related to production of energy, e.g. the construction and operation of power plants, water use for energy production, waste from energy production, activities and infrastructure related to renewable energy.
E	**Development and operation of transportation and service corridors**	Includes pressures related to transportation of materials or energy, such as construction of infrastructure, pollution and disturbances or increased mortality due to traffic.
F	**Development, construction and use of residential, commercial, industrial and recreational infrastructure and areas.**	Includes pressures related to development, construction and use of residential, commercial, industrial and recreational infrastructure, e.g. infrastructural changes on existing built areas, expansion of built areas, land use and hydrological changes for urban or industrial development, disturbances or pollution due to residential, commercial, industrial, or recreational infrastructure. Includes also pressures related to sport, tourism and leisure activities and infrastructure.
G	**Extraction and cultivation of biological living resources (other than agriculture and forestry)**	Includes pressures linked to uses of biological resources other than agriculture and forestry.
H	**Military action, public safety measures, and other human intrusions**	Includes pressures related to public safety and other human intrusions.
I	**Invasive and problematic species**	Includes pressures related to problematic inter-specific relationships with non-native species which cannot be associated with other pressure categories. Includes also problematic relationships with native species, which came out of balance due to human activities.
J	**Mixed source pollution**	Includes pollution which cannot be associated with other pressure categories.

Pressure code	Pressure category	Note
K	**Human-induced changes in hydraulic conditions**	Includes hydrological and physical modifications of water bodies, which cannot be associated with other pressures categories.
L	**Natural processes (excluding catastrophes and processes induced by human activity or climate change)**	Includes natural processes, such as natural succession, competition, trophic interaction, erosion.
M	**Geological events, natural catastrophes**	Includes pressures such as natural fires, storms, tsunamis.
N	**Climate change**	Includes pressures related to climate change.

Note that this table is only illustrative since it uses draft pressure categories that may not be retained as such in the final list of pressures and threats.

Further information on the list of pressures and practical guidance on how to use it for reporting on pressures and threats can be found on the Reporting Reference Portal.

8 Conservation measures

This chapter provides complementary information to the guidance provided in Section '8. Conservation measures' (in 'Field-by-field guidance for habitat reports').

Conservation measures are defined as 'a series of measures required to maintain or restore the natural habitats and the populations of species of wild fauna and flora at a favourable status'.

The main purpose of reporting on conservation measures is to obtain information allowing for a 'broad-brush' overview of the conservation measures: whether measures have been taken and if so which measures, their location (inside/outside the Emerald Network) and their impact on the conservation status of habitat. Information on conservation measures feeds into evaluation of the contribution of the Emerald Network to the conservation status of the habitats. This information can further help to understand any trends in conservation status globally and is important for communicating the results of the conservation status assessment to different stakeholders.

The conservation measures should be reported using the codified list of measures. The list of conservation measures mirrors the list of pressures and threats and the conservation measures are principally understood as an action to mitigate the impact of past and present pressures. The measures are classified into 13 categories corresponding to main pressure categories (see Table 12). The list of measures contains additional category for measures related to management of target species and other native species.

Table 12: Categories of conservation measures

Categories of conservation measures
Measures related to agriculture and agriculture-related habitats
Measures related to forestry and forest-related habitats
Measures related to resources exploitation and energy production
Measures related to development and operation of transport systems
Measures related to residential, commercial, industrial and recreational infrastructures, operations and activities
Measures related to the effects of use and exploitation of species
Measures related to military installations and activities and other specific human activities
Measures related to alien and problematic native species
Measures related to natural processes, geological events and natural catastrophes
Measures related to climate change
Measures outside the Country
Measures related to mixed source pollution and human-induced changes in hydraulic conditions for several uses
Measures related to management of species from the Resolution No. 6 (1998) and other native species

Note that this table is only illustrative since it uses draft measure categories that may not be retained as such in the final list of conservation measures.

Further information on the list of conservation measures and practical guidance on how to use it for reporting can be found on the Reporting Reference Portal.

9 Future prospects

This chapter provides complementary information to the guidance provided in Section '9. Future Prospects' (in 'Field-by-field guidance for habitat reports').

What are future prospects?

Assessments of conservation status must take into account the likely future prospects of the habitat; as for Favourable conservation status, it is required that:

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

The parameter 'Future prospects' focuses on the requirement for the long-term maintenance of structure and functions and the need for area and range to be and to remain stable or increasing in the foreseeable future. The definition of the Favourable conservation status of habitat presumes 'long-term maintenance' and existence of specific structure and functions in the 'foreseeable future'.

For the assessment of Future prospects this should be interpreted as meaning the two future reporting cycles, i.e. the next 12 years. The common perspective towards the future is important in harmonising the Countries' assessments, but some flexibility is permitted and the Future prospects can be assessed over longer future periods than the proposed 12 years. For example, for certain well-studied threats, such as climate change, reasonably robust models are available much further than the next 12 years, indicating bad perspective for a habitat.

The Future prospects parameter should reflect the anticipated future improvements and deteriorations of the conservation status[29] which correspond to future trends in the assessment. The anticipated future improvements and deteriorations should be assessed in relation to the current conservation status. For example, the impact of future deterioration on the assessment of Future prospects will be different if the current status is 'favourable' or, on the other hand, 'unfavourable-bad'.

Assessing future prospects

Future prospects should be evaluated by individually assessing the expected future trends and subsequently future prospects of each of the other three parameters, taking primarily into account the current conservation status of the parameter, threats (related to the parameter assessed) and the conservation measures being taken or planned for the future. Once the future prospects of each of the other three parameters have been evaluated, they should be combined to give the overall assessment of Future prospects. The assessment can be divided into three steps:

- Step 1: Future trend of a parameter.
- Step 2: Future prospects of a parameter.
- Step 3: Assessing overall Future prospects for a habitat.

The method described here relies to some extent on expert judgement, but within a clear framework allowing comparability between assessments from different Countries. It should also help to standardise assessments within countries where several teams are involved, each dedicated to a particular habitat group.

Step 1: Future trends of a parameter

Future prospects of each of the other three parameters should principally reflect the future trends which are the result of balance between threats and conservation measures as described in Table 13.

Future trends of a species are dependent on the identified (known and likely) threats which will have a negative impact and any action plans, conservation measures and other provisions which will have a positive impact. For example, climate change, land-use scenarios and trends in certain policies are aspects that will influence future trends. The measures should be restricted to those anticipated to have a positive impact in the next 12 years (regardless of whether they were already being implemented during the current reporting period or not). Threats are reported in Section 7 'Main pressures and threats' of the Reporting format and the existing measures are reported in Section 8 'Conservation measures'.

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[29] The Future prospects parameter should reflect the anticipated future improvements and deteriorations of the conservation status regardless of how far the future status is likely to be from the reference situation captured via favourable reference values.

In most cases, positive (management actions, policy changes, etc.) and negative influences (threats) will simultaneously affect the habitat. The assessment of future trends therefore has to take into account whether the sum of positive and negative influences (threats) will balance out for the parameter under consideration, or whether either the positive or negative effects are likely to be stronger.

In some cases threats or measures may affect the three parameters differently. For example, the measure ‘restoration of forest habitats’ might increase the area of a forest habitat relatively quickly, but may have little impact on the range within a 12-year period. Only threats and conservation measures related to the specific parameter should be considered.

In many cases it will be difficult to foresee whether the influence of threats and conservation measures on the status of the parameter will balance out and whether the resulting trend will be negative, positive or stable. It can therefore be helpful to interpret the current trend in relationship to the impact of current pressures and measures and to assess the future trend on the basis of potential improvement, deterioration or continuation of the current situation.

Establishing whether the future trend is negative or very negative (or positive/very positive) will be difficult in most cases, although it may be easier if the current trend and trend magnitude are known or in cases of dominating pressures or measures. To differentiate between negative and very negative (and positive or very positive) trends the threshold of 1 % per year, meaning approximately 12 % in 12 years, is recommended. This threshold is used in the assessment matrix for current trends to distinguish between inadequate and bad status for range and area covered by habitat. In theory this threshold should represent a difference between a slight and moderate (< 1 % per year) deterioration/improvement and important (> 1 % per year) deterioration/improvement. The Reporting format does not request an exact measure of trend magnitude for habitat area in good condition. For this parameter the difference between negative and very negative (and positive or very positive) trends should follow the same logic as for the two other parameters and should reflect the difference between slight/moderate and important future deterioration/improvement.

Table 13: Assessing the future prospects of a parameter (Steps 1 and 2)

Step 1 Future trends of parameters			Step 2 Future prospects of a parameter	
Balance between threats and measures	**Predicted future trend reflects balance between**	**Current conservation status of parameter**	**Resulting future Prospects of parameter (over next 12 years)**	
Balance between threats acting on the parameter (mostly threats with insignificant impact [30] and/or Medium impact threats) and conservation measures; no real change in status of the parameter expected	overall stable	Favourable	good	
		Unfavourable-inadequate	poor	
		Unfavourable-bad	bad	
		Unknown	unknown	
Threats expected to have negative influence on the status of the parameter (mostly High or Medium impact threats), irrespective of measures taken	negative / very negative	Favourable	poor (negative)	bad (very negative)
		Unfavourable-inadequate	poor (negative)	bad (very negative)
		Unfavourable-bad	bad	
		Unknown	poor (negative)	bad (very negative)
None (or only threats with insignificant impact[31]) and/or effective measures taken: positive influence on the status of the parameter expected	positive / very positive	Favourable	good	
		Unfavourable-inadequate	poor (positive)	good (very positive)
		Unfavourable-bad	poor (positive)	good (very positive)
		Unknown	poor (positive)[32]	good (very positive)
Threats and/or measures taken unknown or interaction not possible to predict	unknown	Favourable	unknown	
		Unfavourable-inadequate		
		Unfavourable-bad		
		Unknown		

Step 2: Future prospects of parameters

The future prospects of a parameter are assessed by taking into consideration, principally, the future trends and current conservation status. Deciding between the two options proposed for each

[30] The impact of threats reported in field 7.1 should be evaluated as 'High' or 'Medium'. Only threats with Medium or High impact (see definition of impact categories in section '7. Main pressures and threats' (in 'Field-by-field guidance for habitat reports') should be reported, but potentially the species is affected by other pressures and threats not having a significant impact on its conservation status.

[31] See the previous footnote.

[32] Unknown is considered as not being favourable, therefore the assessment of Future prospects of a parameter is as for unfavourable inadequate or bad.

combination of future trends and current conservation status will mainly depend on the potential trend magnitude (negative/very negative or positive/very positive). This is pragmatic and a mechanistic approach aimed at simplifying and harmonising the assessment of Future prospects.

Step 3: Assessing overall Future prospects for a habitat

Once the future prospects of each of the other three parameters have been evaluated, they should be combined to give the overall assessment of Future prospects using the rules in Table 14.

Table 14: Combining the evaluation of the three parameters to give Future prospects for a habitat type

Assessment of Future prospects	Favourable	Unfavourable-inadequate	Unfavourable-bad	Unknown
Prospects of parameter: Range, Surface area and Structure and function	All parameters have 'good' prospects OR prospects of one parameter 'unknown', the other prospects 'good'	Other combination	One or more parameters have 'bad' prospects	Two or more 'unknown' and no parameter with 'bad' prospects

Box 11: Assessing Future prospects of habitat E1.2 Perennial calcareous grassland and basic steppes (assessment example for the specific subtype *Festuco-Brometalia*)'

Range and Area are both stable and the following pressures and threats are recorded.

Code	**Activity**	**Impact of pressure**	**Impact of threat**
A03	Abandonment of grassland management (absence of grazing, absence of mowing)	high	high
AXX	Application of natural fertilisers (e.g. manure, slurry)	medium	high
A14	Application of synthetic fertilisers	medium	medium
I01	Invasive non-native/alien plants and animals	medium	medium
I02	Problematic native plants and animals	medium	medium
A02	Conversion from one type of agricultural land use to another (e.g. from grassland into arable land)	medium	
A08	Overgrazing by livestock	medium	medium

The only measure from the measure list that is implemented is 'CA03 Adapt/manage mowing and grazing'. This measure is expected to be sufficient to keep Range stable but to lead to a moderate decline in both Area and Structure and functions.

Parameter	Assessment of parameter	Expected future trend	Future prospect
Range	Favourable	stable	good
Area	Unfavourable-inadequate	decreasing	poor
Structure and functions	Unfavourable-inadequate	decreasing	poor

By using the combination rules in Table 14, two 'poor' conclusions and one 'good' conclusion lead to an overall assessment for Future prospects of 'unfavourable-inadequate'.

Note that the example is only illustrative since it uses draft codes that may not be retained as such in the final list of pressures and threats.

10 Emerald Network coverage for habitat types listed in Resolution No. 4 (1996)

This chapter provides complementary information to the guidance provided in Section ’11. Emerald Network coverage for habitat types listed in Resolution No. 4 (1996)’ (in ‘Field-by-field guidance for habitat reports’).

The evaluation of the contribution of the Emerald Network to the conservation status of a habitat has three principal components:

1. evaluation of the relevance of the network for different habitats (based on the proportion of the habitat area within the network);
2. possible differences in trends (trend of habitat area in good condition) within the network compared to the general trend (reported under Section 6 ‘Structure and functions’);
3. understanding what type of conservation/management measures have been implemented (see Section ‘8. Conservation measures’ (in ‘Definitions and methods for habitat reporting’)).

The contribution of the Emerald Network to the conservation status of habitat is likely to vary depending on the coverage of the habitat by the network and on site management. Therefore, the habitat area included in the network for each given biogeographical region should be provided.

Another element to be taken into consideration when evaluating the contribution of the network is the possible difference in trends both within the network and globally (mainly for habitats where a significant proportion of a habitat area occurs outside the network). For habitats, this should be expressed by comparing the trend of habitat area in good condition in the biogeographical region with the trend of habitat area in good condition inside the Emerald Network in that same biogeographical region.

The information on conservation measures completes and helps to understand the potential differences between the trends within the network and global trends.

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