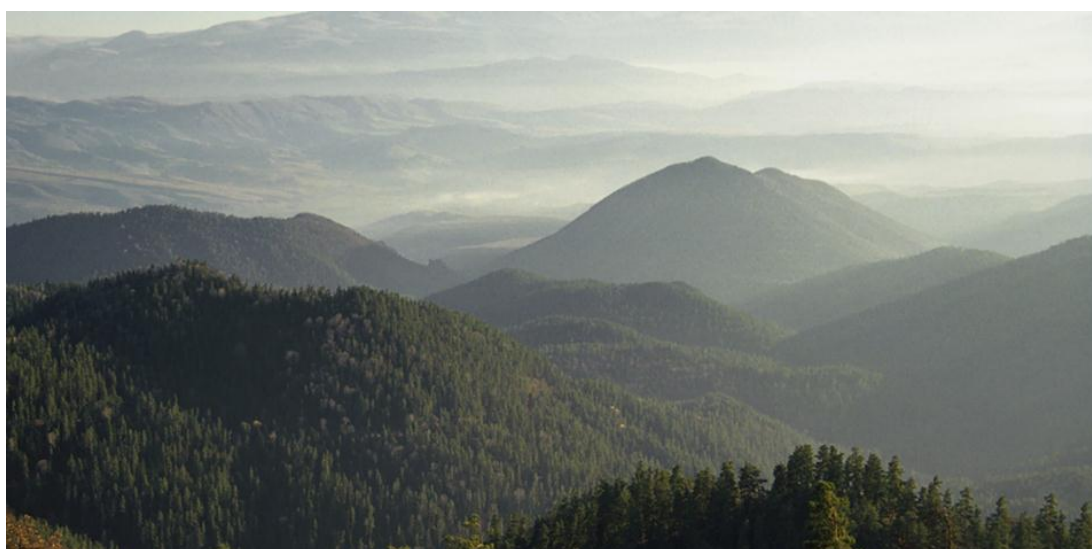


# Wilderness register and indicator for Europe

Final report

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## Executive summary

The main aim of the contract was to increase data availability on wilderness in Europe. The Guidelines on management of wilderness and wild areas in Natura 2000 (DG Environment, *in prep.*) described the benefits of wilderness management within the framework of the EU Biodiversity strategy, analysed the pressures affecting wilderness areas and provided guidelines on their management and protection, largely based on best practice examples of wilderness and wild areas throughout Europe. However, an overview of remaining areas of wilderness and wildlands at the European continental scale was still missing.

The aim of increasing data availability was translated into two main goals:

- a) Compilation of a Wilderness register using existing databases, such as the EEA and WDPA, identifying in tandem with appropriate interested parties the remaining areas of wilderness and wild areas.
- b) Completion of mapping wilderness and wild areas in Europe, involving appropriate definitional and habitat criteria and level of scale to effectively support plans for protecting and monitoring such areas.

In **Chapter 1** we provide a working definition of wilderness, compatible with the IUCN guidelines on protected areas management category Ib ('wilderness') with additions and slight modifications to make it applicable for the filtering of protected areas for the wilderness register from the most relevant databases on protected areas, and for the selection of suitable databases for the wilderness indicator.. Wilderness is defined as an area governed by natural processes. It is composed of native habitats and species, and large enough for the effective ecological functioning of natural processes. It is unmodified or only slightly modified and without intrusive or extractive human activity, settlements, infrastructure or visual disturbance. We make a distinction between wilderness and wild areas. Wild areas tend to be more fragmented than wilderness areas. The condition of their natural habitat, processes and relevant species is often partially or substantially modified by human activities such as livestock herding, fishing, forestry, sport activities or general imprint of human artefacts. However, through certain management measures they have the potential to be transformed into wilderness. The most relevant datasets are the European CDDA database, managed by the EEA and being part of the worldwide WDPA database on protected areas, and the Natura 2000 database. In **Chapter 2** we describe these databases and their relevance for this project.

The mapping of wilderness and wild areas in Europe will result in a wilderness indicator. This indicator permits the spatial analysis of the occurrence of wilderness qualities at the European continental scale and the description of future trends. As such it will become part of the set of Biodiversity indicators managed by the EEA for policy support in actions for halting biodiversity loss. These are described in **Chapter 3**.

In **Chapter 4** we describe the methodology used to compile a register for wilderness. It covers 39 countries being member or collaborate member of EEA. For practical reasons, the CDDA database on national designated areas was used as the main dataset, because it is one of the few datasets on protected areas which contains information on management objectives. We describe the filtering steps leading to a list of pre-selected protected areas most likely to host wilderness qualities. Consultation by stakeholders (NGOs) and site managers was carried out to check quality of the available data related to

the criteria for wilderness derived from the wilderness definition. This is listed in a set of 522 protected areas, that either qualified as wilderness category A or A/B (meeting most of the criteria; 284 PAs ) and category B (wild areas; 238 PAs), i.e. typical wild areas, partly meeting the criteria for wilderness, and with the potential to become wilderness category A if specific management measures are taken. In the EU27, most category A wilderness areas are protected and designated as Natura 2000 area, with a total coverage of 4-5% of the total Natura 2000 network. By far the largest part of these areas is located in the Nordic countries with smaller areas in the Baltic region and in mountainous regions in Europe i.e. Alps, Carpathians, Pyrenees, Apennines.

The presented draft register is not complete yet and should be complemented with further data, in particular for those countries which have not verified/provided available data (15 countries).

A proposal for a wilderness indicator for monitoring wilderness qualities in Europe is presented in **Chapter 5**. This draft indicator is based on multi-criteria evaluation and fuzzy methods, and built on a number of consistently mapped European-wide spatial datasets related to remoteness from access, remoteness from settlements, naturalness of land cover and terrain ruggedness, the key qualities related to wilderness. For mapping, these four sub-indicators are combined into a single wilderness indicator, applicable at the European scale. It has a 1 x 1 km resolution, showing wilderness quality on a linear scale between 0-100. A wilderness map for Europe is presented based on the proposed method. The map shows that the *likeliness of wilderness qualities* is highest in the Fenno-Scandinavian region, the Baltic region, mountainous regions such as the Carpathians, Alps, Apennines, Pyrenees and the Balkan region, in accordance with the picture emerging from the register.

By overlaying the wilderness indicator with the Natura 2000 spatial database we were able to detect protected areas with potentially high wilderness qualities, but not registered in the CDDA database. The potential wilderness qualities of these areas have to be checked by National Focal Points and if in accordance with the set of criteria subsequently added to the register. The draft wilderness indicator will also allow the quantitative assessment of trends in the extent of remote land throughout Europe using GIS techniques. We were also able to detect areas, especially in the Nordic regions where unprotected areas occur (neither registered in CDDA, Natura 2000 or the WDPA database) with potentially high wilderness qualities.

The wilderness register and the draft indicator are the outcome of scientifically based, but different methodologies. Both indicate that wilderness still occurs in Europe, but mostly in a fragmented form. Extensive unfragmented areas are mainly restricted to the Nordic countries. The register can and should be improved and completed by making more data available. In **Chapter 6** we make recommendations for a further increase in data availability on wilderness in Europe and for updating the wilderness register and indicator in due course.

## 1 Background

At the EU Presidency Conference on ‘Wilderness and Large Natural Habitat Areas in Europe’, 27-28<sup>th</sup> May 2009 in Prague, the need for a compilation of a Register of Wilderness for Europe was raised. The register should give an overview of remaining areas of wilderness and wild lands at the European continental scale. In the ‘Message from Prague’ it says under the paragraph ‘further work and information needs’ (C2 and C3):

- Compilation of a Register of Wilderness using existing databases, such as the EEA (European Environmental Agency, Copenhagen) and WDPA (World Database on Protected Areas), identifying in tandem with appropriate interested parties the remaining areas of wilderness and wildlands, the threats and opportunities related to these, and their economic values, with practical recommendations for action.
- Completion of mapping wilderness and wildland areas in Europe, involving appropriate definitional and habitat criteria and level of scale to effectively support plans for protecting and monitoring such areas.

Additionally the Prague message says that *‘Information provided by a Wilderness Register will be a key factor in conservation projects, therefore validity and accuracy of the data should be as precise as possible. A European Wilderness Register would also help with policy development and protect against the further loss of biodiversity’*.

The EU is internationally committed to the protection of biodiversity, and to halting biodiversity and reversing loss within the EU by 2020<sup>1</sup>. In May 2011, the European Commission launched a new strategy to halt and reverse biodiversity loss by 2020<sup>2</sup>. The strategy includes six main targets, and twenty actions, which address the main drivers of biodiversity loss, and which will reduce the main pressures on nature and ecosystem services in the EU by anchoring biodiversity objectives in key sectorial policies. The protection and, where necessary, restoration of Europe’s last wilderness areas can significantly contribute to halting the loss of biodiversity. The benefits of these wilderness areas are significant, especially in terms of retaining biodiversity and for addressing the adverse effects of climate change<sup>3</sup>.

For the purposes of policy development and decision making, areas with wilderness qualities need to be identified.

In the technical tender document it says: *‘In order to produce a widely accepted spatial analysis product and to make the product coherent with existing EU biodiversity indicators, the analysis needs to be based on datasets available from the Biodiversity Data Centre (BDC) and the Biodiversity Information System for Europe (BISE). The work needs to build on the European Environment Agency’s (EEA) Net Landscape Potential Index (NLEP)’*.

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<sup>1</sup> <http://www.cbd.int/convention/articles/?a=cbd-o2>

<sup>2</sup> [http://ec.europa.eu/environment/nature/biodiversity/policy/index\\_en.htm](http://ec.europa.eu/environment/nature/biodiversity/policy/index_en.htm)

<sup>3</sup> Locke, H. & B. Mackey (2009). The Nature of Climate Change, Reunite International Climate Change Mitigation Efforts with Biodiversity Conservation and Wilderness Protection. International Journal of Wilderness 15: 7-13.

Furthermore it says: ‘*A specific European indicator on wilderness is still missing. Spatial analysis related to this indicator needs to be developed in a close co-operation with the relevant stakeholders, most importantly the EEA, in order to meet the objectives set for European biodiversity indicators*’.

## 1.1 Objectives

The overall objective of this project was to improve the data availability on wilderness, allow the monitoring of wilderness qualities and enable enhanced protection of biodiversity and landscape values. This was achieved by:

- a) producing a spatial analysis tool that can be adopted as a draft for a European biodiversity indicator on wilderness in Europe
- b) by creating a draft register of protected wilderness areas.

The register and indicator will together support countries in- and outside the EU to set their own priorities for maintenance and improvement of protected sites with wilderness qualities at their territory. It may also offer opportunities for stronger public participation in wilderness protection.

## 1.2 Setting a working definition for wilderness

Wilderness areas represent a vital element of Europe’s natural and cultural heritage. For a working definition of wilderness, we follow the EU Guidance on the management of wilderness and wild areas in Natura 2000 (European Commission, 2012; in press<sup>4</sup>):

*A wilderness is an area governed by natural processes. It is composed of native habitats and species, and large enough for the effective ecological functioning of natural processes. It is unmodified or only slightly modified and without intrusive or extractive human activity, settlements, infrastructure or visual disturbance.*

This definition was developed by the Wilderness Working Group, as part of the Wild Europe Initiative and agreed by the European Commission<sup>5</sup>.

This definition is compatible with the IUCN guidelines on protected area management class Ib ‘Wilderness’<sup>6</sup>. *Category Ib protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition* (Dudley 2008).

Our working definition is more explicit on important characteristics related to biological and anthropogenic qualities of wilderness, i.e. native habitats and species, no extractive or intrusive human activity, no infrastructure and no visual disturbance. This allows us to pose a clear set of criteria to filter protected areas from the CDDA database that might qualify as wilderness for the wilderness

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<sup>4</sup> <http://ec.europa.eu/environment/nature/natura2000/wilderness/pdf/guidance.pdf>

<sup>5</sup> Wild Europe (2012). A Working Definition of European Wilderness and Wild areas. Discussion Draft; 25 October 2012; 17 p.

<sup>6</sup> Dudley, N. (Ed.) (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86pp

register (Chapter 4) and to select suitable databases for a wilderness indicator, which allows the calculation of wilderness index values for certain areas or regions (Chapter 5).

Generally, three ‘zones’ can be distinguished in wilderness areas: i.e.

- a) a *core zone* with a predominance of natural processes and a minimal human interference, surrounded by
- b) a *buffer zone* with a relatively low impact of human activities, which in turn is surrounded by
- c) a *transition zone* where a range of human activities is permitted but under certain restrictions.

In the buffer zone, emphasis is mostly on *restoration/rewilding*<sup>7</sup> of natural habitats and processes. And where feasible, parts of this zone might in the short or longer term be incorporated into the core zone and expand outwards over time into the transition zone.

This structure offers best protection of key wilderness principles, allowing potential for future expansion and interaction with other forms of land use<sup>8</sup>.

We make a distinction between wilderness and wild areas (or wild lands):

*Wild areas have a high level of predominance of natural processes and natural habitat. They tend to be more fragmented than wilderness areas, although they often cover extensive tracts. The condition of their natural habitat, processes and relevant species is however often partially or substantially modified by human activities such as livestock herding, fishing, forestry, sport activities or general imprint of human artefacts*<sup>9</sup>.

Through certain management measures wild areas can often be developed to wilderness, for instance by removing all forms of human interference and/or by interconnecting fragmented wild zones in an area by removal or bridging of ecological barriers. A minimum of 10,000 hectares for the core zone seems ecologically reasonable, allowing the effective ecological functioning of natural processes. The minimum size, however, will be dependent on ecosystem types involved and local geography.

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<sup>7</sup> *Restoration* involves reinstatement of natural habitats and processes, eventually together with reintroduction of wildlife, i.e. indigenous species appropriate to the area at present time. *Rewilding* is the return of an area to a wild natural condition by initiating, stimulating and allowing natural processes to become predominant again.

<sup>8</sup> Wild Europe (2012). A Working Definition of European Wilderness and Wild areas. Final version; 25 October 2012; 17 p.

<sup>9</sup> Wild Europe (2012). A Working Definition of European Wilderness and Wild Areas. Final version; 25 October, 2012; 17 p.



## 2 European database on protected areas

Protected areas today cover a relatively large part of Europe, with almost 21 % of the territory of EEA member countries and cooperating countries consisting of protected areas<sup>10</sup>. A 'protected area' is any site with defined boundaries classified or designated by countries under legislation primarily aiming at nature conservation i.e. at the protection, management and restoration of species, habitats and ecosystems. The most important international legal agreements for protected areas in Europe are the UN Convention on Biological Diversity and the EU Birds and Habitats Directives. Protected areas (PAs) in Europe are registered in the European CDDA (Common Database on Designated Areas) database.

### 2.1 CDDA database

The European inventory of nationally designated areas holds information about protected sites and about the national legislative instruments, which directly or indirectly create protected areas<sup>11</sup>. The CDDA database managed by EEA contains data on individual nationally designated sites and designations in EEA member and collaborating countries<sup>12</sup>.

The inventory began under the CORINE program and is now maintained for EEA by the European Topic Centre on Biological Diversity (ETC/BD) and is annually updated through EIONET. This is a partnership network of the EEA and its member and cooperating countries involving approximately 1000 experts and more than 350 national institutions. The network supports the collection and organisation of data and the development and dissemination of information concerning Europe's environment. EEA provides the European inventory of nationally designated areas to the WDPA and to Eurostat. The nationally designated areas data can also be queried online in the European Nature Information System (EUNIS). The inventory is the national module of the CDDA database, which also includes information on areas designated under European Community legislation and areas designated under international conventions.

The designation types of protected areas are classified according to three categories:

- Category A: Designation types used with the intention to protect fauna, flora, habitats and landscapes (the latter as far as relevant for fauna, flora and for habitat protection).
- Category B: Statutes under sectorial, particularly forestry, legislative and administrative acts providing an adequate protection relevant for fauna, flora and habitat conservation.
- Category C: Private statute providing durable protection for fauna, flora or habitats

The CDDA database is including category A mainly.

For non-EU countries, the list is based on the data being prepared under the Emerald network of the Bern Convention. As Emerald is being developed on the same scientific and technical basis, the same coding principles are applied.

<sup>10</sup> EEA (2012). Protected areas in Europe –an overview. EEA Report No 05/2012. Copenhagen. 130 p.

<sup>11</sup> A nationally designated area is an area designated by a national designation instrument based on national legislation.

<sup>12</sup> <http://dd.eionet.europa.eu/datasets/latest/CDDA/tables/designations>

The 2011 CDDA data set covers 52 countries with over 120,000 records in the database and over 112,000 spatial records (Table 2.1). EEA is responsible for data collection from EEA member and collaborating countries (39), while UNEP-WCMC (United Nations Environment Programme-World Conservation Monitoring Centre) is responsible for collection of data from several other European countries (13) (Table 2.1).

In 39 countries in the European territory, on average 16 % of the terrestrial area has been designated as a national protected area<sup>13</sup>.

The CDDA database contains both spatial data (i.e. boundaries) and attribute data (i.e. information) about protected areas. The spatial data are represented by shapefiles in polygon format (ArcGIS) and a geographic location (latitude and longitude) as point data.

### **2.1.1 Restrictions on data dissemination**

EEA does not have permission to distribute some or all sites reported by Austria, Bulgaria, Estonia, Ireland, Malta, the Netherlands, Romania, Spain and Turkey. Copyright has to be mentioned for Estonia, Finland, Germany and Slovenia.

### **2.1.2 Relation with the WDPA database**

The CDDA database is part of the worldwide WDPA database, based on a memorandum of understanding between EEA and UNEP/WCMC (2007). There is on- going joint work of the two organisations on the European content of the global database.

The WDPA is a global spatial dataset on marine and terrestrial protected areas<sup>14</sup>. It is managed at UNEP-WCMC in Cambridge, UK, supported by IUCN staff and World Commission on Protected Areas (WCPA) members all over the world. Since 1981, UNEP-WCMC through its Protected Areas Program has been compiling this information and making it available to the global community<sup>15</sup>. It relies on work carried out by staff in institutions covering every country in the world.

In 2010, the website Protected Planet was launched ([www.protectedplanet.net](http://www.protectedplanet.net)) by a joined action of UNEP and IUCN. This is an interactive, social media-based website that provides information on 150,000 protected areas worldwide. Protected Planet is an initiative that makes digital information about national parks and protected areas available for global internet users, with the 'citizen science' approach enabling anyone to edit and contribute to protected areas information. A WDPA team has prepared data standards with instructions on data requirements and the conditions of submitting data to the WDPA<sup>16</sup>. The WDPA contains both spatial (i.e. boundaries) and attribute (i.e. information) data of protected areas.

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<sup>13</sup> EEA (2012). Protected areas in Europe –an overview. EEA Report No 05/2012. Copenhagen. 130 p.

<sup>14</sup> <http://www.wdpa.org/>

<sup>15</sup> <http://www.unep-wcmc.org/>

<sup>16</sup> <http://www.wdpa.org/PDF/WDPA%20Data%20Standard.pdf>

## 2.2 IUCN Management categories

The term ‘*protected area*’ embraces a wide range of different management approaches, from highly protected sites where few if any people are allowed to enter, through parks where the emphasis is on conservation but visitors are welcome, to much less restrictive approaches where conservation is integrated into the traditional (and sometimes not so traditional) human lifestyles or even takes place alongside limited sustainable resource extraction. Some protected areas ban activities like food collecting, hunting or extraction of natural resources while for others it is an accepted and even a necessary part of management (Dudley, 2008<sup>17</sup>).

The IUCN set out the following definition of a “protected area” (Dudley, 2008):

*‘A protected area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.’*

According to the CBD ‘*Protected area*’ means a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives<sup>18</sup>.

The IUCN-WCPA<sup>19</sup> has distinguished the following six categories of protected areas. These are areas managed mainly for:

- I: Strict protection (Ia Strict nature reserve; Ib Wilderness area)
- II: Ecosystem conservation and protection (i.e. National park)
- III: Conservation of natural features (i.e. Natural monument)
- IV: Conservation through active management (i.e. Habitat/species management area)
- V: Landscape/seascape conservation and recreation (i.e. Protected landscape/seascape)
- VI: Sustainable use of natural resources (i.e. Managed resource protected area)

The IUCN protected area *management categories* are a global framework, recognised by the Convention on Biological Diversity, for categorizing the variety of protected area management types. They classify protected areas according to their management objectives. The categories are recognised by international bodies and by many national governments as the global standard for defining and recording protected areas and as such are increasingly being incorporated into government legislation.

The way individual countries apply these categories to their own context, however, is quite variable and is the cause of much debate<sup>20</sup>. For instance, national parks are differently defined by the national legislation in various countries, and protected areas called ‘national parks’ can be found in several of the IUCN protected area categories. Sometimes national legislation makes reference to the IUCN management categories but interprets these in different ways. There is sometimes confusion about the relationship between the definition of conservation objectives for a protected area and its classification.

<sup>17</sup> Dudley, N. (Ed.) (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86 pp.

<sup>18</sup> CBD Programme of Work on Protected Areas; <http://www.cbd.int/protected/pacbd/>

<sup>19</sup> WCPA: World Commission on Designated Areas (commission of the IUCN); is one of the six voluntary Commissions of IUCN and is administered by the Programme on Protected Areas at IUCN’s headquarters in Gland, Switzerland.

<sup>20</sup> EEA (2012). Protected areas in Europe — an overview. EEA Report No 05/2012. Copenhagen. 130 p.

Additionally, difficulties are often encountered in interpreting the categories system for large protected areas. These may have elements and respective management objectives that correspond to two or more management categories. The guidelines recommend that each individual protected area be assigned to a particular category, based on its primary objective. *In order to establish the appropriate category, at least 75% and preferably more of the area must not be in conflict with that primary purpose.*

Sometimes one category ‘nests’ within another. For instance, national parks (category II) often contain category Ia and Ib areas. This is entirely consistent with the application of the IUCN categories systems for management objectives, providing such areas are identified separately for accounting and reporting purposes<sup>21</sup>.

Furthermore, there are sometimes complications with the use of category II (National park). Sometimes there is a strong political pressure to ensure that such areas are so classified in the national list, whilst the management objectives do not fulfill the requirements of category II<sup>22</sup>.

The CDDA database includes information on which IUCN management category applies to nationally designated sites in Europe. So far, this information has been provided for almost 70 % of the sites across the 39 EEA countries. However, in the case of the Flemish part of Belgium, parts of Greece, Slovakia, Slovenia, Spain and Turkey, the data are either lacking or incomplete. These data are also lacking or not used at all for very small sites in Scandinavia. In Estonia, IUCN management categories are allocated to each different management area within a designated site<sup>23</sup>.

Most relevant for wilderness are the categories Ia, Ib, II and VI. These are summarized in Annex 1, based on texts of the IUCN-guidelines.

Category Ia, ‘*strict nature reserves*’, are strictly protected areas set aside to protect biodiversity and geodiversity features, and are free of significant human intervention which usually implies limiting access and excluding settlement and any forms of land use. They are strictly controlled and limited to ensure the protection of nature conservation values. They mostly have a full set of native habitats and species with intact ecological processes. They can represent wilderness qualities, especially when these areas are large enough to ensure integrity of ecosystems.

Category Ib, ‘*wilderness area*’, are natural areas with a high degree of intactness, undisturbed by significant human interference, free of modern infrastructure (roads, pipelines, power lines, cellphone towers, oil and gas platforms etc.), where natural processes prevail. They are protected to preserve their natural condition. Category Ib areas are mostly areas with high wilderness qualities. In Nordic countries indigenous communities can maintain here their traditional wilderness-based lifestyle.

Category II, ‘*National park*’, are protected natural or near natural areas set aside to protect large-scale ecological processes, and to promote education and recreation. Visitor use is managed for educational, cultural and recreational purposes in a way that will not cause significant ecological degradation. Many

<sup>21</sup> <http://data.iucn.org/dbtw-wpd/edocs/1999-048-2.pdf>

<sup>22</sup> <http://data.iucn.org/dbtw-wpd/edocs/1999-048-2.pdf>

<sup>23</sup> EEA (2012). Protected areas in Europe –an overview. EEA Report No 05/2012. Copenhagen. 130 p.

national parks have zoning, with core zone(s) characterised by non-intervention management. These represent wilderness qualities.

Category VI, '*protected area with sustainable use of natural resources*', are protected areas to conserve ecosystems and habitats together with associated cultural values and traditional natural resource management systems to preserve biodiversity in such a way to provide products and ecosystem services for the community. They are generally large with most of the area in a natural condition. Most category VI areas do not represent wilderness qualities. Finland, however, has assigned this category to many of their wilderness areas, because of subsistence use of resources for reindeer herding by the Sámi people<sup>24</sup>.

## 2.3 Natura 2000 database

Natura 2000 is the ecological network of protected areas in the EU27, set up to ensure the survival of Europe's most valuable species and habitats. It is comprised of Special Areas of Conservation (SAC) designated by Member States under the Habitats Directive, and also incorporates Special Protection Areas (SPAs) which they have designated under the 1979 Birds Directive.

Every site in the database has a unique code which comprises nine characters and consists of two components. The first two characters represent the country code; the remaining seven characters create a unique alphanumeric code for each site.

Besides general information on attributes such as size, location, latitude and longitude, Nuts code, biogeographical region, date of designation, protection status, ownership, and responsible management body, the database holds for each site information on species and habitats for which the site is designated. The elaboration of GIS features for Natura 2000 is an ongoing project, which has not yet been completed. The Natura 2000 GIS is up and running since 2010 (<http://www.eea.europa.eu/themes/biodiversity/document-library/natura-2000/natura-2000-network-statistics/area-calculations-2007-to-2009/gis-area-of-natura-2000-network>). Both the European descriptive database and the GIS features are managed by DG Environment with support of EEA and ETC/BD. The database is updated twice a year.

### 2.3.1 Overlap with CDDA database

For almost all 27 EU Member States, protected areas listed in the CDDA partly overlap with Natura 2000 sites designated under the habitats and birds EU directives. The degree of overlap between CDDA and Natura 2000 sites is known and has been published in the 2012 EEA protected area report<sup>25</sup>. This overlap varies from almost 100% for certain MS (e.g. Latvia, Estonia) to less than 5% for others (e.g. Cyprus, Ireland, and Luxembourg). Different countries follow different approaches<sup>26</sup>. Some countries have the same site designated as a national site and as a Natura 2000 site, other countries have part of the Natura 2000 site designated as a national site or vice versa (Fig. 2.1)

<sup>24</sup> <http://data.iucn.org/dbtw-wpd/edocs/1999-048-2.pdf>

<sup>25</sup> EEA (2012). Protected areas in Europe –an overview. EEA Report No 05/2012. Copenhagen. 130 p.

<sup>26</sup> EEA (2012). Protected areas in Europe –an overview. EEA Report No 05/2012. Copenhagen. 130 p.

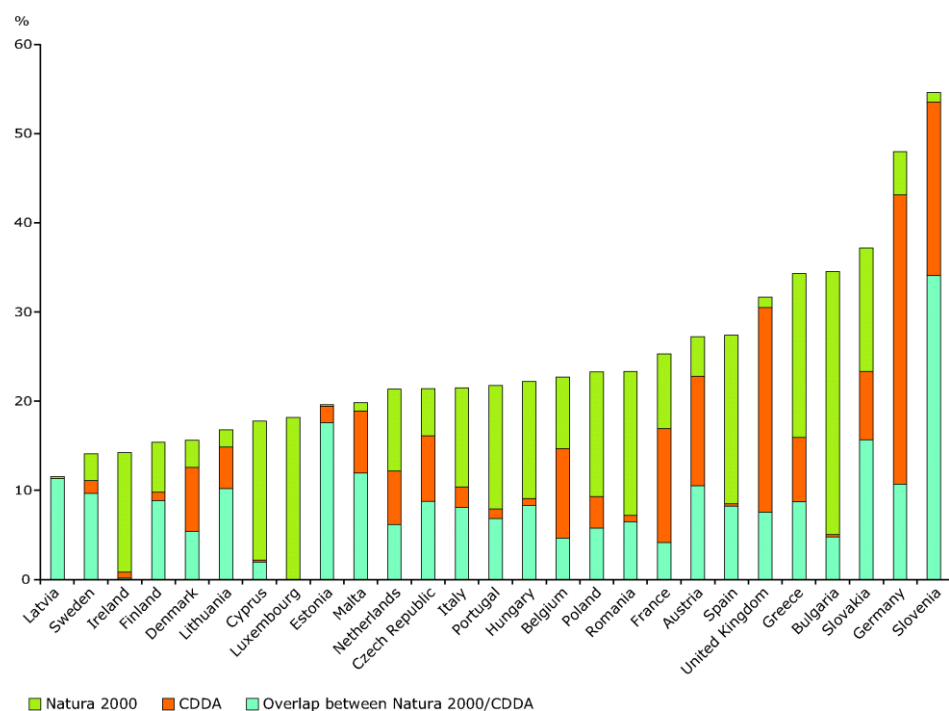


Figure 2.1. Share of terrestrial area designated in EU Member States under Natura 2000 and national designations (EEA, 2012<sup>27</sup>).

<sup>27</sup> EEA (2012). Protected areas in Europe –an overview. EEA Report No 05/2012. Copenhagen. 130 p.

### 3 Biodiversity indicators

The pan-European initiative, SEBI 2010 (Streamlining European 2010 Biodiversity Indicators), was launched in January 2005 to develop a European set of biodiversity indicators for assessing and informing about progress in halting biodiversity loss. The EEA has worked on developing this set since 2005, in collaboration with countries, international organisations, non-governmental organisations, the European Commission and the UNEP. What is now ready is a detailed description of each of the indicators (26), complete with methodological data, i.e. how to calculate and use them<sup>28</sup>.

One challenge when developing the set of indicators has been to find indicators with good geographical coverage, i.e. indicators which can be calculated for countries at a pan-European scale. Other challenges have been to boil the set down to a manageable number of indicators, and to choose the ones that are most helpful to reach policy objectives.

The wilderness indicator, when available, will be added to the set of biodiversity indicators managed by EEA.

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<sup>28</sup> <http://www.eea.europa.eu/publications/streamlining-european-biodiversity-indicators-2020>



## 4 Wilderness register

### 4.1 Objective

The aim of compiling a wilderness register is to improve data availability at the level of countries all over Europe, and make it possible for countries to set their own priorities for maintenance and improvement of wilderness quality at their national territory, with specific attention for trans-boundary areas since, like biodiversity, wilderness is no respecter of political boundaries. In the long run the wilderness register should give support on protection prioritising.

The wilderness register exist of a tabular database in MS Access with attribute data; a spatial database (GIS-based) with information on boundaries represented by shapefiles in polygon format and point data (latitude, longitude in appropriate projection) has to be added in the future. This information has to be made available by consultation of local authorities.

The register has the form of a stand-alone database, but can be linked to the CDDA database via the unique identifier.

The identification of potential threats of wilderness areas was *not* part of this contract, but might be a next step in the protection of wilderness areas in Europe (see recommendations, Chapter 6).

### 4.2 Data sources

The register is primarily based on the CDDA database of protected areas. The register covers the main part of the European territory (39 countries), i.e. EU27 + 6 candidate Member States (Croatia, Macedonia, Iceland, Montenegro, Serbia, Turkey) + 6 other countries being EEA members (Albania, Bosnia-Herzegovina, Kosovo, Liechtenstein, Norway, Switzerland). Therefore, parts of the Emerald network (outside Natura 2000) are included as well (Table 4.1)<sup>29</sup>. Not included are Russia and other parts of the former Soviet Union.

The selection of the 39 countries had mainly a practical reason: they are all member of EEA or collaborate with EEA, and provide data for the CDDA database, managed by EEA and ETC/BD. This database was the basic data source, as it contains information on nationally designated protected areas and their main conservation objectives.

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<sup>29</sup> The Emerald network is an ecological network to conserve wild flora and fauna and their natural habitats of Europe, which was launched in 1996 by the Council of Europe as part of its work under the convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) that came into force on June 1, 1982. The Emerald network is a network of areas of special conservation interest (ASCIs), which is to be established in the territory of the contracting parties and observer States to the Bern Convention, including, among others, central and east European countries and the EU Member States. It comprises 45 countries, many of which are outside the EU. Natura 2000 is considered to be the EU contribution to the Emerald Network. For non-EU members, The Emerald network is still in its initial phase and has nominated 1,280 sites covering almost 95,000 km<sup>2</sup>.

The Natura 2000 database was *not* used as a primary data source. This database contains no information on management objectives and ‘wilderness protection’ is not distinguished as a special provision within the Natura 2000 framework. Therefore, from the database we do not have any information on these areas which might qualify them as wilderness. Moreover, for many countries there is a rather big overlap between CDDA and Natura 2000 databases (see paragraph 2.3), and therefore the chance that wilderness areas would be ‘missed’ because we relied mainly on the CDDA database was rather small.

During the verification process, data managers of National Focal Points (EIONET) have been asked to add Natura 2000 sites to the list in case they entail wilderness qualities (see paragraph 4.5). This acts to further minimise the chance of overlooking sites with wilderness qualities. In incidental cases this has been done by NFPs (see Annex 4).

Another approach we followed was by overlaying the European wilderness map (based on a wilderness indicator developed in this contract; see Chapter 5) with the Natura 2000 map, to identify those Natura 2000 sites with high wilderness qualities, but were not included in the CDDA database. This exercise resulted in the identification of a restricted number of sites which potentially might have wilderness qualities. For the results of this approach see paragraph 5.8.1

#### **4.2.1 IUCN Management categories**

Based on the CDDA database (vs.9/full version), a preliminary list was compiled of protected areas where wilderness qualities might occur. Protected areas of the following IUCN management categories were selected:

- Ia/Ib: *Strict nature reserve / Wilderness area*
- II: *National park*; some protected areas contain zones classified and mapped by law as having different management objectives than the protected area itself. For example, national parks can contain wilderness areas which have a stricter management regime than the national park they reside in.
- VI: *Protected area with sustainable use of natural resources*; Finland (and possibly Estonia) uses this category for part of their protected areas/zones within designated areas with wilderness qualities (see Fig. 4.1). Finland is under way with assignment and reassignment of categories for all state-owned protected areas. It is very likely that all present category VI sites will be reassigned to category Ib.

For the relevance of these management categories for wilderness, see paragraph 2.2.

#### **4.2.2 Size criterion**

Protected areas in the CDDA database of category Ia/Ib encompass areas from less than one hectare to >500,000 ha. To be able to make a pre-selection of potential wilderness areas, we used a minimum size criterion.

From an ecological point of view it can be argued that a wilderness area should meet minimum size features, i.e. is large enough for the effective ecological functioning of natural processes (see working

definition in paragraph 1.2). The spatial scale needed for maintaining the ecological integrity of a natural area determines its minimum size (i.e. scale needed for undisturbed natural ecological processes and viable species populations). Of course, this will be largely dependent on the ecosystem types involved.

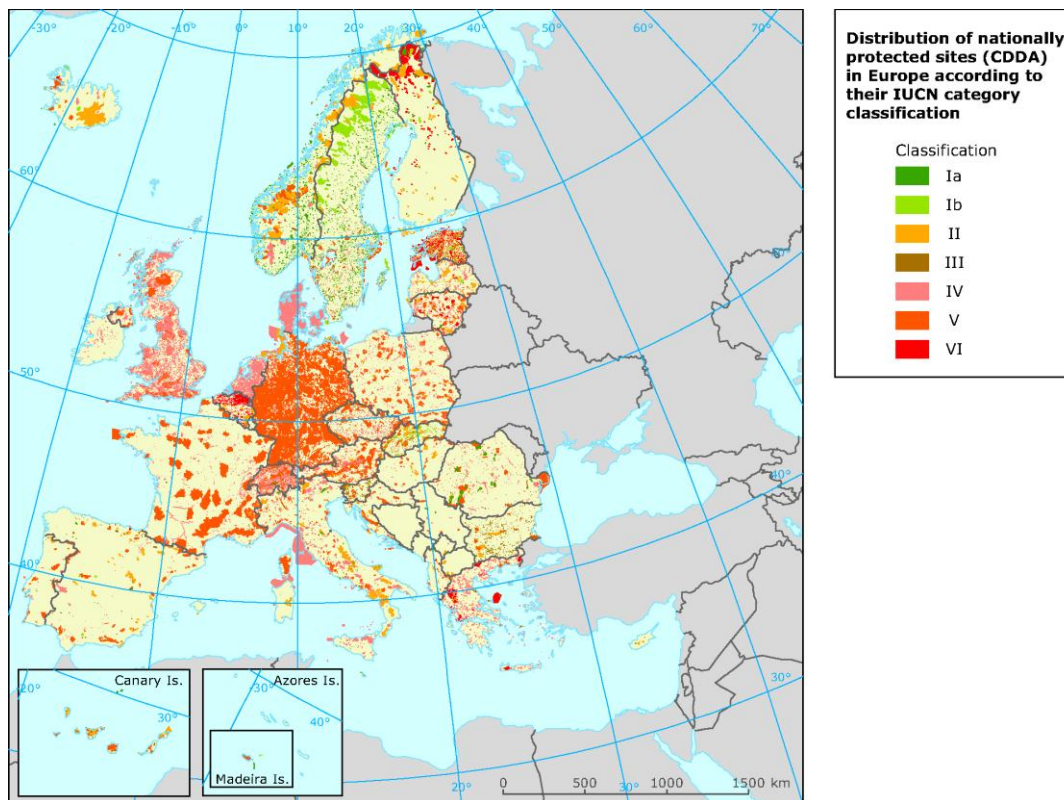


Figure 4.1. Distribution of nationally protected areas (CDDA) in Europe according to their IUCN category classification (EEA, 2012<sup>30</sup>).

The IUCN guidelines do not use any minimal size limit for a wilderness area (Category Ib). Sweden, by the Swedish Environmental Protection Agency (SEPA), has decided on additional standards for IUCN category Ib; one of them is:

- areas should be larger than 1,000 ha in northern Sweden and larger than 500 ha in southern Sweden<sup>31</sup>.

The US Wilderness Act (1964) mentions a minimum size of 5,000 acres<sup>32</sup>. The US Forest Service uses the following criterion<sup>33</sup>:

1. They contain 5,000 acres or more (~2,000 ha).
2. They contain less than 5,000 acres but:  
due to physical terrain, natural conditions can be preserved;

<sup>30</sup> EEA (2012). Protected areas in Europe –an overview. EEA Report No 05/2012. Copenhagen. 130 p.

<sup>31</sup> <http://www.europarc.org/uploaded/documents/313.pdf>

<sup>32</sup> US Wilderness Act (1964) <http://www.wilderness.net/index.cfm?fuse=NWPS&sec=legisAct>

<sup>33</sup> <http://www.wilderness.net/index.cfm?fuse=NWPS&sec=designateFS>

- they are self-contained ecosystems, such as an island, that can be effectively managed as a separate unit of the National Wilderness Preservation System;
- they are contiguous to existing wilderness, primitive areas, administration-endorsed wilderness, or potential wilderness in other Federal ownership, regardless of their size;
- 3. They do not contain improved roads maintained for travel by standard passenger-type vehicles, except a permitted in areas east of the 100th meridian.

PAN Park Foundation is working on a network indicated as European Wilderness Preservation System<sup>34</sup>. There is a growing amount of protected areas assessed as 'Wilderness Partners' and as 'Certified PAN Parks' under criteria established by PAN Parks in support of wilderness<sup>35</sup>:

#### 1. *Wilderness Partner*

The protected area has an ecologically unfragmented wilderness area of at least 1,000 hectares (with the potential to grow up to 3,000 hectares) where no extractive uses are permitted and where the only management interventions are those aimed at maintaining or restoring natural ecological processes and the ecological integrity.

#### 2. *Certified PAN Parks Wilderness*

The protected area has an ecologically unfragmented wilderness area of at least 10,000 hectares where no extractive uses are permitted and where the only management interventions are those aimed at maintaining or restoring natural ecological processes and the ecological integrity.

According to the Working definition document of Wild Europe any new core area to be labeled as 'wilderness' should have a core area of at least 3,000 hectares. However, a minimum size of 10,000 hectares seems ecologically reasonable for an effective ecological functioning of natural processes.

For the Wilderness register we adopted a minimum threshold value for a wilderness core zone of **3,000 hectares**.

For the *pre-selection*, however, we have chosen a minimum size of 2,500 hectares. By using a slightly smaller threshold size for the pre-selection procedure, it was assured that also those protected areas were included in the pre-selection which have the potential to meet the size criterion at short term.

Applying the size criterion on the CDDA list of protected areas resulted in a preliminary list of ca. 700 protected sites (38 countries; see Table 4.1). Areas smaller than 2,500 hectares were not taken into consideration, unless it was clear that smaller core zones with a singular CDDA code were part of the same protected area.

### 4.2.3 Size distribution of the pre-selection of protected areas

The size distribution of the selected areas on the preliminary list is presented in Figure 4.2. Although a considerable number of PAs is relatively small in size (<5,000 ha), a substantial number (n=351; 50%) has a size of >10,000 hectares.

<sup>34</sup> <http://www.panparks.org/what-we-do/the-million-project/wilderness-preservation-system>

<sup>35</sup> <http://www.panparks.org/learn/partnerships-for-protected-areas/apply-for-verification>

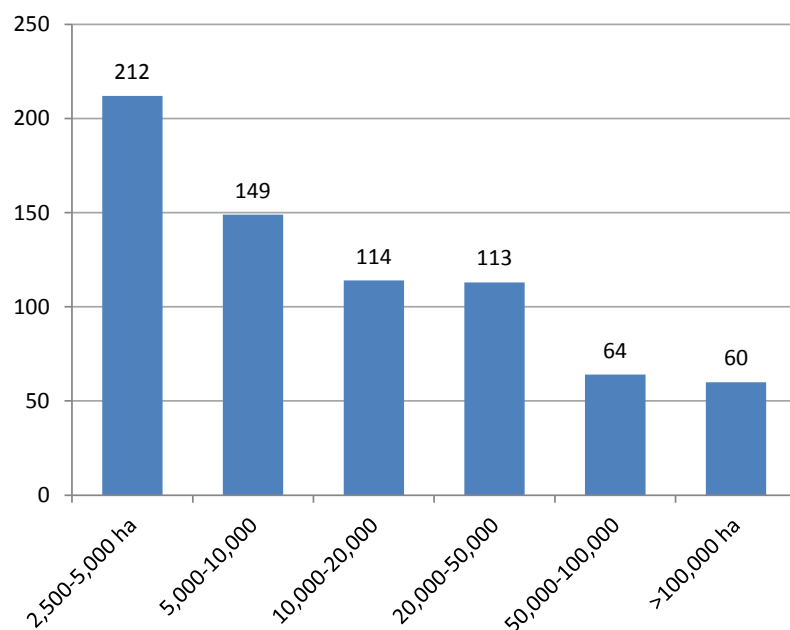


Figure 4.2. Number of protected sites per size class on the preliminary list (n=717).

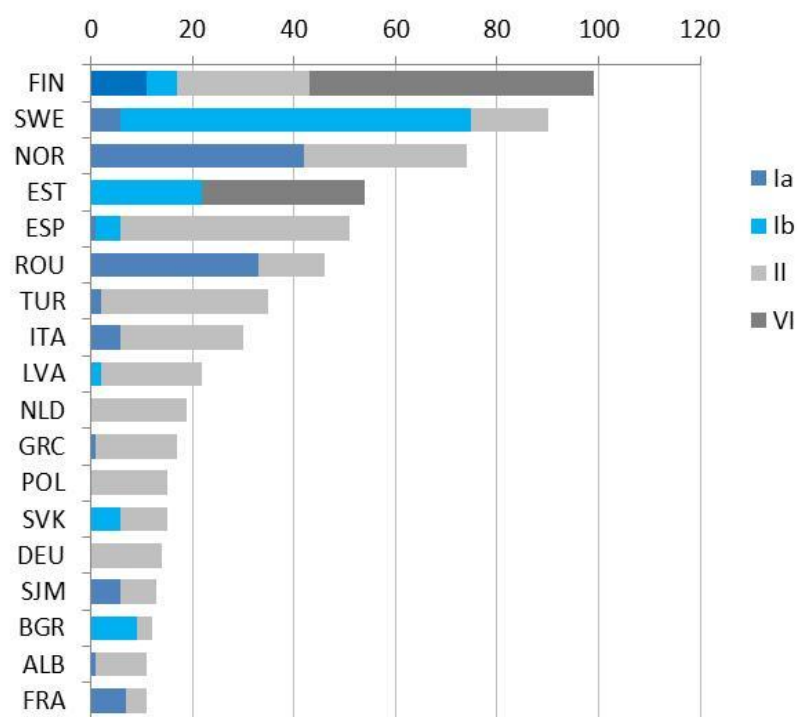


Figure 4.3. Number of pre-selected protected sites per country and IUCN category (only countries with >10 selected sites are presented).

Table 4.1. Number of protected sites per country for each IUCN management category, as selected from the CDDA database.

	IUCN Category				Total
	Pre-selected				
Country	Ia	Ib	II	VI	Total
ALB	1		10		11
AUT			5		5
BEL			9		9
BGR		9	3		12
BIH			4		4
CHE	1				1
CYP	1	1	2		4
CZE		1	3		4
DEU			14		14
DNK		2	1		3
ESP	1	5	45		51
EST		22		32	54
FIN	11	6	26	56	99
FRA	7		4		11
GRC	1		16		17
GRL		5	1		6
HRV			8		8
HUN			5		5
IRL			5		5
ISL	1	2	4		7
ITA	6		24		30
LTU	4		5		9
LUX			2		2
LVA		2	20		22
MKD	1		3		4
MNE			4		4
NLD			19		19
NOR	42		32		74
POL			15		15
PRT	2	2	1		5
ROU	33		13		46
SJM	6		7		13
SRB			2		2
SVK		6	9		15
SVN			1		1
SWE	6	69	15		90
TUR	2		33		
XKX			1		1
Total	126	132	371	88	717

#### 4.2.4 Countries missing

BIH (Bosnia-Herzegovina): has not assigned IUCN categories to most of their protected areas, with only a few exceptions (where categories II and V are used);

GBR (United Kingdom): has protected areas designated mainly under IUCN categories IV and V only;

TUR (Turkey): has not assigned IUCN categories to any of their protected areas in CDDA vs. 9, but in CDDA vs. 8 it has; therefore, this previous version was used for Turkey.

#### 4.2.5 Set of measurable criteria for verification

Derived from the working definition ( paragraph 1.2), a set of measurable criteria was developed. This allowed us to judge if a protected site has *sufficient* wilderness qualities in line with the working definition for wilderness.

*Wilderness qualities* are related to scale, naturalness of landscape features and habitats, remoteness from access and settlement, and absence of any form of human interference..

Therefore, for inclusion in the wilderness register, information is needed on the following attributes:

- a) zonation
- b) size of the core zone with non-intervention management
- c) extent of management measures (e.g. restoration) and human interference

Forms of human interference affecting wilderness qualities can be:

- d) habitation/settlements/resorts for tourists
- e) road building/motorised access
- f) extraction of natural resources (logging, fishing, hunting, grazing with domestic stock, mining, etc.)
- g) habitat management
- h) wildlife management (e.g. culling)

For compilation of the wilderness register, this list of attributes was translated to a set of measurable criteria (Table 4.2):

Table 4.2 Set of measurable criteria used for qualifying protected areas as 'wilderness'.

Core zone	The core zone measures at least 3,000 hectares, there can be two or more cores in the area (adding up to a surface of at least 3,000 ha), if linked and with a plan for full amalgamation.
Effective ecological functioning of natural processes	Of sufficient size for the effective ecological functioning of natural processes, for the preservation of biodiversity and the maintenance of evolutionary processes.
Undeveloped or only slightly modified	A high degree of ecological intactness, with a large percentage of original ecosystems and complete or near-complete native floral and faunal species assemblages.
No habitation	Without habitation or permanent settlements.
No infrastructure	The area should be free of modern infrastructure or development; no pipelines, power lines, or cell phone towers; no roads or a plan for removal of existing infrastructure; except traditional gathering sites required by indigenous people to practice their traditional reindeer herding; in Finland wilderness legislation already exists to permit certain activities, and these cannot thus be legally excluded.
No motorised access	Preferably highly restricted or no motorised access. Areas are only free to public access on foot; no wheels or motorised access for recreational use; only access is allowed in cases of emergency for safety reasons or for law enforcement (ranger service).
No habitat management	No interference that affect natural habitats and processes.
Wildfire control	Only if needed for e.g. public safety.
No wildlife management	None, except by exceptional agreements under existing wilderness legislation in Nordic countries, so long as there is no significant impact on biodiversity. No re-stocking except for restoration purposes.
No livestock	None, except in exceptional circumstances for indigenous people (only in Nordic countries, where wilderness legislation exists and reindeer herding is included).
No extraction of natural resources	No commercial extraction of natural resources; no collecting of berries, nuts, mushrooms, wood, fish etc.; except by special agreements for indigenous people in Nordic countries; in case of extensive and local livestock grazing or fishing, there should in any case be no significant impact on biodiversity.
Tourism and recreation	Activities allowed if not requiring built infrastructure. Tourism activities permitted under strict 'leave no

	<i>trace</i> ' rules. There should be no ecological impact. Ample opportunities to experience 'sense of solitude'.
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### *Zoning*

In some countries, such as Estonia, management categories are allocated to each different management zone within a designated area. In several other countries, categories Ia/Ib are embedded in IUCN management categories II or V<sup>36</sup>. This means that in statistics on protected areas there is 'doubling'. In those cases, the sub-areas were added in the Register, with additional information on zoning and on those protected areas in which they are embedded.

### *Infrastructure*

The issue of 'no infrastructure' in the wilderness definition is interpreted as follows:

- Infrastructure in wilderness areas:
  - a) Soft tourism infrastructure offering opportunity for visitors to experience wilderness e.g. trails, bridges, sign, shelters, etc. To certain extent this is possible also in wilderness area but have to respect certain rules e.g. minimise visual disturbance.
  - b) Infrastructure used for PA/wilderness zone management purpose e.g. old roads, cabins, etc. Exceptionally use of existing old gravel road in large and remote wilderness areas e.g. northern part of Scandinavia for monitoring, patrol, safety and rescue.
  - c) Existing infrastructure of regional/national/international purpose e.g. power lines, water dams and reservoir, etc. Generally these infrastructures should not be inside of wilderness areas but it's likely that some exception will come sooner or later e.g. power lines crossing wilderness areas.
- Infrastructure outside of wilderness areas but visible from wilderness areas:
 

This might be the case in some areas, not only in mountainous areas such as the Alps, but everywhere with open landscape. This is a rather complex issue. Wilderness in Europe is extremely scarce and with this additional criteria of "non-visibility" it will be even less. Therefore it's argued that the visibility of regional/national/international infrastructure from wilderness areas should not be a decisive reason to not qualify a protected area as wilderness area. In specific cases we plea to use 'common sense' to deal with this issue.

In many sites with wilderness qualities there are some forms of infrastructure present. It is important to know whether roads are used only for management purposes or also for the public. We tried to gain information for each potential wilderness areas for this particular point. Mostly this kind of information is not available to NGOs, and sometimes not even in management plans if available. Therefore, this criterion was rather difficult to interpret correctly.

### *Indigenous people and subsistence use of natural resources*

In Nordic countries 'wilderness' may include some forms of traditional land use from local and indigenous people. Indigenous communities can maintain their traditional wilderness-based lifestyle in wilderness areas. Reindeer herding is considered part of the indigenous cultural heritage and is under existing wilderness legislation allowed almost everywhere in the Nordic region. This is the

<sup>36</sup> EEA (2012). Protected areas in Europe –an overview. EEA Report No 05/2012. Copenhagen. 130 p.

traditional way of the Sámi people.. In Finland, reindeer grazing is allowed by the Reindeer Husbandry Act in their Wilderness Reserves and other PAs within the Reindeer Husbandry Area. The (statutory) primary objective for establishment of the Finnish Wilderness Reserves established under the Wilderness Act (1991), was originally not protection of biodiversity, but preservation of wilderness and traditional subsistence livelihoods of the indigenous Sámi and other locals in Lapland.

The reindeer herding has some disturbing elements, especially when motorised vehicles, such as snowmobiles are used. But there are areas, however, where the impact on habitats is small. It cannot be compared, however, with livestock grazing which mostly alters natural habitats.

With the revised Guidelines for Applying IUCN Protected Area Management Categories (2008) came sharpened definitions for PAs and clear explanations for the interpretations of management categories. Interpretation of definitions in the Nordic context was discussed with experts and managers as well as NGOs at seminars in 2012. The IUCN Guidelines from 2008<sup>37</sup> allow for a less strict interpretation of category Ib, compared to the 1994 definitions and interpretations in subsequent guidelines (e.g. EUROPARC & IUCN 2000<sup>38</sup>).

#### *Grazing*

Grazing is a rather complicated issue We followed the argument, as written down in the Wilderness definition document (WWG), that no grazing with livestock is allowed in wilderness core zones, or there should be clear plans for phasing out in short time. Traditional reindeer grazing as practiced by indigenous people in the Nordic countries is formally allowed (Sámi rights) under existing wilderness legislation.

#### *Wildlife management*

In many PAs qualifying for wilderness, there are some forms of wildlife management, i.e. hunting, especially in national parks. The absence of large predators results in growing populations of wild ungulates species if no population management is applied. The management of these populations is obviously a contradiction to the effort to increase the naturalness of these areas. Controlled hunting, however, is in many of these national parks permitted in an effort to keep some control on the populations. Therefore, it is important to know if no hunting occurs in the core zone(s). Another aspect is the 'right to hunt' which is often the result of the right of free access to public land and traditional land-use, a common practice in Nordic countries, permitted by wilderness legislation.

#### *Tourism and infrastructure*

Wilderness areas have high landscape and amenity values and for their aesthetic benefits they are often highly preferred destinations for nature tourism, i.e. tourism relying primarily on the natural environment for its attractions or settings. In most wilderness areas tourism and recreation are allowed but under strict conditions and without any built infrastructure. The development of a zoning system to steer visitor pressure while still allowing visitors access to certain parts of the area with

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<sup>37</sup> Dudley, N. (Ed.) (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86pp

<sup>38</sup> <http://data.iucn.org/dbtw-wpd/edocs/1999-048-2.pdf>

specific provisions such as trails, has proven to be a successful approach. although not all wilderness areas are suitable for recreation or ecotourism due to their fragile ecosystems.

#### *Visual disturbance*

To be able to have a ‘real wilderness experience’, it is important that there is no visual disturbance related to human activities to provide a ‘sense of solitude’. From the information available for each PA, this is one of the criteria most difficult to check at the European scale though local scale modelling has included this as a key indicator (e.g. Scotland<sup>39</sup>). No hard criterion can be used here at this scale.

### **4.3 Stakeholder consultations**

Stakeholder consultations were organised to acquire relevant additional data and ensure sufficient quality of the data available. The most relevant stakeholders were national/local NGOs in 39 countries and site managers of protected wilderness and wild areas (listed in Annex 2).

#### *NGOs and local stakeholders*

The preliminary list of protected sites, where wilderness qualities might occur, was sent to local NGOs or other local stakeholders (at least one contact address per country) with the request to check the list of protected areas for their country and to affirm those areas which have a wilderness core zone. For each of those sites they were asked to fill in a data form (see Table 4.3 for an example) to provide additional information. Thereby, it was possible to check if these sites fulfil the criteria set for wilderness (paragraph 4.2.5). This form had a simple as possible design to maximise the response.

The contact points were also explicitly asked to add (protected) areas with wilderness qualities to the preliminary list which are:

- part of the CDDA database, but hidden in other IUCN management categories;
- not in the CDDA database, but qualify as ‘wilderness’, for instance Natura 2000 sites which are not registered in the CDDA database.

The working process is summarised in Figure 4.4.

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<sup>39</sup> Carver, S.J., Comber, A., McMorran, R. & Nutter, S. (2012) A GIS model for mapping spatial patterns and distribution of wild land in Scotland. *Landscape and Urban Planning* 104(3-4), 395-409

## Compilation of a Wilderness register for Europe

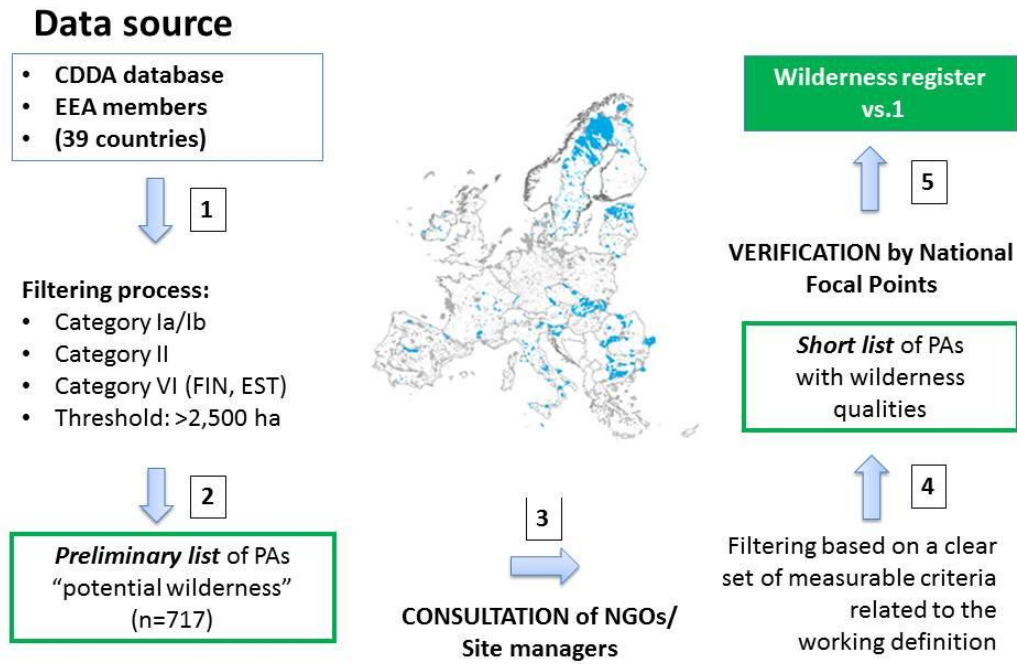


Figure 4.4. The working process for compilation of a wilderness register for Europe.

Table 4.3. Data form to be filled in by national protected area data managers to check the presence of wilderness qualities in protected areas selected from the CDDA database (categories Ia/Ib, II and VI/Finland). As example, the list for France.

CDDA Site code	National code	ISO3	Desig_abbr	Site_name	Site_area	IUCN_category	IUCN-UNEP WDPA website	1. Strictly protected area/wilderness (core) zone*	2. If yes, % of total area	3. Habitation/settlements/resorts	4. Motorised access	5. Habitat management	6. Wildlife management	7. Extractive use of resources	8. Grazing with domestic stock	9. Road building allowed	10. Spatial data available (e.g. shapefiles)	11. Natura 2000 site	12. If yes, provide Natura 2000 site code
								y/n	<25%	25-75%	>75%	y/n	y/n	y/n	y/n	y/n	y/n	y/n	
659	FR3300005	FRA	FR01	Ecrins	91,800	II	<a href="http://www.protectedplanet.net/sites/Ecrins_National_Park_Core_Area">http://www.protectedplanet.net/sites/Ecrins_National_Park_Core_Area</a>												
664	FR3300006	FRA	FR01	Mercantour	68,500	II	<a href="http://www.protectedplanet.net/sites/Mercantour_National_Park_Core_Area">http://www.protectedplanet.net/sites/Mercantour_National_Park_Core_Area</a>												
661	FR3300001	FRA	FR01	Vanoise	52,839	II	<a href="http://www.protectedplanet.net/sites/Vanoise_National_Park_Core_Area">http://www.protectedplanet.net/sites/Vanoise_National_Park_Core_Area</a>												
662	FR3300003	FRA	FR01	Pyrénées Occidentales	45,705	II	<a href="http://www.protectedplanet.net/sites/Pyrenees_Occidentales_National_Park_Core_Area">http://www.protectedplanet.net/sites/Pyrenees_Occidentales_National_Park_Core_Area</a>												
345948	FR2400196	FRA	FR06	Sylve d'Argenson	2,579	Ia	<a href="http://www.protectedplanet.net/sites/Sylve_D_Argenson_Forest_Biological_Reserve">http://www.protectedplanet.net/sites/Sylve_D_Argenson_Forest_Biological_Reserve</a>												
391970	FR2400199	FRA	FR06	Les Maures	2,531	Ia													
142747	FR2400132	FRA	FR06	La Wantzenau	?	Ia	<a href="http://www.protectedplanet.net/sites/La_Wantzenau_Forest_Biological_Reserve">http://www.protectedplanet.net/sites/La_Wantzenau_Forest_Biological_Reserve</a>												
388657	FR3500001	FRA	FR02	Lauvitel	?	Ia													
388658	FR3500002	FRA	FR02	Ilots de Port-Cros	?	Ia													
345944	FR2400193	FRA	FR06	Bois Sauvage	?	Ia	<a href="http://www.protectedplanet.net/sites/Bois_Sauvage_Forest_Biological_Reserve--2">http://www.protectedplanet.net/sites/Bois_Sauvage_Forest_Biological_Reserve--2</a>												
330613	FR2400164	FRA	FR06	Daubensand	?	Ia	<a href="http://www.protectedplanet.net/sites/Daubensand_Forest_Biological_Reserve--2">http://www.protectedplanet.net/sites/Daubensand_Forest_Biological_Reserve--2</a>												
<b>Note: question 2-12 are related to the strictly protected (wilderness) core zone, if present</b>																			
If there is no non-intervention management zone, questions 2-12 can be skipped																			

In the consultation process, 22 local stakeholders from 23 countries have commented on the pre-selection of protected areas with potential wilderness qualities, have provided additional information and have made amendments to the preliminary list of selected PAs (see Annex 2 for a list of NGOs involved in the consultation process).

#### *Site managers*

For those countries for which no response was received from stakeholders (16), individual site managers of protected areas on the list of pre-selected protected areas were contacted. A total of about 100 site managers were requested to provide information on wilderness qualities in their particular protected area. Their response was ca. 50%. They provided detailed information for specific protected areas.

Based on these stakeholder consultations, information on wilderness qualities of protected areas was received for 72% of the pre-selected PAs, thereby ensuring the quality of available data for a large part of pre-selected PAs.

The data forms returned by local stakeholders and site managers are summarised in Annex 4.

### **4.3.1 Short list of confirmed PAs with wilderness qualities**

#### *Category A (wilderness) and B (wild area)*

If for a certain protected area all attributes were in accordance with the wilderness definition (highest possible score: 8), it was nominated as ‘wilderness area’ (category A). In most occasions, however, there were deviations. Those protected areas with a score of at least 5 were nominated as protected areas with a potential to become wilderness, after certain measures have been taken. These areas are qualified as ‘wild area’ and conform the definition presented in paragraph 1.2:

*“Wild areas have a high level of predominance of natural processes and natural habitat. They tend to be more fragmented than wilderness areas, although they often cover extensive tracts. The condition of their natural habitat, processes and relevant species is, however, often partially or substantially modified by human activities such as livestock herding, fishing, forestry, sport activities or general imprint of human artefacts<sup>40</sup>.”*

From the viewpoint of maintaining and increasing wilderness qualities in Europe, and localisation of opportunities for wilderness extension, it is important that these ‘category B’ areas (wild areas) are also included in the database supporting the wilderness register, with an indication of actions to be taken to transform them into wilderness areas (category A).

As such, the compilation of a database composed of category A and B protected areas harbouring wilderness qualities, can benefit protection and restoration of wilderness and wild areas.

#### *Technical working procedure*

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<sup>40</sup> Wild Europe (2012). A Working Definition of European Wilderness and Wild Areas. October, 2012.

Four main criteria were used to differentiate between category A and B, i.e. size, extractive use, subsistence use and infrastructure (Table 4.4). Visual disturbance is also an important aspect affecting the experience of wilderness, but we could not include this as criterion because of lack of available information (see also paragraph 4.2.5).

Table 4.4 Main criteria used to distinguish between category A and B.

Issue	Category A	Category B
Size	minimum 3,000 ha	less than 3,000 ha (but with potential to expand)
Extractive use	none	yes e.g. extensive hunting, fishing, collecting berries and grazing (but with potential to reduce and remove these uses)
Subsistence use	none; with the exception of traditional reindeer herding as practiced by indigenous people in the Nordic countries which is formally allowed (Sámi rights) under existing wilderness legislation	yes e.g. subsistence hunting, fishing, collecting berries and grazing (but with potential to reduce and remove these subsistence uses)
Infrastructure	none (certain compromises are necessary, e.g. existing/old gravel road used for safety, fire control, management, etc.)	yes e.g. existing roads (but with potential to reduce and/or remove them)

#### Category A/B

For six countries with large wild areas, i.e. Finland, Sweden, Norway, Iceland, Greenland and Svalbard/Jan Mayen, we distinguished the wilderness category A/B. Large parts of these areas qualify as category A, but in certain parts there is subsistence use (livestock grazing, fishing, hunting). Because these countries do not apply any zonation in wilderness management, it is not possible to present boundaries between those parts where the criteria set for category A wilderness are fully met, and the parts which should be qualified as category B (wild area). These areas are qualified as category A/B.

## 4.4 Verification by National Focal Points

The consultation of NGOs and site managers resulted in a *short list* of protected areas for each country, qualifying for wilderness, which was checked by the data reporters of the National Focal Points (NFPs; see Annex 4). For each of the 39 EEA members a request for verification of the data in

the draft register was sent to the national contact person. Until the end of the contract (30 June 2013), response was received from 24 countries. Although a reminder was sent, verification stayed pending for 15 countries (for further details see Annex 3).

#### 4.5 Draft wilderness register

The draft wilderness register is made available as MS Access data file. The database encompasses two tables:

- a) a list of PAs qualifying as either wilderness category A, A/B or B with their Natura 2000 status;
- b) a table with details on wilderness attributes as confirmed by site managers, NGOs, local stakeholders and National Focal Points.

The draft register encompasses 522 PAs. Besides category Ia/Ib, a substantial number of PAs with wilderness qualities occur within the core zones of national parks (category II; Table 4.5). Each PA has the CDDA code attached as unique identifier by which it can be linked to the CDDA database.

A total of 284 protected areas are qualified as wilderness category A (or A/B), and another 238 sites of category B. (Table 4.6). Most wilderness areas occur in Finland, Sweden, Norway, Bulgaria, Slovakia, Poland and Romania (Table 4.6; Fig. 4.5).

Detailed information on wilderness qualities of specific protected areas is for each country summarised in Annex 4. Here, all background information can be found on the decision to qualify certain PAs either as category A, A/B or B.

*Table 4.5 Number of protected sites with wilderness qualities per IUCN management category.*

<b>Wilderness category</b>	<b>Ia</b>	<b>Ib</b>	<b>II</b>	<b>VI</b>	<b>others</b>	<b>total</b>
A	14	34	27	-	1	76
A/B	56	40	66	45	1	208
B	46	54	105	9	24	238
Total	116	128	198	54	26	522

*Table 4.6 Number of protected sites with wilderness qualities (category A, A/B or B) per country.*

<b>Country</b>	<b>EU 27</b>	<b>Cat. A</b>	<b>Cat. A/B</b>	<b>Cat. B</b>	<b>Total</b>
ALB				3	3
AUT	+	11			11
BGR	+	22		20	42
BIH				10	10
CHE		1			1
CZE	+	1		1	2
DEU	+	1		13	14
ESP	+			3	3
EST	+	9		8	17
FIN*	+	4	79	16	99

FRA	+			3	3
GRL*			6		6
GRC	+			2	2
HRV	+	4		1	5
ISL*		1	6		7
ITA	+	2		13	15
LTU	+	3		4	7
LUX	+			1	1
LVA	+			3	3
MKD				2	2
MNE				6	6
NLD	+			5	5
NOR*		1	72		73
POL	+	6		16	22
PRT	+	1		3	4
ROU	+	6		14	20
SJM*			13		13
SRB	+	1			1
SVK	+			26	26
SWE	+	1	32	52	85
TUR		1		13	14
Total		76	208	238	522
EU27	+	72	111	201	384

\*These countries do not apply core areas/zonation in their protected areas. So far, it was not possible to provide spatial information on the boundaries of sub-areas with wilderness A qualities. These PAs are therefore categorised as A/B.

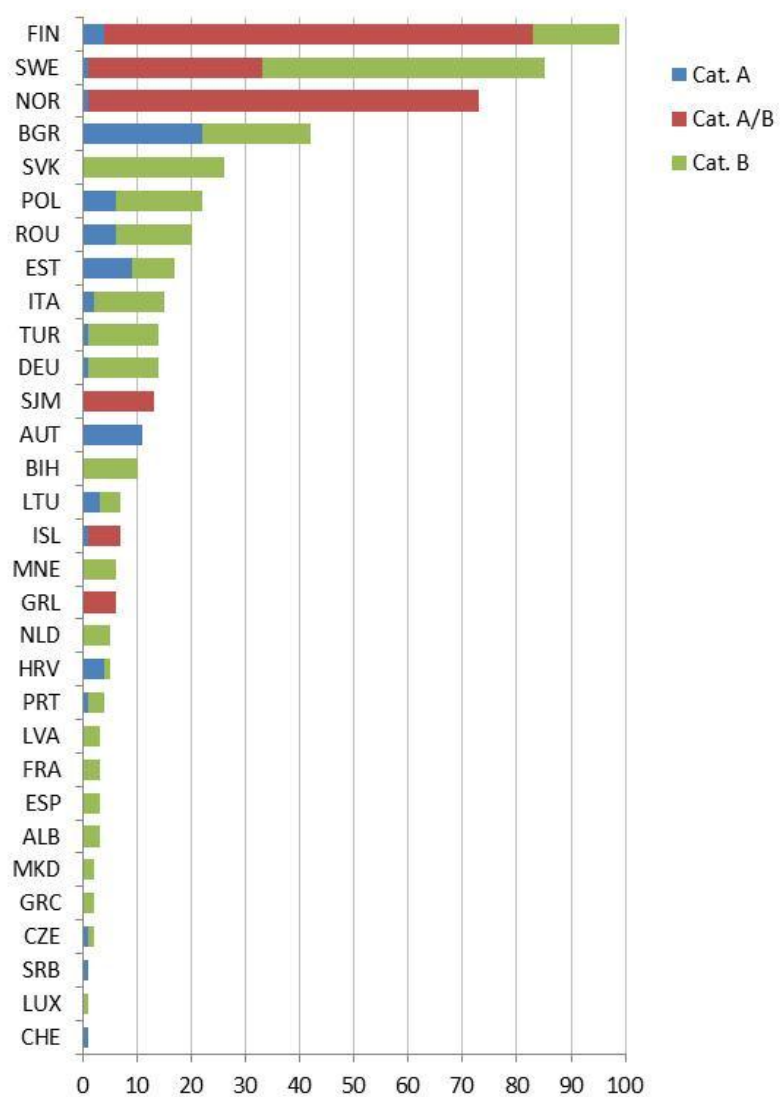


Figure 4.5 Number of wilderness areas (Cat. A, A/B) and wild areas (category B) per country.

Table 4.7 Cover of wilderness areas (in hectares) per country.

	Site areas	Core areas	Site areas	Core areas	Estimated core areas (total)*
	A	A	A/B	A/B	
ALB					
AUT	154,804	78,765			78,765
BGR	54,626	54,626			54,626
BIH					
CHE	17,033	17,033			17,033
CZE	3,615	3,615			3,615
DEU	24,217	12,593			12,593
ESP					
EST	39,281	39,281			39,281
FIN	97,599		2,876,546		1,802,663
FRA					
GRC					
GRL			98,724,420		58,513,889
HRV	56,620	38,494			38,494
ISL	6,559	6,559	1,459,301		891,058
ITA	133,882	59,885			59,885
LTU	55,502	26,223			26,223
LUX					
LVA					
MKD					
MNE					
NLD					
NOR	5,800	5,800	3,330,649		2,024,544
POL	159,912	52,601			52,601
PRT	69,593	5,000			5,000
ROU	72,968	39,277			39,277
SJM			11,782,813		
SRB	19,200	2,963			2,963
SVK					
SWE	38,440	22,140	3,460,424		2,119,542
TUR	37,000	15,758			15,758
	1,046,651	480,613	121,634,153		65,647,266
EU27	980,259	435,463	6,336,970		3,499,124

\*The ratio core area/total area is estimated as 48% (based on the average ratio for those PAs where information on core zones is available).

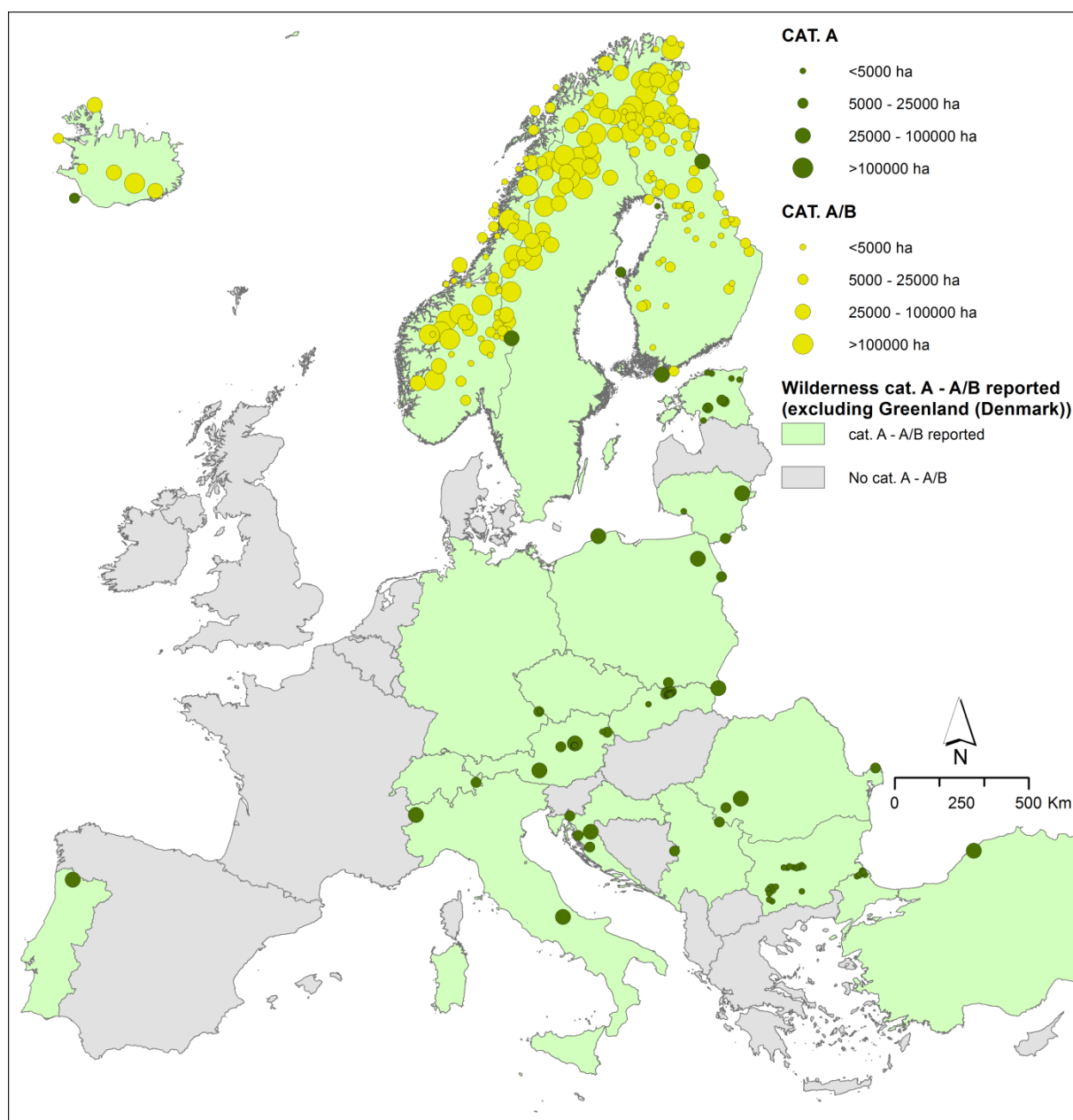


Figure 4.6 Map of wilderness areas (Category A and A/B) included in the draft wilderness register.

#### 4.6 Overlap with Natura 2000

For the Member States of EU27, most wilderness category A areas are part of the Natura 2000 network (>99%). To assess the spatial overlap, GIS-based information is needed on wilderness and the geographical location of strictly protected areas/core zones within each wilderness area. This information is not made available yet.

The total cover of the core zones of wilderness areas (category A and A/B) in EU 27 is estimated at 3,500,000<sup>41</sup> hectares (n=183 PAs; Table 4.7), which makes up about 4.5% of the total Natura 2000 network (total terrestrial cover 76,800,000 ha; status end 2011<sup>42</sup>).

#### 4.7 Discussion

Although data availability on wilderness qualities in protected areas throughout Europe was strongly increased with the assistance of local stakeholders, the draft wilderness register needs improvement.

For practical reasons we have chosen to use the CDDA database as starting point for the analysis of wilderness qualities in protected areas of Europe for the Wilderness register. This is the only European-wide database with information on conservation objectives. This brings the risk that wilderness areas which are not registered in the CDDA (but eventually in Natura 2000 database) were missed in the inventory, especially for those countries where there is small overlap between these two databases (see Fig. 2.1), such as Bulgaria, Cyprus, Ireland, Portugal, Romania, Spain. This point is further discussed in paragraph 5.9.2.

For the data we were dependent on information provided by stakeholders and National Focal Points. However, for certain countries no response was received on requests for information on specific protected areas. This resulted in a lack of data for these countries. This was partly overcome by approaching individual site managers for those countries where no information was received. However, a lack of data persisted in particular for Greenland, Ireland, Iceland, Lithuania, Luxembourg, Romania, Svalbard/Jan Mayen, Slovenia, Turkey and Kosovo.

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<sup>41</sup> The size of the wilderness core zone was known for 73 PAs; the unknown core areas were estimated as 49% of the total area (same ratio as those PAs with known core area within the EU27).

<sup>42</sup> EEA (2012). Protected areas in Europe –an overview. EEA Report No 05/2012. Copenhagen. 130 p.

## 5 Proposal for a wilderness indicator

### 5.1 Objective

For the purposes of policy development and decision making, areas and regions with wilderness conditions have to be identified. The aim was to make a draft biodiversity indicator on wilderness, based on a *multifunctional spatial analysis*.

The indicator is based on spatial landscape features which make the presence of wilderness conditions likely, and is built upon four key-wilderness aspects derived from the wilderness working definition, i.e. naturalness of land cover and vegetation, remoteness from settlements, remoteness from access, and terrain ruggedness. Where the register is a tabular database with information on protected areas with wilderness qualities, the wilderness indicator is an index based on a combination of different landscape features related to wilderness. A high index value for a certain area or region indicates a high potential that wilderness conditions occur at that location.

The methodology used is building further on previous work carried out on wilderness indicators at various scales from global (e.g. Sanderson et al., 2002 and the Human Footprint<sup>43</sup>), to European (e.g. the draft maps produced for Prague May 2009 and the EEA Mountains Report 2010<sup>44</sup>), to member states (e.g. Scotland, Austria, Iceland, Norway, etc.) and individual parks/regions (e.g. Romania Carpathians, Scottish National Parks; further illustrated in paragraph 5.8.2).

The indicator for wilderness is developed for:

- a) monitoring of changes in wilderness conditions and potential over time in Europe;
- b) identification of existing wilderness areas in different regions of Europe, which might encompass also unprotected areas.

The wilderness indicator has a format of a 1 x 1 km resolution raster dataset, showing wilderness quality on a linear scale between 0-100.

In order to produce a widely accepted *spatial analysis product* and to make the product coherent with existing EU biodiversity indicators, the analysis needed to be based as much as possible on datasets available from the Biodiversity Data Centre (BDC) and the Biodiversity Information System for Europe (BISE).

A multi-scale approach is chosen, with wilderness quality mapped at a European scale using the best available and consistently mapped European-wide data, followed by a lower tier of several national scale maps, using national data. When possible and data are available, a third tier of mapping might involve high resolution, local level mapping for individual protected areas. By using national/regional mapping examples of well-known wilderness areas, the actual (mapping) aspects of wilderness can be explored in detail.

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<sup>43</sup> Sanderson, E.W., M. Jaiteh, M.A. Levy, K.H. Redford, A.V. Wannebo & G. Woolmer (2002). The Human Footprint and the Last of the Wild. *Bioscience* 52: 891-904.

<sup>44</sup> EEA (2010) Europe's ecological backbone: recognising the true value of our mountains. EEA report no 6/2010, Copenhagen; Paragraph 10.3 Mountains and wilderness; pp. 192-201.

Spatial analysis related to this indicator was developed in close co-operation with the relevant stakeholders, most importantly the EEA, in order to meet the objectives set for European biodiversity indicators. It guarantees that the indicator (and register) is relevant and tailor-made for DG Environment policy needs.

Paragraphs 5.2-5.4 describe the main datasets involved. Paragraphs 5.5-5.6 give a methodological description of the compilation of the draft wilderness indicator. Additionally, recommendations are provided for updating the indicator and how to fill gaps in data availability.

## 5.2 Exploration of relevant datasets

The most relevant datasets for the spatial analysis of wilderness qualities throughout Europe have been explored and the need for processing these datasets was investigated.

Datasets to be used for the development of the indicator had to be:

- consistent across national boundaries throughout the European territory;
- with a sufficient and coherent spatial resolution (lowest resolution for a EU coverage = 1 x 1 km);
- preferably not being restricted to EU15/EU27, but cover also non-EU countries and edges of adjoining countries (e.g. Russia) as to avoid edge effects;
- showing the probability to adapt and implement the draft indicator at different scales, where needed.

According to previous work on wilderness mapping carried out by WRi/University of Leeds (Fisher et al. 2010<sup>45</sup>, Carver et al. 2012<sup>46</sup>), the four most relevant aspects of wilderness in a European wide context are:

- *Naturalness of land cover* –natural vegetation and land cover, largely undisturbed by human interference;
- *Remoteness from settlement / absence of human influence* - The absence of obvious artificial forms or structures within the landscape can at the European level be calculated by selecting those areas which have a very low access from population, which can be seen as a proxy of human disturbance;
- *Remoteness from access* –based on time needed to enter an area from the nearest point of mechanised access;
- *Ruggedness of terrain*: rugged and challenging character of the terrain – the physical characteristics of the landscape including effects of steep and rough terrain and harsh weather conditions often found at higher altitudes.

For mapping, these four sub-indicators are combined using a combination of linear multi-criteria evaluation (MCE) and fuzzy methods. They are combined into a single wilderness indicator, applicable at the European scale.

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<sup>45</sup> Fisher, M., Carver, S. Kun, Z., McMorran, R., Arrell, K. & Mitchell, G. (2010). Review of Status and Conservation of Wild Land in Europe. Project commissioned by the Scottish Government.

<sup>46</sup> Carver, S, A. Comber, R. McMorran & S. Nutter, 2012. A GIS model for mapping spatial patterns and distribution of wild land in Scotland. *Landscape and Urban Planning* 104 (2012) 395– 409

### 5.3 EU-wide datasets

Starting point was the exploration of methodology and datasets stored under BDC and BISE used for EEA's Net Landscape Ecological Potential (NLEP). These included datasets on:

- a) GBLI: land use (green background landscape index based on CORINE/CORILIS).
- b) NATURILIS\_COMB: designation status (Natura 2000/CDDA/EMERALD data on protected areas).
- c) MEFF: landscape fragmentation (effective mesh size).

We explored which additional data were needed for a coherent and ecologically meaningful picture of wilderness in Europe, related to the main qualities of wilderness, i.e. the predominance of natural processes, remoteness and unaffectedness by human interference. Sub-paragraphs 5.3.1. – 5.3.3. describe the possibly relevant and available EU-wide datasets for the calculation of a wilderness indicator. Not all datasets named here were necessarily used in the final calculation, but it was felt that it was important to mention them as a potential source of information.

#### 5.3.1. Datasets on population density

Datasets providing information on population density are:

- GEOSTAT\_Grid\_POP\_2006\_1K European population grid dataset: this dataset contains total population figures for the reference year 2006, disaggregated to a 1 km<sup>2</sup> grid. The 2006 population grid map is an estimation which is based on different datasets - 2011 Census building centroids, persons address data from population register, data about new buildings from buildings register and the official 2006 population counts on municipalities level. (<http://www.efgs.info/data/geostat/open-data>)
- AIT disaggregated European population grid for 2006 1 km<sup>2</sup>: this dataset contains also total population figures for the reference year 2006, disaggregated to a 1 km<sup>2</sup> grid. The dataset has been produced by the Austrian Institute for Technology (AIT). Data cover: EU 27 and EFTA countries (except Cyprus, no LAU population figures for CY). The source population data is reported on LAU2. The main ancillary dataset is the GMES soil sealing layer 2006. (<http://www.efgs.info/data/geostat/open-data>)

Both can be combined with:

- EuroGeographics Regional database (EUROREGIONAL) with the settlements layer for e.g. calculation of remoteness of small islands or with figures of GDP to calculate economic density maps (see Metzger et al. 2010<sup>47</sup>).

#### 5.3.2 Datasets on landscape fragmentation and infrastructure

Available datasets that provide information on the biophysical intactness and or the remoteness of landscape and vegetation are:

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<sup>47</sup> Metzger, M.J., R.G.H. Bunce, M. van Eupen, & M. Mirtl (2010) An assessment of long term ecosystem research activities across European socio-ecological gradients. *Journal of Environmental Management* 91: 1357-1365.

- MEFF: landscape fragmentation (effective mesh size) EEA/Landscape fragmentation 2009: Remoteness, and thus fragmentation by infrastructure (road, railway and to a certain extent waterways), is a relevant issue. The here used mesh size can be of direct value for describing the fragmentation of protected areas although the 1 km resolution could possibly be too coarse to link it directly to all Natura 2000/CDDA/EMERALD data. This was explored.
  - three fragmentation datasets (based on three different geometries are published as GIS- layers: <http://www.eea.europa.eu/data-and-maps/figures/landscape-fragmentation-per-km-data>
- The concept of the FARO Urban-Rural typology (Eupen et al. 2012<sup>48</sup>), calculating the average remoteness from urban centers for (six) classified sizes of cities (varying from small (20,000) to large (750,000) inhabitants). For these or comparable remoteness calculations, a road network and urban nodes should be available (see below).
- Infrastructure Database: Roads/Railways/Navigable rivers :
  - TeleAtlas. This database was used to calculate the MEFF. Preferably we use the TeleAtlas data if available directly from the Commission (but EEA has not prolonged their contract);
  - Alternative for using the Teleatlas database is the Roads layer from the EuroGeographics Regional database (EUROREGIONAL map – 1:250 000 scale topography dataset covering 31 countries (EU27 exclusive Bulgaria; for Bulgaria only the EuroGlobalMap – 1:1 million scale topography is available).
  - Open source: Open Street Map. The OpenStreetMap Project (OSM) based at OpenStreetMap.org, is the worldwide mapping effort that includes more than half a million volunteers around the globe. OSM is an open initiative to create and provide free map data to anyone who wants them. OSM can be used in addition to other databases where no coverage exist. Depending on the region data can be less accurate and/or more fragmented.

### 5.3.3 Datasets on naturalness of land cover and vegetation

- CORINE/NLEP/Corilis (EU27 + NO + CH + TR: EEA/CORINE 2000 (GRE) & 2006 (Rest)).
  - Additionally, we explored the GBLI from NLEP: land use (green background landscape index based on CORINE/CORILIS). Although this dataset is including all pastures-forest and other nature areas (where pastures are not considered as wilderness areas), the *conceptual approach* was explored. Since the rules to create the index are not clearly covering the scope of wilderness indicator, but more a greenness indicator only the basic datasets to create this index (CORINE) was used to prevent misinterpretation of the results.
  - NATURILIS from NLEP: the used thresholds for creating NATURILIS (5 km) were considered not being valid for designating wilderness areas generally over Europe,

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<sup>48</sup> Eupen, M. van, M.J. Metzger, M. Pérez-Soba, P.H. Verburg, A. van Doorn, A. & R.G.H. Bunce (2012). A Rural Typology for Strategic European Policies. Land Use Policy 29: 473-482.

although since it is a simple measurement, a comparable approach was by combining datasets with a fuzzy approach (see paragraph 5.5).

- Tree species maps for European forests: showing the main forest type areas in Europe (Brus et al. 2011 EFI/Alterra<sup>49</sup>). Conclusion: Since the map just showed the forecasted main species-type and not species management/naturalness, the map was considered of less value for the wilderness indicator.
- Global Livestock Production and Health Atlas (GLiPHA, <http://kids.fao.org/glipha/>). GLiPHA is an interactive, electronic atlas containing global animal production and health statistics. Sub-national statistics relating to the livestock sector can be viewed cartographically, against a back-drop of selected maps, such as livestock densities, land-use and topography. Based on EUROSTAT and FAO census statistics the FAO created maps with the amount (heads) of cattle and sheep and goats grazing per gridcell (5' x 5'). Dataset can be used to show the land use intensity part of the (CORINE) land cover database<sup>50</sup>.
- EURODEM<sup>51</sup> (topography data for Europe), height above sea-level. To be used in combination with land cover data and to use to calculate terrain roughness (for both remoteness and naturalness). Alternative for using the standard GTOPO/SRTM/ASTER-DEM data.
- The LANMAP2 dataset (Landscape Map for Europe (Alterra, 2007)) is of value when there is a possibility or need for selecting region specific thresholds for wilderness values (see par. 5.5).<sup>52</sup> LANMAP2 is a hierarchical classification with four levels and has 350 landscape types at its lowest level (level 4), The first level of the classification is determined by climate and has only eight classes. The second level is determined by climate and topography and has 31 classes. The third level, determined by climate, topography and parent material has already 76 classes.
- CDDA: The European inventory of nationally designated areas holds information about protected sites and about the national legislative instruments, which directly or indirectly create protected areas. The dataset contains data on individual nationally designated sites and of EEA member and collaborating countries. The extended version of the public CDDA database can be used, showing insight in the location and designation status of the collaborating countries.
- Natura 2000 is an ecological network composed of sites designated under the Birds Directive (Special Protection Areas, SPAs) and the Habitats Directive (Sites of Community Importance, SCIs, and Special Areas of Conservation, SACs). The descriptive database also pairs with a spatial database. Borders of sites submitted by each Member State are validated by the European Environment Agency (EEA) and linked to the descriptive data<sup>53</sup>.
- GLOBCORINE: bordering the EU 27 (where no-CLC land cover data exist) we propose to use the Globcover Land Cover database (V2.3 2009<sup>54</sup>): GLOBCOVER was launched in 2004 as an initiative of the European Space Agency (ESA) which aims to produce a new global land cover

<sup>49</sup> Brus, D.J., G.M. Hengeveld, D.J.J. Walvoort, P.W. Goedhart, A.H. Heidema, G.J. Nabuurs & K. Gunia, 2011. Statistical mapping of tree species over Europe. *European Journal of Forest Research* 131 (1): 145–157.

<sup>50</sup> This map will/can be replaced in the near future by work to be published soon by EEA (pers. note Óscar Gómez Prieto (EEA))

<sup>51</sup> <http://www.eurogeographics.org/content/products-services-eurodem>

<sup>52</sup> <http://www.alterra.wur.nl/NR/exeres/6DA551F0-D7A6-45C6-A499-AC6B80FB82EB>;

[http://content.alterra.wur.nl/internet/webdocs/internet/geoinformatie/projects/LANMAP2/Metadata-LANMAP2\\_ud.pdf](http://content.alterra.wur.nl/internet/webdocs/internet/geoinformatie/projects/LANMAP2/Metadata-LANMAP2_ud.pdf)

<sup>53</sup> <http://www.eea.europa.eu/data-and-maps/data/natura-2000>

<sup>54</sup> [http://www.efi.int/portal/virtual\\_library/information\\_services/mapping\\_services/tree\\_species\\_maps\\_for\\_european\\_forests/](http://www.efi.int/portal/virtual_library/information_services/mapping_services/tree_species_maps_for_european_forests/) [https://globcover.s3.amazonaws.com/LandCover2009/Globcover2009\\_V2.3\\_Global.zip](https://globcover.s3.amazonaws.com/LandCover2009/Globcover2009_V2.3_Global.zip);  
[https://globcover.s3.amazonaws.com/LandCover2009/GLOBCOVER2009\\_Validation\\_Report\\_1.0.pdf](https://globcover.s3.amazonaws.com/LandCover2009/GLOBCOVER2009_Validation_Report_1.0.pdf)

database based upon fine resolution pictures (300 m) from the ENVISAT satellite. By using this dataset, less so called “border effects” will be visible compared to the use of no-data<sup>55</sup>.

#### 5.4 Regional datasets for the analysis of wilderness

- UK/Scotland:
  - Example 1: Data used in the Wildness Study in the Cairngorms National Park (Steve Carver, Lex Comber, Steffen Fritz, Robert McMorran, Steve Taylor & Justin Washtell March 2008<sup>56</sup>).
  - Example 2: Data and method used in: A reconnaissance level wild land map of the UK for the John Muir Trust’s (Steve Carver, 2010).
  - Example 3: Data and method used in the Scottish Natural Heritage national wildness map for Scotland (March 2012).
- Austria:
  - o Example 4a: Data and method used in: MAPPING THE WILDERNESS OF THE ALPS – A GIS-BASED APPROACH (Kaissl, 2002<sup>57</sup>), a GIS-based study into the wilderness areas of the Alps; understood as an area remote from/undisturbed by influences of modern society.
  - o Example 4b: Mapping used to derive the national Strategy to promote wilderness – Further potential inside and outside N2000 areas. Michael Zika, WWF Austria, The conference ‘Protecting Wilderness in Europe’ PAN Parks, 2012.
- Romania:
  - o Example 5: Identification and mapping of wilderness areas in the South Western Carpathians (Department of Geography/EPC Consulting, University of Bucharest).

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<sup>55</sup> Although with the use of this kind of datasets the extension of the wilderness indicator outside EU27 looked promising, it was finally only possible to create a consistent map for EU27 + NO + CH due to the omission of several other consistent layers outside EU27 (e.g. roads database). A separate more rough wilderness map could be made for areas outside EU 27

<sup>56</sup> <http://www.wildlandresearch.org/Cairngorm2008.pdf>

<sup>57</sup> <http://www.panparks.org/learn/wilderness-resource-bank/mapping-the-wilderness-of-the-alps-a-gis-based-approach>

Table 5.1. Datasets used for compiling the draft wilderness indicator for Europe.

Dataset	Description	Availability	Spatial resolution	Thematic accuracy	Costs
GEOSTAT_Grid_POP_2006_1K	European population grid dataset:	available	1 x 1 km	LAU2	Free
EuroGeographics Regional database (EUROREGIONAL)	settlements layer	Available EC	1: 50,000	Medium	Free (needs EC permission)
EuroGeographics Regional database (EUROREGIONAL)	Road layer	Available EC. Alternative for using the Teleatlas database	1: 50,000	High	Free (needs EC permission)
Corine Landcover 2000/2006 (GRE)	Land Cover database EU 27 + 2	Available. EU27 + NO + CH + TR: EEA/CORINE 2000 (GRE) & 2006 (Rest).	100 x 100 m	High	Free
GLOBCORINE (GLOBCOVER classified into the main CLC characteristics)	Land Cover database Europe	Available for Europe	300 x 300 m	Medium	Free
EURODEM (topography data for Europe),	height above sea-level.	Available the EC?	100	100	Restricted, EC has no license
SRTM dem	height above sea-level.	Available	90 x 90 m	High	Free
AsterDEM V2	height above sea-level.	Available	30 x 30 m	High	Free
CDDA	The European nationally designated areas	Available EEA	1: 50,000 up to 1: 25,000	High, differences per member state	Free, but with restrictions
Urban Night lights	Light from stable sources	Available per month	90 x 90 m	High	Free
PNV	Potential natural vegetation of Europe	(Böhn et al. 2000)	1: 2,500,000	High	Free
FAO Global Livestock Production and Health Atlas (GLiPHA)	Grazing intensity	Available for 2000 and 2006	5'x 5'	Medium	Free

## 5.5 Mapping approach, combining indicators

The four sub-indicators: a) naturalness of land cover and vegetation b) remoteness from settlement, c) remoteness from access and d) terrain ruggedness are combined to a draft wilderness quality index. The applied method is a combination of fuzzy membership as e.g. described for calculating a wilderness map in Comber et al. (2010<sup>58</sup>), and linear multi-criteria evaluation (MCE) (Carver et al. 2012<sup>59</sup>). This will be explained in more detail below.

### 5.5.1 Step 1: Scaling between 0-1 of all input layers

The process of transforming original input values to the 0 to 1 scale of possibility of membership is called the fuzzification process (Comber et al. 2010). All the original input values of each input dataset are transformed to the 0 to 1 scale (with 1 = maximum for the factor) of possibility of membership to each specific wilderness criterion. This transformation can be done using various scaling techniques, e.g. linear or with a Gaussian curve etc. (see text box). The major problem of fuzzy MCE can be that the final output is more difficult to be interpreted and more challenging to lead back to the used input thresholds. To keep the scaling process understandable, all four factors were scaled using a simple linear relationship with a minimum and maximum threshold, where between the linear transformation takes place. The choice of the used threshold value is very important. The main reason to use minimum and maximum thresholds was to remove the outliers in the distribution of the values. In this way the thresholds have no real ecological value, but are more used as technical way to improve the scaling of the data. Each factor, for example distance to roads, ruggedness and land-use types, was transformed (Fig. 5.1).

### 5.5.2 Step 2: Combining of the four factors

Second step in the mapping process is the combination of the four factors into one map. Simple MCE (Multi Criteria Evaluation or MCA Analysis) is often used to meet a particular objective, evaluating several criteria and consider their different levels of importance (Carver et al. 2012). Also here, different methods of combining and weighing the data are possible. From again a purely fuzzy approach to very simple linear weighed multi-criteria evaluation (MCE) will give different output (Comber et al. 2010, Carver et al. 2012). Following the working definition of wilderness (paragraph 1.2), thresholds are not easy to set. This suits well with a method which results in a range of wildness values compared with a map showing a single threshold of wilderness.

Since we like to keep the MCE process as transparent as possible, we choose to combine the fuzzy first step of the MCE with a simple weighing of the four factors. The various sets of weights are applied within a simple Weighted Linear Combination MCE model (Carver et al. 2002, 2012). By applying

<sup>58</sup> Comber, A., S. Carver, S. Fritz, R. McMorran, J. Washtell & P. Fisher (2010). Different methods, different wilds: Evaluating alternative mappings of wildness using fuzzy MCE and Dempster-Shafer MCE Computers. *Environment and Urban Systems* 34: 142–152.

<sup>59</sup> Carver, S., A. Comber, R. McMorran & S. Nutter (2012). A GIS model for mapping spatial patterns and distribution of wild land in Scotland. *Landscape and Urban Planning* 104: 395– 409.

specified factor weights, different wilderness maps can be generated, taking into account the perception of wilderness and human disturbance (Carver et al. 2010).

For specific areas in the UK, thresholds were derived using people's perception of wild areas (Carver et al. 2002<sup>60</sup>, 2012). These thresholds values, however, cannot simply be copied to the European context /scale. The final output map was reviewed by confronting the values of the wilderness indicator with the wilderness areas described in the wilderness register. Based on the comparison results, weighing factors can be adjusted. Differential weightings to different layers/attributes in the wilderness indicator will calibrate the indicator.

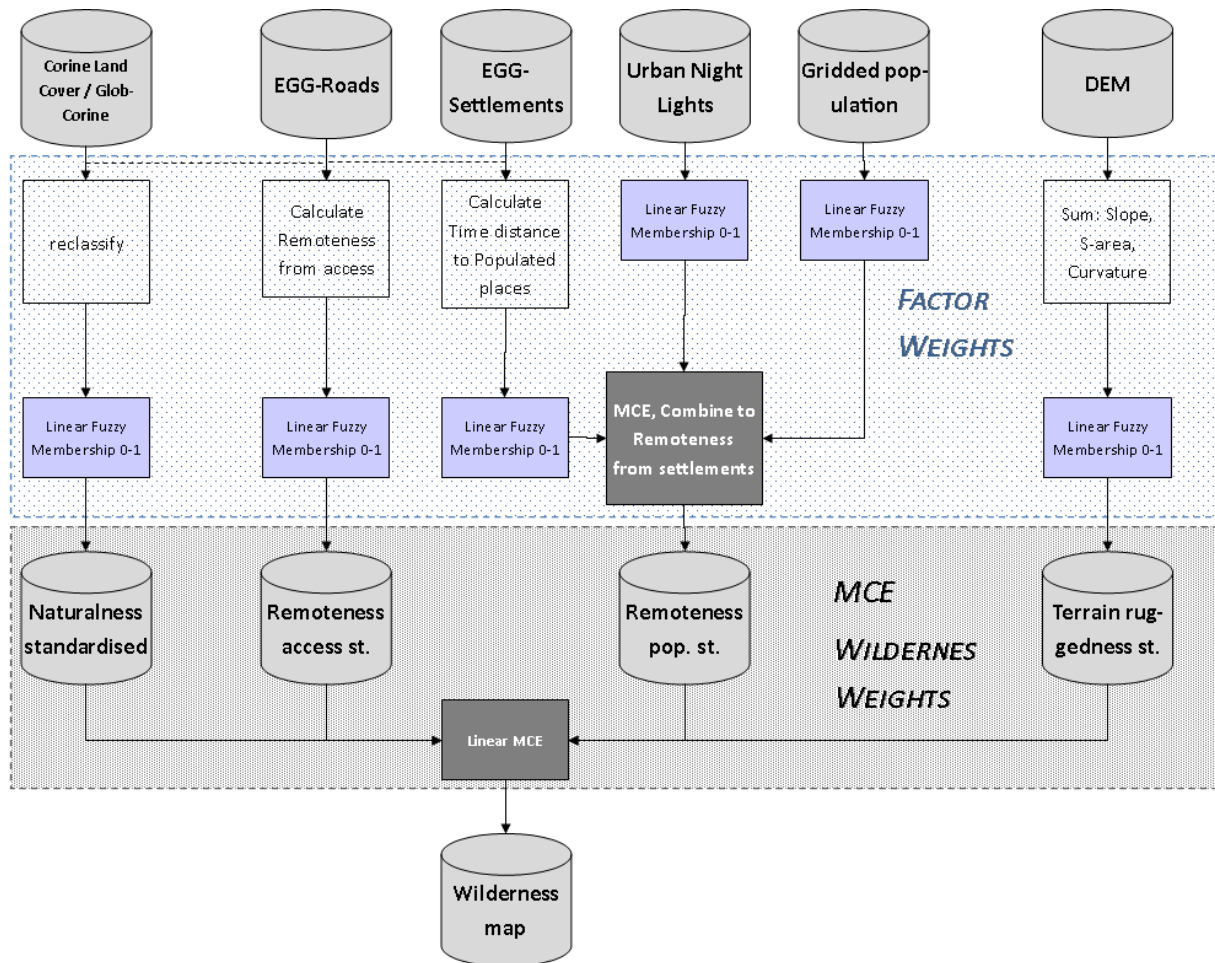


Figure 5.1 Method applied for mapping of wilderness quality in Europe.

Based on the initial mapping output, combined with the results from the register, two rationales were chosen for the final weighing:

- If a sub-indicator equals zero in the fuzzy scaled maps, the final indicator will also equals zero; this prevents that completely non-natural vegetated areas as farmland which is very remote or very far away from roads will be classified as wilderness.
- To keep the final output map as understandable as possible, the sub-indicators were multiplied with each other with equal importance. This results in a final indicator value with a

<sup>60</sup> Carver, S., A. Evans & S. Fritz (2002). Wilderness attribute mapping in the United Kingdom. International Journal of Wilderness 8 (1).

scale of 1 (all sub-indicators have a score of 1) to zero (one or more sub-indicators have a score of zero).

- “Terrain ruggedness” is used both as separate sub-indicator and as factor in the calculation of “remoteness from access” and “remoteness from population” (both using terrain ruggedness in the friction surface). It was concluded that the weights for the sub-indicator “terrain ruggedness” needed to be minimised; for that reason this sub-indicator was given a zero weighing (left out) in the final MCE.

In summary, we applied a weighing in which naturalness of vegetation is weighed equally with remoteness from settlement and equally with remoteness from access, and terrain ruggedness is only used as parameter in the remoteness calculations.

## **5.6 Methods deriving maps for each factor**

### **5.6.1 Naturalness of landscape and vegetation**

From the point of view of naturalness of landscape and vegetation it seems straightforward to select those (mapped) land use/ vegetation types which are undisturbed by man. The map showing the natural vegetation of Europe (Böhn et al. 2000<sup>61</sup>) gives an idea about what land cover types should be selected to be considered as natural. The natural vegetation map itself could be used to check if vegetation types can be seen as the most natural types but unfortunately the map is digitised on a coarse 1: 1 / 2.5 mln. level, which makes it difficult to combine with higher resolution land cover layers (Fig. 5.3).

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<sup>61</sup> Böhn, U., Gollub, G., Hettwer, C., Neuhauslova, Z., Schlueter, H. & Weber H. ( 2000). Karte der natürlichen Vegetation Europas. Map of the natural vegetation of Europe. Federal Agency for Nature Conservation, Bonn.

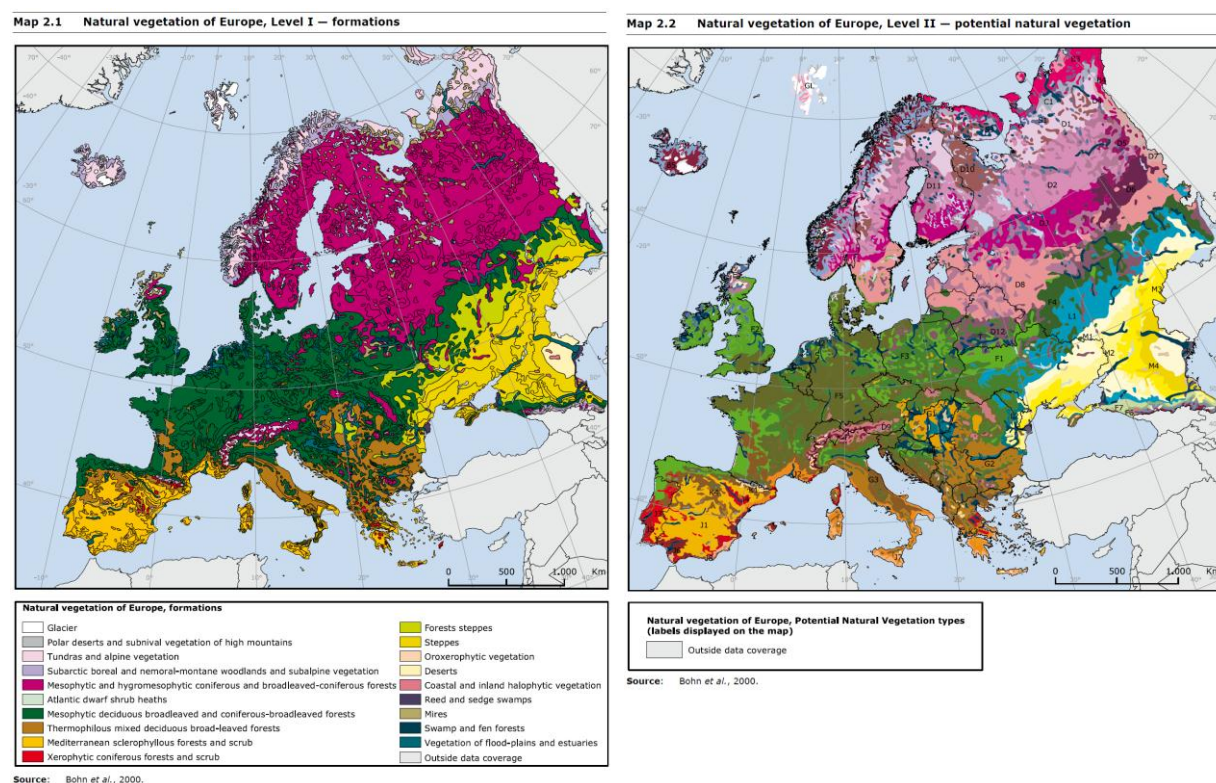


Figure 5.2. Map of the natural vegetation of Europe (Böhn et al. 2000).

The PNV legend consists of ca. 700 classes grouped in 20 ‘formations’ (Figure 5.2). From the legend used in the Potential Natural Vegetation map it is clear that the main discussion is to what extent ‘semi-natural vegetation’ types can be seen as wilderness (or wild area). In terms of coverage of area this will affect mainly the existing coverage of the land use class ‘forest’ and to a smaller extent ‘semi-natural grasslands’. For this aspect we are following the way of defining natural and semi-natural forest as described by EEA (EEA, 2006):

- Forests undisturbed by man are: “forests which show natural forest dynamics, such as natural tree composition, occurrence of dead wood, natural age structure and natural regeneration processes, the area of which is large enough to maintain its natural characteristics and where there has been no known significant human intervention or where the last significant human intervention was long enough ago to have allowed the natural species composition and processes to have become re-established”. Undisturbed forests represent today 27 % of the total European forest area (the largest forest area found in eastern and northern Europe, Russia mainly), whereas ‘semi-natural’ forests account for the 70 % of total European forest area (MCPFE 2003/TBFRA 2000; in EEA, 2006)<sup>62</sup>.

From the above, it can be concluded that it seems relatively simple to select “undisturbed natural processes” as a selection criterion. In practice it is not easy to get grip on this criterion with the current available datasets. There are no (pan-)European datasets describing natural processes as the e.g. age and human use of forests. However, even simple overlaying the PNV map with the CLC-land cover

<sup>62</sup> EEA (2006). Technical report No 9/2006. European forest types. Categories and types for sustainable forest management reporting and policy. 2<sup>nd</sup> edition, May 2007.

map will at least show those actual land cover types which are the most related to the original described potential natural vegetation types. The FAO grazing density maps are in succession used as a proxy<sup>63</sup> for '*human intervention*' by filtering only those natural land cover types which have a very low grazing density.

### *Method*

Estimate the probability that a CLC land-cover class belongs to one of the 700 PNV types classified in three classes (assumed=1; probable=0.5 and possible=0.1). This map is combined with the FAO grazing density information which is linear transformed to the 0 to 1 scale, where 1 equals 20 heads/km<sup>2</sup> or more. This classification of naturalness is subjective and has probably to be regionalised and improved based on for example the regional perception of naturalness of the areas in the wilderness register.

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<sup>63</sup> Although the FAO-grazing density maps shows also the grazing of the (semi-)natural vegetation types, not only the managed pastures, no EU dataset was found with information on (real) forest management.

Table 5.2a Example of 25 of the 700 units of the PNV map first clustered to CLC class information (last column).

PNV UNIT	Textmain1	Textmain2	TEXT Detail	CodeW1	Main Codes to Link with CLC
L1	Forest steppes	Lowland-colline types	Dry lichen heaths ( <i>Aspicilia calcaria</i> , <i>Cetraria nivalis</i> , <i>Collema</i> s	L100	Forest steppes with deciduous broad-leaved f
L2	Forest steppes	Lowland-colline types	Volyn-Podolian meadow steppes ( <i>Brachypodium pinnatum</i> , <i>Carex</i>	L100	Forest steppes with deciduous broad-leaved f
L3	Forest steppes	Lowland-colline types	Moldavian-Ukrainian meadow steppes ( <i>Stipa tirsia</i> , <i>S. pennata</i> , <i>C</i>	L100	Forest steppes with deciduous broad-leaved f
L4	Forest steppes	Lowland-colline types	South Sarmatian meadow steppes ( <i>Stipa pennata</i> , <i>S. tirsia</i> , <i>Festu</i>	L100	Forest steppes with deciduous broad-leaved f
L5	Forest steppes	Lowland-colline types	Central Russian-Volgian meadow steppes and steppe-like mea	L100	Forest steppes with deciduous broad-leaved f
L6	Forest steppes	Lowland-colline types	Transvolgian-pre-Ural meadow steppes ( <i>Stipa tirsia</i> , <i>S. pennata</i> )	L100	Forest steppes with deciduous broad-leaved f
L7	Forest steppes	Lowland-colline to submontane type	West Caucasian meadow steppes ( <i>Stipa tirsia</i> , <i>S. pennata</i> , <i>Brom</i>	L100	Forest steppes with deciduous broad-leaved f
L8	Forest steppes	Submontane to montane type	North Caucasian meadow steppes ( <i>Carex humilis</i> , <i>Stipa tirsia</i> , <i>S.</i>	L100	Forest steppes with deciduous broad-leaved f
L9	Forest steppes	Lowland-colline types	Pannonian halophytic steppes ( <i>Festuca pseudovina</i> ) with <i>Artem</i>	L100	Forest steppes with deciduous broad-leaved f
L10	Forest steppes	Lowland-colline types	South Pannonian herb-grass steppes ( <i>Festuca rupicola</i> , <i>F. valesi</i>	L100	Forest steppes with deciduous broad-leaved f
L11	Forest steppes	Lowland-colline types	Pannonian sand steppes ( <i>Festuca vaginata</i> , <i>F. wagneri</i> ) with <i>Dia</i>	L100	Forest steppes with deciduous broad-leaved f
L12	Forest steppes	Lowland-colline types	Danubian sand steppes ( <i>Festuca vaginata</i> , <i>F. wagneri</i> ) with <i>Dia</i>	L100	Forest steppes with deciduous broad-leaved f
L13	Forest steppes	Lowland-colline types	Danubian herb-grass steppes ( <i>Stipa lessingiana</i> , <i>Festuca valesi</i>	L100	Forest steppes with deciduous broad-leaved f
L14	Forest steppes	Lowland-colline types	Sand steppes of Danubian Delta ( <i>Stipa anomala</i> , <i>Festuca arenic</i>	L100	Forest steppes with deciduous broad-leaved f
L15	Forest steppes	Lowland-colline types	East Thracian steppes on marl clay, alternating with downy oak	L100	Forest steppes with deciduous broad-leaved f
L16	Forest steppes	Submontane type	Crimean herb-grass steppes ( <i>Stipa pontica</i> , <i>S. brauneri</i> , <i>Elymus r</i>	L100	Forest steppes with deciduous broad-leaved f
L17	Forest steppes	Montane type	Crimean meadow steppes ( <i>Carex humilis</i> , <i>Stipa tirsia</i> , <i>Festuca ca</i>	L100	Forest steppes with deciduous broad-leaved f
M1	Steppes	Lowland-colline types	West and central Pontic herb-rich grass steppes ( <i>Stipa tirsia</i> , <i>S. le</i>	M100	Herb-rich grass steppes
M2	Steppes	Lowland-colline types	Central Pontic herb-rich grass steppes ( <i>Stipa tirsia</i> , <i>S. lessingiana</i>	M100	Herb-rich grass steppes
M3	Steppes	Lowland-colline types	Transvolgian herb-rich grass steppes ( <i>Stipa zaleskii</i> , <i>S. korshin</i>	M100	Herb-rich grass steppes
M4	Steppes	Montane type	Transcaucasian altimontane herb-grass- and meadow steppes ( <i>M</i>	M100	Herb-rich grass steppes
M5	Steppes	Lowland-colline types	West and central Pontic herb-grass steppes ( <i>Stipa ucrainica</i> , <i>S. l</i>	M100	Herb-rich grass steppes
M6	Steppes	Lowland-colline types	Central Pontic herb-grass steppes ( <i>Stipa lessingiana</i> , <i>S. capillat</i>	M100	Herb-rich grass steppes
M7	Steppes	Lowland-colline types	Pontic hemi-psammophytic herb-grass steppes ( <i>Stipa capillata</i> , <i>M</i>	M100	Herb-rich grass steppes
M8	Steppes	Lowland-colline types	Pontic psammophytic herb-grass steppes ( <i>Stipa anomala</i> , <i>Agrop</i>	M100	Herb-rich grass steppes

Table 5.2b Potential naturalness of vegetation based on the probability that Corine Land Cover classes belonging to the grouped PNV-types.

Main Codes from PNV classification	CLC_CODE	Forest and semi natural areas												Wetlands				
		Broad-leaved forest	Coniferous forest	Mixed forest	Natural grasslands	Moors and heathland	Sclerophyllous vegetation	Transitional woodland-shrub	Beaches, dunes, sands	Bare rocks	Sparsely vegetated areas	Burnt areas	Glaciers and perpetual snow	Inland marshes	Peat bogs	Salt marshes	Salines	Intertidal flats
		311	312	313	321	322	323	324	331	332	333	334	335	411	412	421	422	423
bare, sparse	1100	0	0	0	0.75	0.5	0	0	1	1	1	0	1	1	1	0.1	0.1	0.1
tundra sparse / herbs, mosses, creeping shrub	2100	0.1	0.5	0.5	1	0.5	0.1	0	0.5	1	1	0	1	1	1	1	1	1
tundra dwarf shrub with willow & birch	2200	0.5	0.1	0.1	1	0.75	0.1	0.5	0.5	1	1	0	1	1	1	1	1	1
artic grassland system, creeping/dwarf shrub	2300	0.1	0.1	0.1	1	0.75	0.1	0.5	0.5	1	1	0	1	1	1	0.1	1	1
woodland open, birch, pinus, shrub, heathlands	3100	1	0.75	0.75	1	0.75	0.1	0.5	0.5	1	0.5	0	1	1	1	0.1	0.1	1
open forests, scrub and dwarf shrub comb. with grasslands	3200	1	0.75	0.75	1	0.1	0.5	0.75	0.5	1	0.5	0	1	1	1	0.1	0.1	1
forest coniferous, with betula, wooded mires	4100	0.5	1	0.75	0.5	0.1	0.1	0.5	0.5	1	0.1	0	1	1	1	0.1	0.1	1
forest coniferous dwarf shrub	4200	0.5	1	0.75	0.5	0.1	1	0.75	0.5	1	0.1	0	1	1	1	0.1	0.1	1
forest coniferous, mixed with broadleaved	4300	0.75	0.75	1	0.1	0.1	0.5	0.75	0.5	1	0.1	0	1	0.1	0.1	0.1	0.1	1
forest coniferous, open, mosses and dwarf shrubs	4400	0.5	1	0.75	0.1	0.1	0.1	0.5	0.5	1	0.75	0	1	1	0.5	0.1	0.1	1
forest coniferous with broadleaved and grassland	4600	0.75	0.75	1	1	0.5	0.1	0.5	0.5	1	0.75	0	1	1	0.5	0.1	0.1	1
forest coniferous with grassland	4700	0.1	1	0.75	0.5	0.1	0.75	0.5	0.5	1	0.1	0	1	1	1	0.1	0.1	1
atlantic dwarf shrub heaths	5100	0.5	0.1	0.1	1	0.75	0.1	0.1	1	1	1	0	1	1	1	0.1	0.1	1
forest broad leaved	6100	1	0.5	1	0.1	0.1	0.1	0.5	0.5	1	0.1	0	1	0.5	0.5	0.1	0.1	1
forest mixed coniferous-broad-leaved	6200	1	0.5	1	0.5	0.1	0.5	0.5	0.5	1	0.1	0	1	0.5	0.5	0.1	0.1	1
forest broad leaved, shrub, grassland	6300	1	0.5	0.75	1	0.1	0.75	0.5	0.5	1	0.5	0	1	1	1	0.1	0.1	1
forest broad leaved, grassland	7100	1	0	0.5	1	0.75	0.5	0.1	0.5	1	0.1	0	1	0.5	0.5	0.1	0.1	1
forest broad leaved	7200	1	0	0.1	0.5	0.1	0.1	0.5	0.5	1	0.1	0	1	0.5	0.5	0.1	0.1	1
forest broad leaved shrub	7300	1	0	0.1	0.1	0.1	1	0.5	0.5	1	0.1	0	1	0.5	0.5	0.1	0.1	1
mixed deciduous broad-leaved forests	8100	1	0	0.1	0.1	0.1	1	0.75	0.5	1	0.1	0	1	0.5	0.5	0.1	0.1	1
forest broad leaved shrub	9100	0.75	0	0.1	0.1	0	1	0.75	0.5	1	0.1	0	1	0.5	0.5	0.1	0.1	1
thermo-xerophilous scrub	9200	0.75	0	0.1	0.1	0	1	0.75	0.5	1	0.1	0	1	0.5	0.5	0.1	0.1	1
forests coniferous, woodlands and scrub	10100	0	1	0.5	0.1	0	1	0.5	0.5	1	0.5	0	1	0.5	0.5	0.1	0.1	1
forests coniferous and mixed broad-leaved-coniferous	10200	0.75	1	1	0.1	0	0.75	0.75	0.5	1	0.5	0	1	0.5	0.5	0.1	0.1	1
forests coniferous, woodlands and scrub	10300	0.1	1	0.75	0.1	0	0.75	0.75	0.5	1	0.1	0	1	0.5	0.5	0.1	0.1	1
forest steppes broad-leaved, grasslands, scrub	11100	0.75	0	0.1	1	0.5	1	0.75	0.5	1	1	0	1	0.5	0.5	0.1	0.1	1
herb-rich grass steppes	12100	0.1	0	0	1	0.5	0.1	0.1	0.5	1	1	0	1	0.5	0.5	0.1	0.1	1
grass steppes	12200	0	0	0	1	0.5	0	0	1	1	1	0	1	0.5	0.5	0.1	0.1	1
desert steppes	12300	0	0	0	0.75	0.5	0	0	1	1	1	0	1	0.5	0.5	0.1	0.1	1
oroxerophytic vegetation (shrub)	13100	0.1	0.1	0.1	1	0	1	0.75	1	1	1	0	1	0.5	0.5	0.1	0.1	1
deserts	14100	0	0	0	0.5	0	0.1	0	1	1	1	0	1	0.5	0.5	0.1	0.1	1
coastal vegetation and inland halophytic vegetation	15100	0	0.1	0	1	0	0.1	0	1	1	1	0	1	0.5	0.5	1	0.1	1
tall reed vegetation, swamps, aquatic	16100	0.5	0	0	0.1	0.5	0	0.1	0.75	1	1	0	1	1	0.5	1	1	1
mires, raised bogs, fens	17100	0.5	0	0	0.5	1	0	0.1	0.75	1	1	0	1	1	1	1	1	1
swamp and fen forests	18100	1	0	0.1	0.1	1	0	0.1	0.5	1	1	0	1	1	1	1	1	1
alluvial forests, shrub	19100	1	0.1	0.5	1	0.1	0	0.5	0.5	1	0.1	0	1	1	1	1	1	1
glacier, lake, river saltflat	99200	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1	1	1	0.1	0.1	1

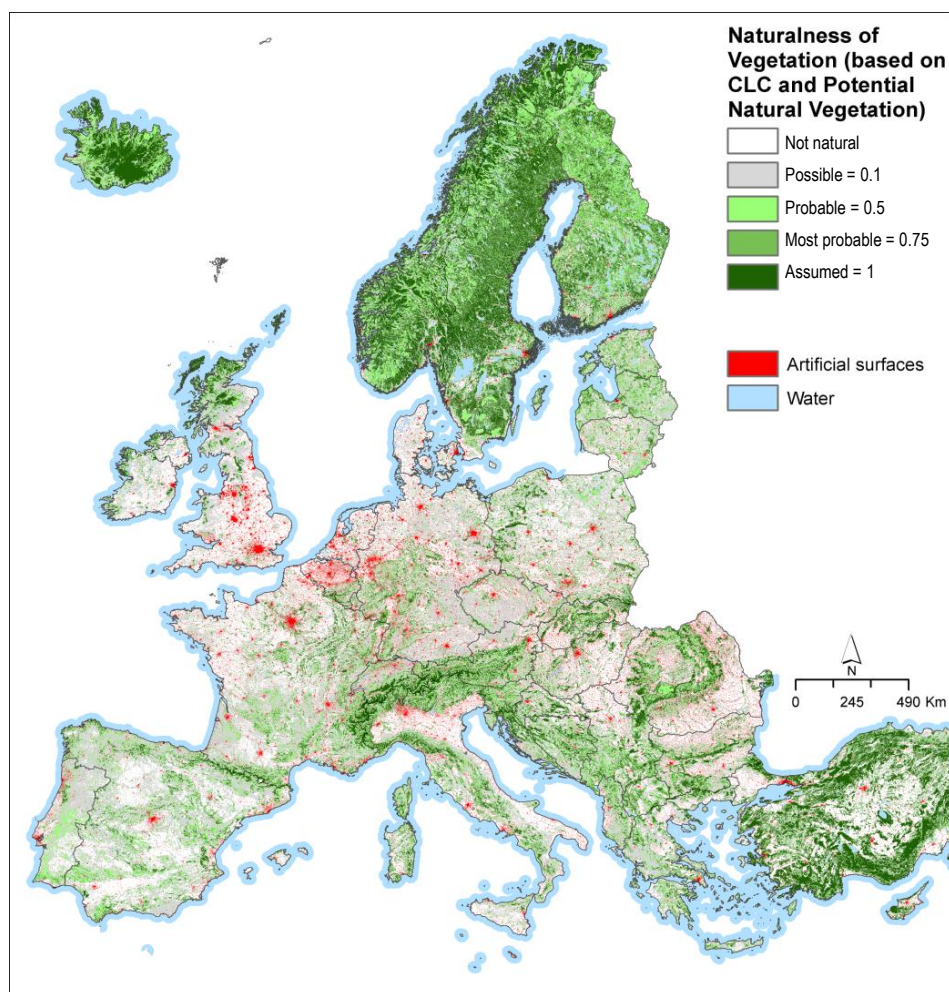


Figure 5.3a CLC-PNV probability.

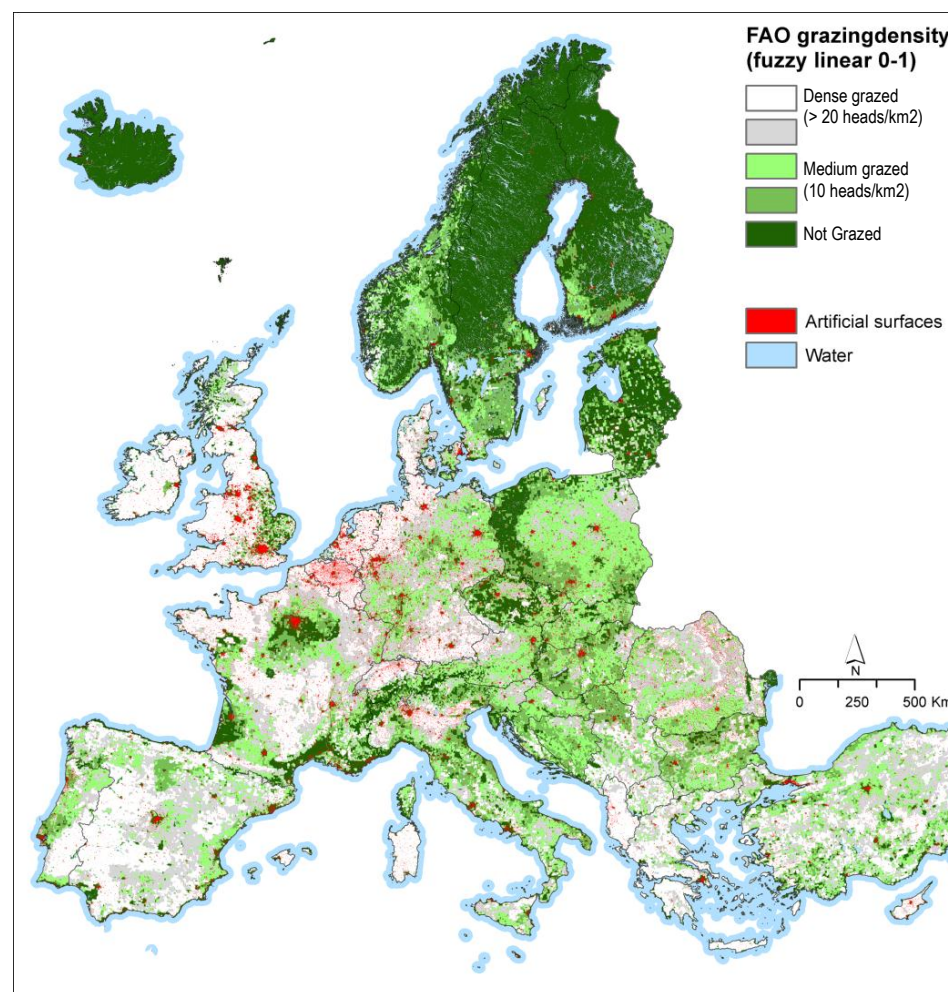


Figure 5.3b FAO GliPha grazing density.

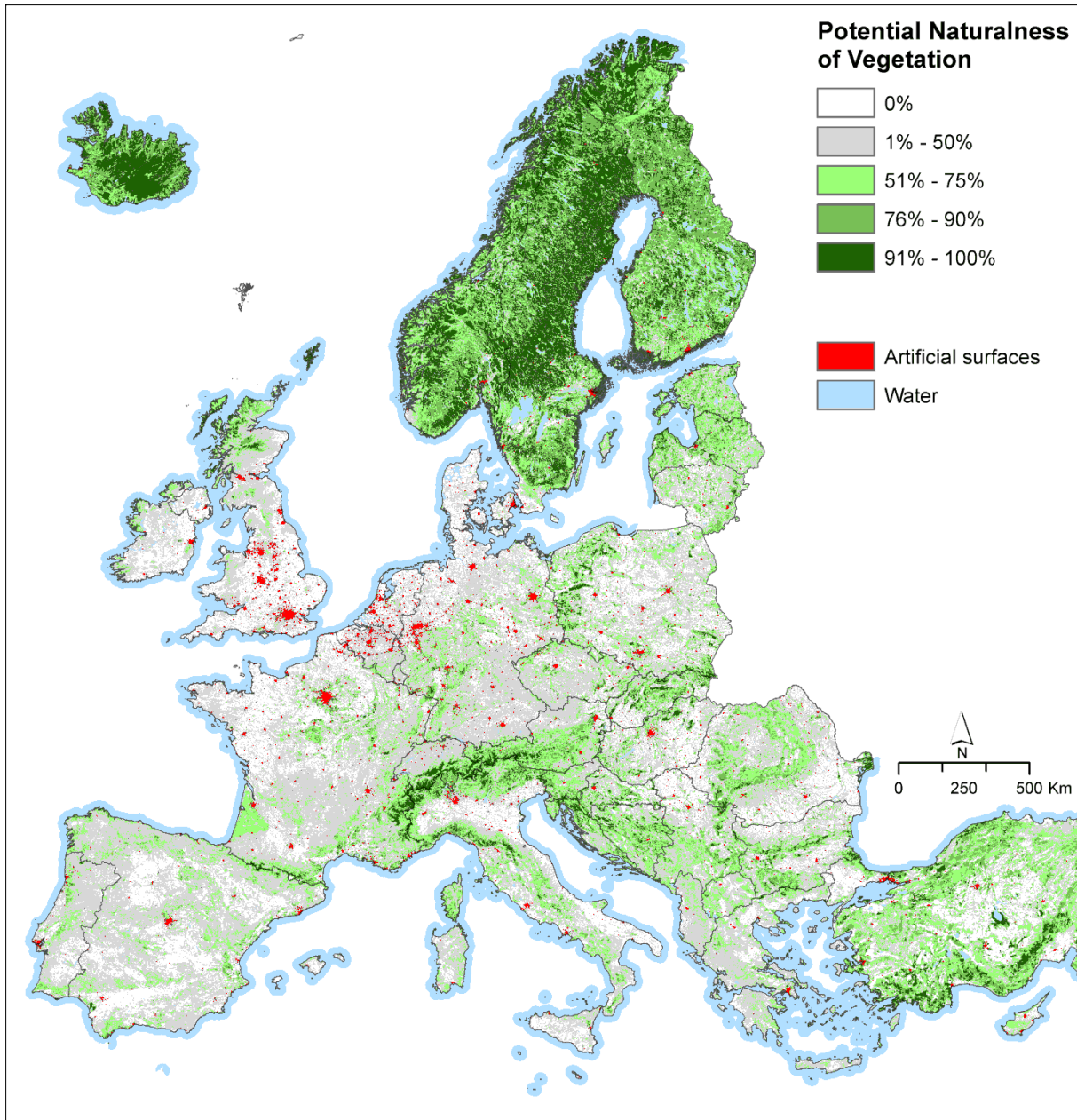


Figure 5.4 Map showing the naturalness of vegetation based on PNV, Corine Land Cover (Fig. 5.3 a) & GliPha grazing density (Fig. 5.3b).

### 5.6.2 Remoteness from settlement and access

For the *remoteness from settlement*, showing the absence of population disturbance, three maps are used:

1. Travel time to populated places as a proxy for remoteness of population;
2. Urban night lights, as a proxy for the absence of artificial forms or structures;
3. Population density itself as a refinement/enhancement of the urban night lights dataset.

Urban Night lights and population density are directly scaled to the 0-1 level. Travel time is calculated using a simple cost-distance approach (method see below). The three scaled maps between 0-1 are combined in a MCE with equal weights to the final remoteness from settlements layer.

The cost distance over and including terrain ruggedness is used to calculate remoteness from access and settlements. Rules are applied to a GIS-grid-based cost distance model in a comparable way Carver & Fritz (1999<sup>64</sup>) described the implementation of Naismith's Rule. This is a traditional rule of thumb used to calculate walking times in mountainous areas, using detailed terrain and land cover information to estimate the time required to access an area from the nearest paved road. A relative cost surface is assumed for all CLC-land cover types where e.g. forest and marshland have slower travel time than open pasture and croplands. Rivers and water bodies have been set as absolute barriers, except for those places where a bridge is crossing. Steep slopes have a negative impact on travel time.

Based on the source to total time- cost to access each cell is calculated:

- calculate the remoteness from road networks: as a source grid all paved roads in the EGG road database are taken;
- calculate the remoteness from settlements as mean remoteness to three classes of settlements: villages/small cities (<50,000), medium-sized cities (<50,000 – 200,000) and main cities (>200,000) (Eupen et al. 2012).

#### *Method*

- Create friction area as cost for cost distance calculation; based on:
  - Roads: Eurogeographics Road database, OSM-database ([www.openstreetmap.org](http://www.openstreetmap.org))
  - Terrain ruggedness: slope, elevation derived from SRTM/ GTOPO1km
  - Water: river network JRC
  - Land use CLC 2000/2006
- Calculate (cost)time-distance to settlements and road networks.
- Correct with an urban night lights dataset weighted for population density for local disturbance around isolated bigger settlements,

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<sup>64</sup> Carver, S., & Fritz, S. (1999). Mapping remote areas using GIS. In M. Usher (Ed.), *Landscape character: Perspectives on management and change* (pp. 112–126). Natural Heritage of Scotland Series, HMSO: Edinburgh.

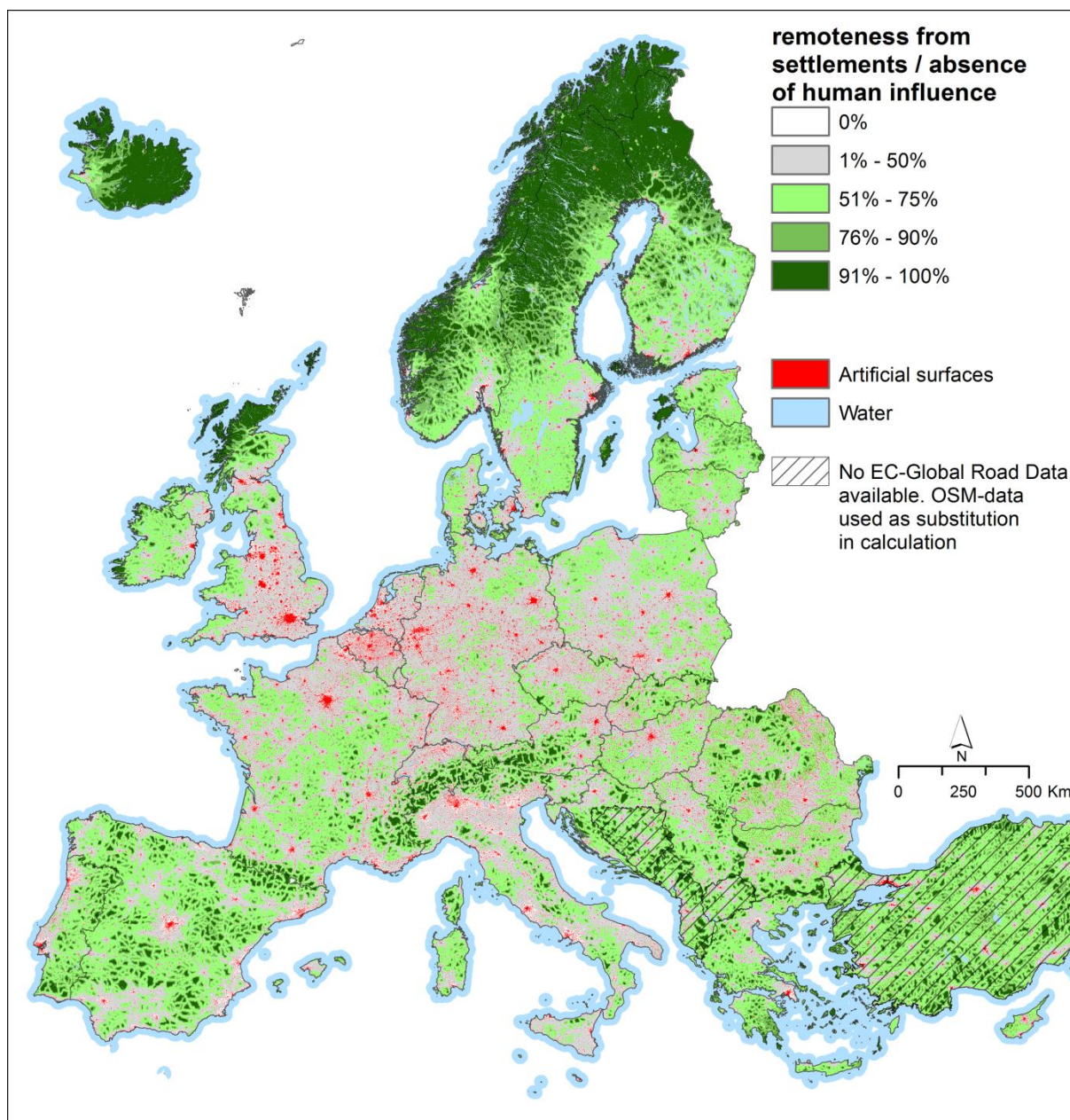


Figure 5.5 Map showing remoteness from settlements / absence of human influence.

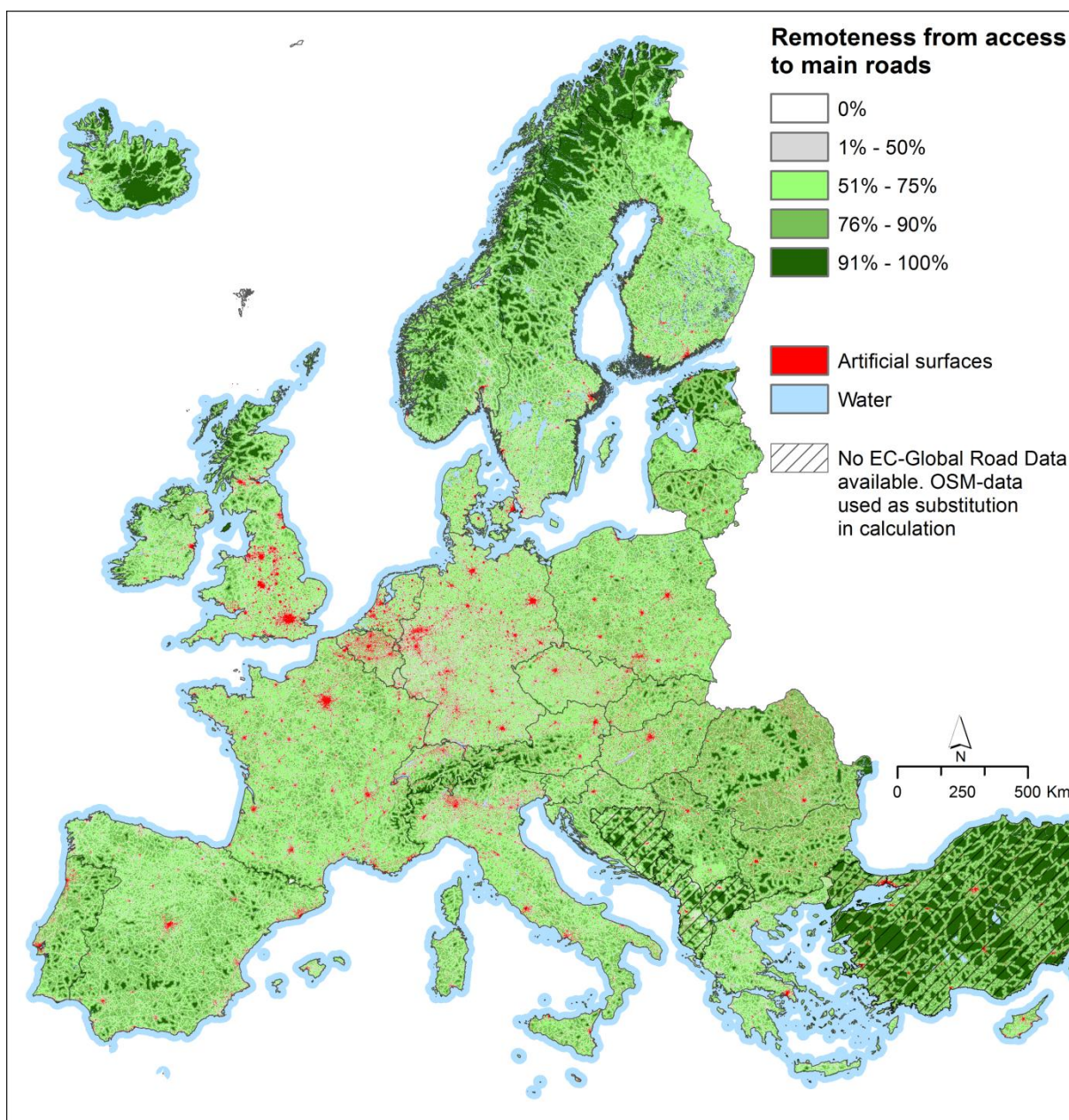


Figure 5.6 Map showing the remoteness from access.

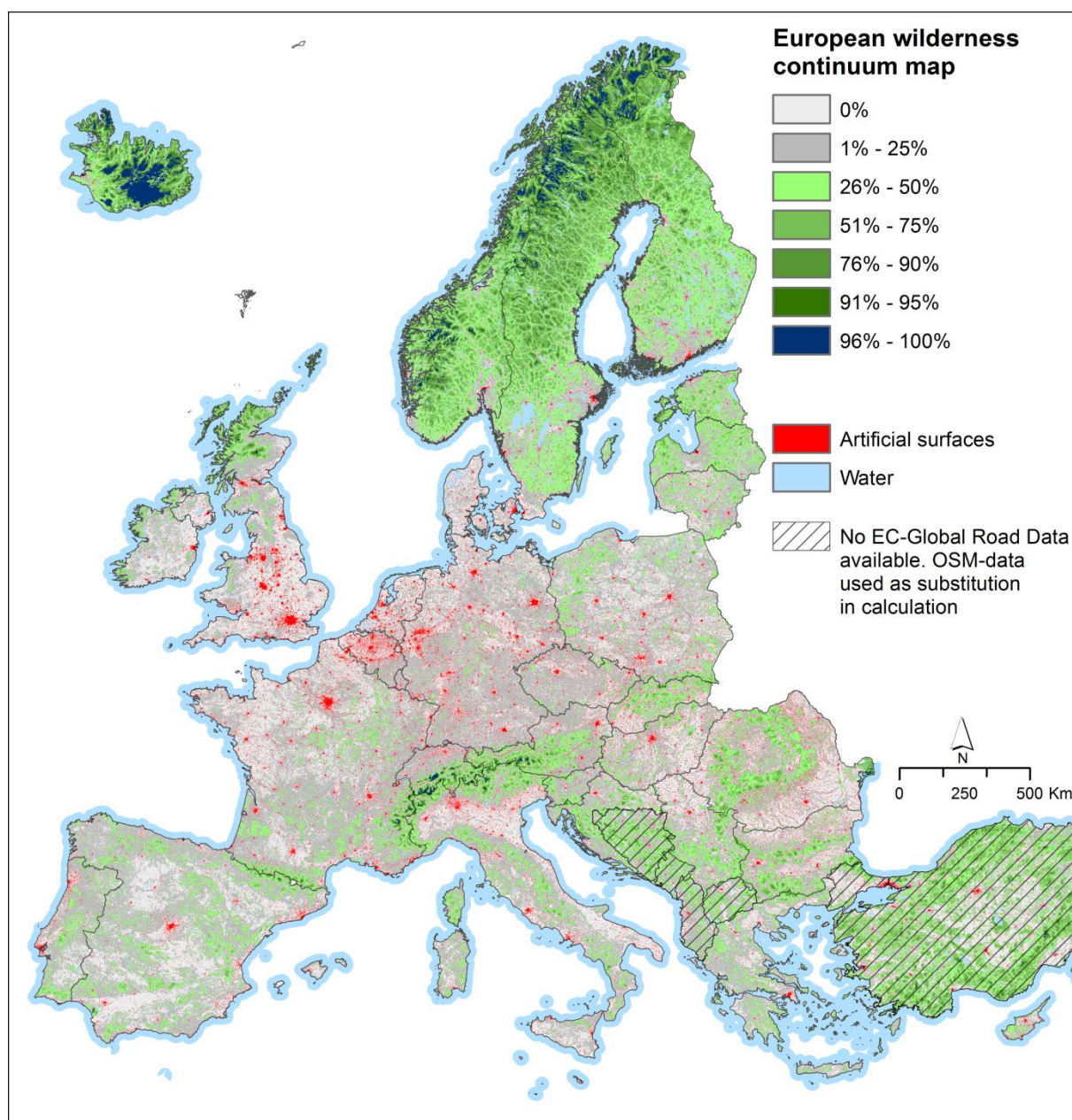


Figure 5.7 Draft European wilderness continuum map.

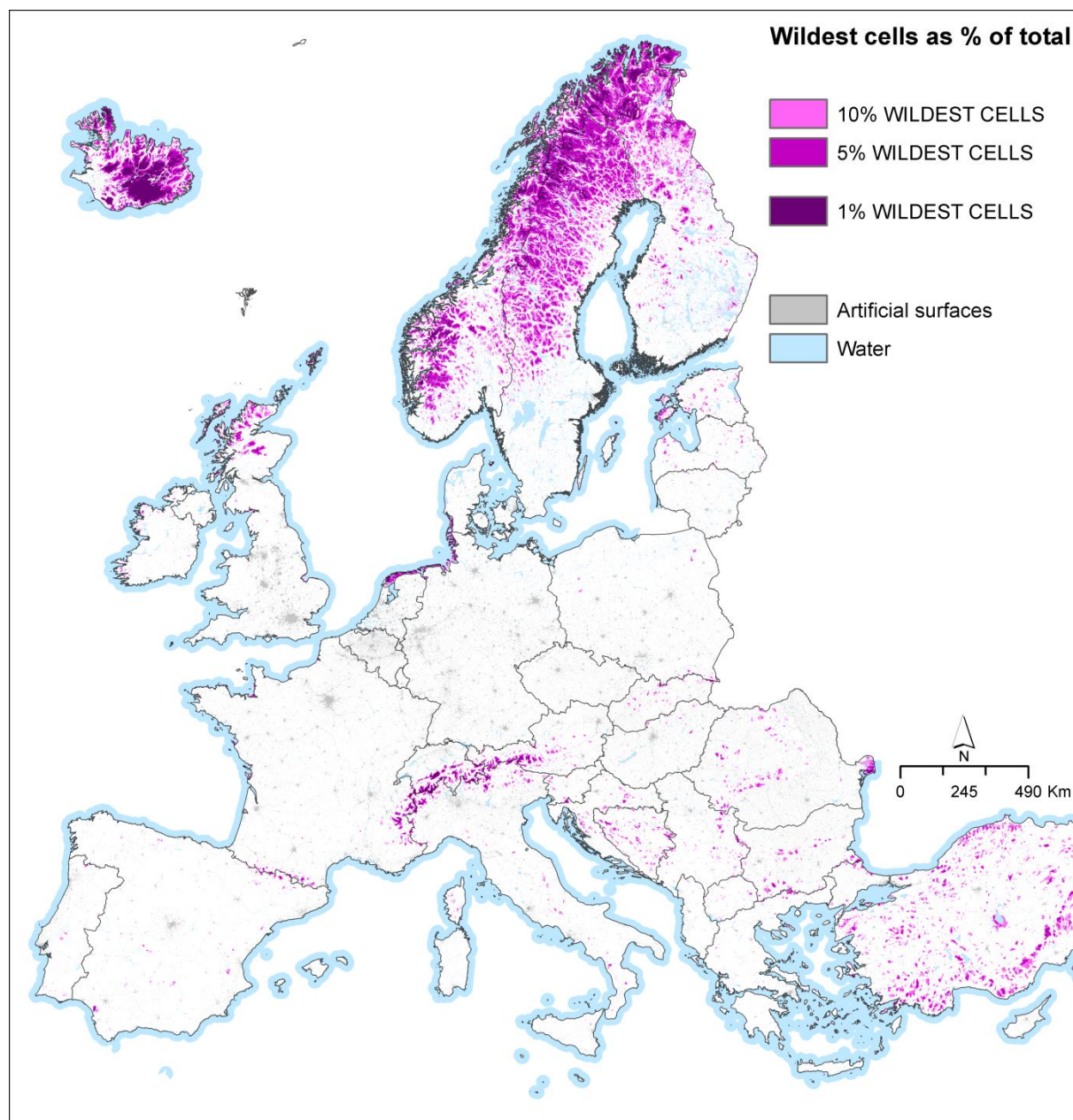


Figure 5.8 The 10%, 5% and 1% wildest cells of Europe taken from the European wilderness continuum map (Fig 5.7).

## 5.7 Usage for monitoring purposes

The draft wilderness indicator will allow the quantitative assessment of trends in the extent of remote land throughout Europe using GIS techniques. By periodically quantifying trends in land use and development, this indicator will show changes in fragmentation rate, in remoteness from infrastructure, and in other aspects related to wilderness qualities. It will reflect the impacts on the natural environment from human activities such as settlement, transport, agriculture, and forestry.

## 5.8 Mapping European wilderness

Results of applying the European indicator for wilderness can be presented as a map, showing spatial data on wilderness index values. Figure 5.7 shows the result of mapping the wilderness index, based on the proposed method as described in the previous paragraphs, using pan-European datasets on remoteness from access and settlements, population density, and apparent naturalness of land cover data. The map shows that the *likeliness of wilderness* qualities is highest in the Fenno-Scandinavian region, the Baltic region, mountainous regions such as the Carpathians, Alps, Apennines, Pyrenees and the Balkan region.

### 5.8.1 Wilderness areas included/not included in CDDA

The wilderness indicator and related maps with wilderness index values can also be used for comparing wilderness register polygons with wilderness quality index values, allowing the identification of “de facto” wilderness areas which are not included in the CDDA database as “de jure” wilderness areas. As a meaningful threshold for wilderness all areas covering more than 3,000 hectares, with a wilderness value of >70% of the maximum wilderness index value were classified as “(containing a) wilderness area”. The threshold of 70% is comparable with the wildest-5%-cells-in-Europe criterion shown in Figure 5.8.

Table 5.3 Overview of amount of the CDDA-area in the wilderness register with wilderness qualities.

Sum area (ha) of CDDA-sites	Wilderness register Category A		A Total	Wilderness register Category A/B		A/B Total	Wilderness register Category B		B Total	Grand Total
	Wilderness area in site	No Wilderness area in site		Wilderness area in site	No Wilderness area in site		Wilderness area in site	No Wilderness area in site		
Country										
AUT	41,949	101,087	143,035							143,035
BGR		49,209	49,209				306,487	14,576	321,063	370,272
CHE	17,032		17,032							17,032
DEU							1,151,214	20,821	1,172,035	1,172,035
ESP							15,690		15,690	15,690
EST		17,100	17,100							17,100
FIN	55,964		55,964	3,252,716		3,252,716		5,192	5,192	3,313,872
HRV		27,007	27,007							27,007
ISL				4,019,320		4,019,320				4,019,320
ITA	71,078		71,078				314,696	69,042	383,738	454,816
LTU								27,207	27,207	27,207
NOR				3067337	53669	3121006				3,121,006
POL	88,882	21,179	110,061				19,662	2,373	22,035	132,096
PRT	69,590		69,590							69,590
ROU	9,447	68,714	78,161				105,270	66,810	172,079	250,240
SVK		36,445	36,445				150,327	47,269	197,596	234,041
SWE				4,095,527		4,095,527	258,526	10,804	269,330	4,364,858
TUR	37,201		37,201				139,380	86,887	226,267	263,469
<b>Grand Total</b>	<b>391,144</b>	<b>320,739</b>	<b>711,883</b>	<b>14,434,900</b>	<b>53,669</b>	<b>14,488,569</b>	<b>2,461,251</b>	<b>350,983</b>	<b>2,812,234</b>	<b>18,012,686</b>

Wilderness in site: &gt;3000 ha wilderness; &gt;70% wilderness value

Very often CDDA areas are neighbouring each other due to practical, historical or political reasons. The thresholds used to characterise an area as wilderness (>3,000 ha; >70% of maximum wilderness) should in principle not be hindered by such man made divisions. For this reason a similar analysis was done, but now with the removal of all internal borders between CDDA areas. This resulted in complexes of CDDA areas which are larger and consequently more likely to contain a larger surface of wilderness area. The same wilderness threshold values were used on these complexes to see how much extra wilderness could potentially be identified by the removal of internal borders. The underlying CDDA areas were marked subsequently if they are a part of the complex of polygons with wilderness >3000 ha; >70% wilderness value.

Table 5.4 shows the area in hectares of all the four resulting categories:

- hectares classified as 'wilderness' by the indicator and the register inside a single CDDA area
- hectares classified as 'wilderness' by the indicator inside a single CDDA area
- extra hectares classified as 'wilderness' by the indicator and the register inside a complex of CDDA areas
- extra hectares classified as 'wilderness' by the indicator inside a complex of CDDA areas

It's important to identify "de facto" 'wilderness areas' which are not included in CDDA but are part of the Natura 2000 network. CDDA and Natura 2000 areas are often (partially) overlapping. However, it is very difficult to give a meaningful comparison between CDDA and Natura 2000 in terms of amount of overlap per CDDA/Natura 2000 site since there are many differences in boundary definition, type of designation, completeness and ambition of both databases per country. Moreover, the naming and coding of CDDA-sites cannot be linked to (overlapping) Natura 2000 sites, since is not consistent, or following a common standard, which makes it not possible to compare areas based on a common code or name.

Therefore, a GIS approach was followed, from which the most relevant results are presented in Table 5.5. This table is presenting those areas which could be classified as wilderness outside CDDA areas.

These areas are:

- >3,000 ha with a wilderness indicator value of >70%
- completely outside CDDA polygons
- could be part of a Natura 2000 site which is (partly) overlapping with CDDA
- could be part of a Natura 2000 site which is not overlapping CDDA

In the supplementary material (excel table) all detailed information per CDDA-Natura 2000 site is given.

Table 5.4 Likeliness of wilderness qualities in hectares of all the four resulting categories

Sum area (ha) of wilderness	Wilderness in CDDA Sites (Areas >3,000ha; >70% wildness)		Site Wilderness Total	Extra Wilderness in complexes of adjacent CDDA-Areas (>3,000ha; >70% wildness)		Complex Wilderness Total	Grand Total
	Country code	in Register	Not in Register	in Register	Not in Register		
ISL		3,640,513	71,123		715	715	3,712,351
SWE		3,111,770	91,498	6,091	10,683	16,774	32,20042
NOR		2,266,035	643,825	8,735	37,195	45,930	2,955,790
FIN		1,792,682		1,081	4,110	5,191	1,797,873
TUR		62,498	247,124	100	4,785	4,885	314,507
DEU		267,106		2,530	186	2,716	269,822
GBR			222,114		36,217	36,217	258,331
FRA			225,470		3,553	3,553	229,023
CHE		6,071	202,598		19,739	19,739	228,408
AUT		21,946	164,953	1,859	19,241	21,100	207,999
ROU		28,738	134,738	3,907	7,318	11,225	174,701
ITA		47,257	106,153	292	14,136	14,428	167,838
ESP		5,319	48,214		1,665	1,665	55,198
BGR		39,643		7,822	251	8,073	47,716
SVK		13,937	6,123	1,995	6,022	8,017	28,077
POL		20,026		1,948	3,935	5,883	25,909
SVN			11,248		4,720	4,720	15,968
SRB			14,696				14,696
EST			3,983	844	4,401	5,245	9,228
HRV			7,099	176		176	7,275
LVA			4,486		1,745	1,745	6,231
HUN			4,792				4,792
PRT		4,683					4,683
GRC					3,768	3,768	3,768
LTU				100	2,183	2,283	2,283
<b>Grand Total</b>		<b>11,328,224</b>	<b>2,210,237</b>	<b>37,480</b>	<b>186,568</b>	<b>224,048</b>	<b>13,762,509</b>
<b>In %</b>		<b>82%</b>	<b>16%</b>	<b>0.25%</b>	<b>1.35%</b>	<b>1.6%</b>	<b>100%</b>

Table 5.5 Extra hectares of areas with likeliness of wilderness qualities in Natura 2000 not covered by CDDA.

Member states	Area (ha) extra N2000 wilderness (Areas >3000ha; >70% wildness)	% of extra wilderness areas compared to wilderness areas in CDDA (see table 5.4)	Nr. of extra N2000 sites with wilderness qualities
SWE	442,393	+14%	21
FIN	262,098	+15%	12
BGR	85,612	+179%	9
ITA	62,277	+37%	10
ROU	45,928	+26%	5
FRA	31,441	+14%	5
GRC	17,708	+470%	1
IRL	14,510	No CDDA	3
GBR	12,929	+5%	3
ESP	9,534	+17%	2
SVK	3,378	+2%	1
<b>Grand Total</b>	<b>987,808</b>	Over all areas in CDDA (13,762,509 ha) +7%	<b>72</b>

- From Tables 5.3-5.5 it can be concluded that: the total area of potential 'wilderness / wild land' in Europe (39 countries) amounts to ca. 13 million hectares; for a correct understanding and as mentioned earlier: a high wilderness indicator value only means that there is a high *likeliness* that wilderness qualities do occur; to assess if an area is 'de facto' wilderness, additional information is needed.
- 87% of which is located in the Nordic region (ISL, SWE, NOR, FIN);
- approximately 7% of Natura 2000 sites with wilderness qualities is outside CDDA; therefore only a relatively small number of sites are 'missed' taking CDDA as starting point for the register;
- for three countries i.e. Ireland (no CDDA), Bulgaria and Greece, the majority of protected 'wilderness' can be found inside Natura 2000 areas, instead of CDDA;
- 64% of the registry areas falls in the category of >3,000 ha, >70% wildness, but for category A areas, this is the lowest (43%). Most likely this indicates that the draft wilderness indicator is not selective enough.

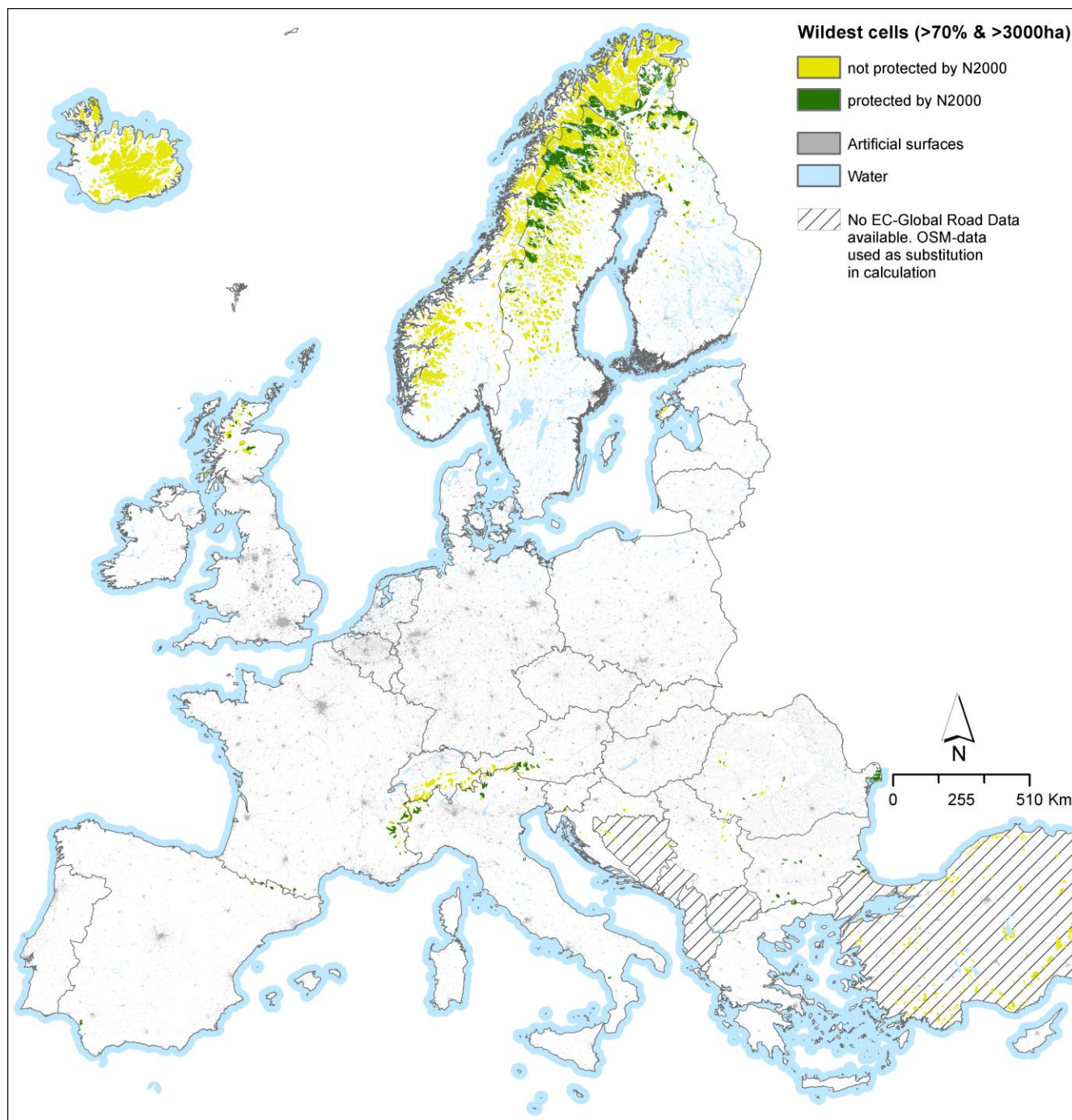


Figure 5.9 Protection status of the wildest cells (>70% wilderness value; >3000 ha cell clusters) by Natura 2000.

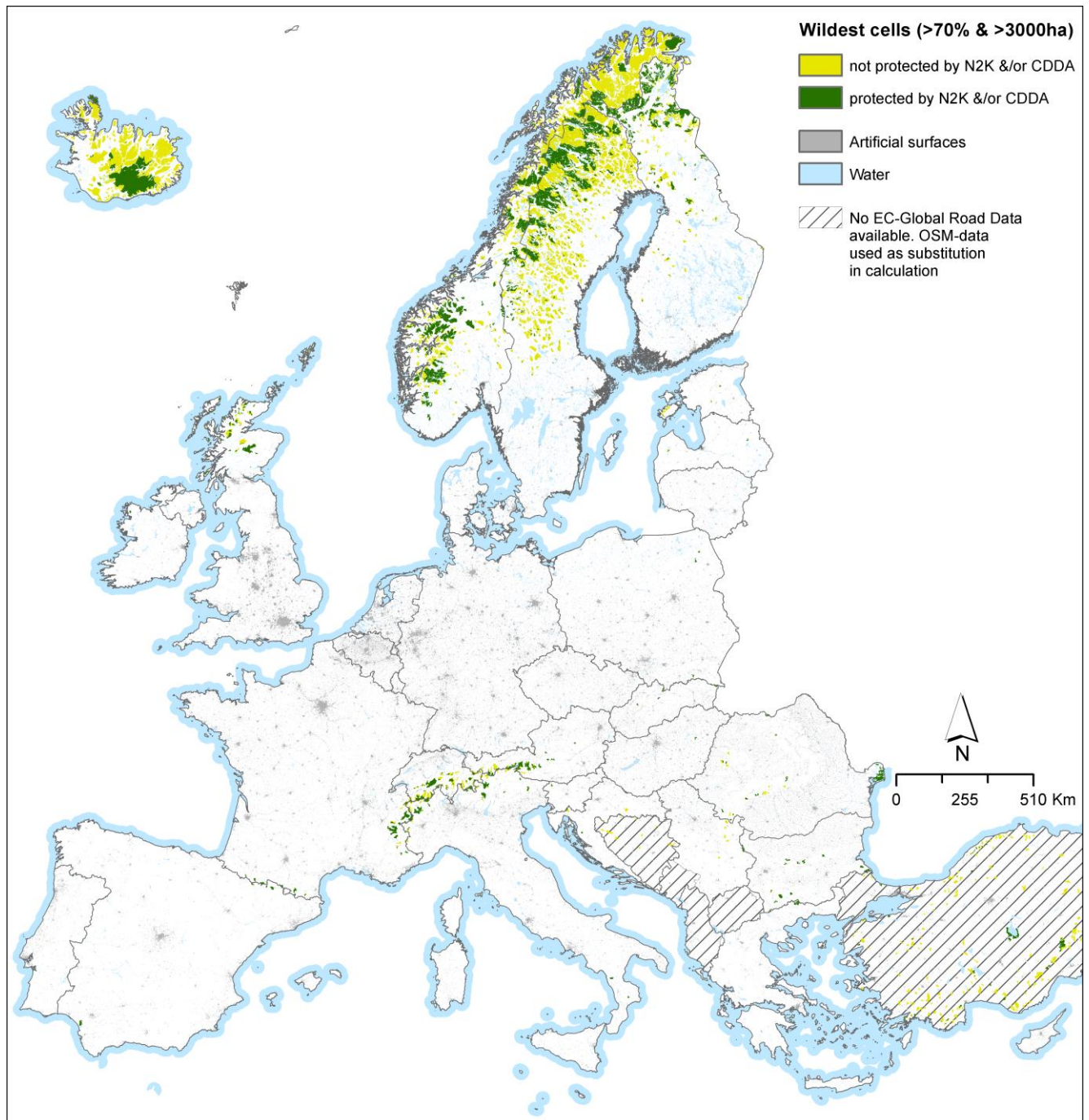


Figure 5.10 Protection status of the wildest cells (>70% wilderness value; >3000 ha cell clusters) by Natura 2000 combined with CDDA.

### 5.8.2 Comparison with existing regional mapping of wilderness

The relevance of regional mapping will be described and illustrated with examples from Scotland, Austrian Alps, and the Carpathians (Romania), showing the impact of methodological issues such as weighting different input layers, data processing and tackling problems of data inconsistencies.

Figures 5.11-5.13 show the visual comparison between the regional datasets and the proposed European wilderness indicator.

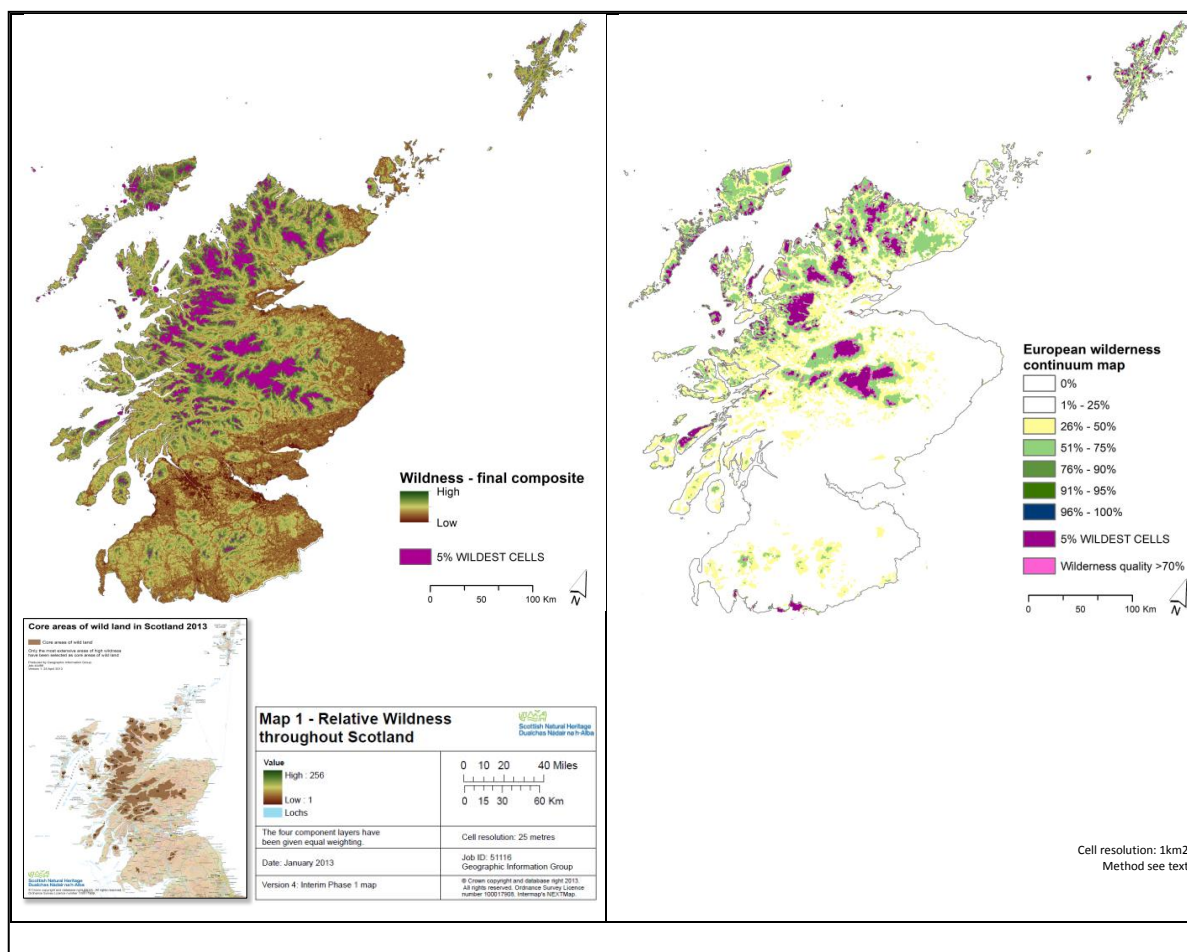


Figure 5.11 Wilderness map for Scotland, (left side) compared with a cropped area of the European draft wilderness indicator map (right side).

The Scottish Natural Heritage identified the most significant and valued areas of wild land sharing comparable GIS techniques with the European indicator (<http://www.snh.gov.uk/>). The map of wild land is using four physical attributes: perceived naturalness, rugged or challenging terrain, remoteness from public roads, and visible lack of built development and other modern artifacts. In a later phase, this data was analysed to identify the largest and most wild areas, and provisional boundaries of core-areas were drawn, (small map left) (SNH, 2013<sup>65</sup>).

<sup>65</sup> SNH, 2013. Mapping Scotland's Wildness, Non –Technical Methodology, revised February 2013. Available at: [www.snh.gov.uk/docs/A892789.pdf](http://www.snh.gov.uk/docs/A892789.pdf)

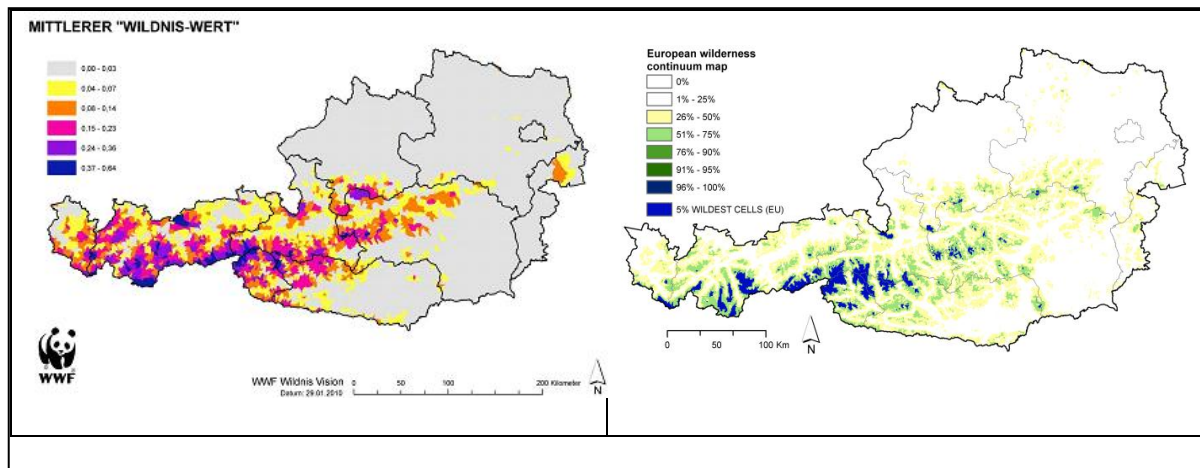


Figure 5.12. National wilderness potential of Austria (Plutzer, 2010<sup>66</sup>, left) with the draft wilderness indicator map (right).

In this study large contiguous areas were identified where there are no roads and settlements, no hydro and ski lift and no cable car facilities; furthermore also the natural degree of proximity of the forests was included in the analysis. As visible, especially in the Alps, there are still significant wild areas that could be maintained or developed as wilderness area (WWF 2012). The EU-wilderness indicator map (right) shows a highly comparable pattern.

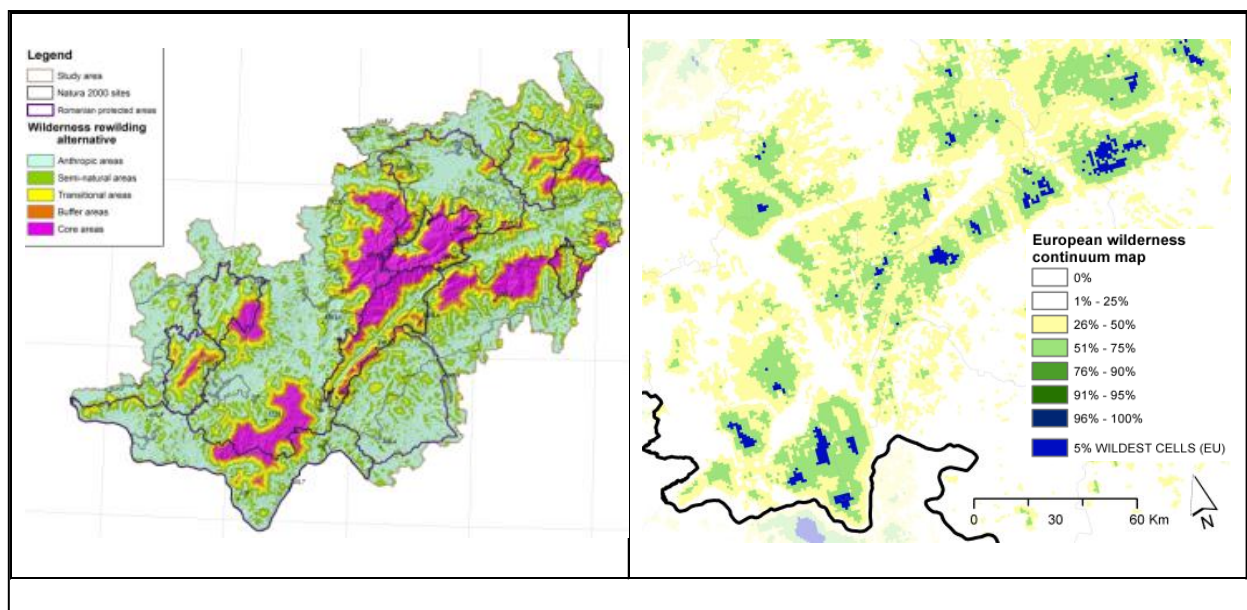


Figure 5.13 Wilderness rewilding alternative for the Southern Carpathians (University of Bucharest, Romania as presented by Zika in 2012<sup>67</sup>).with the draft wilderness indicator map (right).

<sup>66</sup> Plutzer C. (2010). WWF Wildnis Vision – GIS-Modellierung, WWF Österreich-VINCA, interner Bericht, Wien. In: Kohler, B. C. Laßnig, M. Zika, 2012. Wildnis in Österreich? Herausforderungen für Gesellschaft, Naturschutz und Naturraummanagement in Zeiten des Klimawandels. Österreichische Bundesforste AG (ÖBf AG) / WWF, Purkersdorf, Austria. 66 p.

<sup>67</sup> Zika, M. 2012. Towards a National Strategy to promote wilderness. Nature Conservation Department, WWF Austria. Wilderness Policy Conference, Brussels, 31 January 2012. Available at: <http://es.slideshare.net/panparks/presentation-from-michael-zika-wilderness-officer-wwf>.

Figure 5.13 left and right shows a rather comparable pattern, but with less explicit core areas. This is most likely due to the used FAO-grazing density map, which shows grazing activities in the proposed core areas (see Figure 5.3b).

The main features of the draft wilderness indicator when compared with the wilderness values on all regional maps are very similar. The very high wilderness values found in the European map are also visible in the all regional datasets (and generally *vice versa*). The European map is purely focusing on wilderness areas, and thus excluding extreme areas which do not have any score on one of the sub indicators. The Austrian map is narrowing down for wilderness areas in a comparable way. The Scottish regional wilderness map is looking more for a gradually increasing wilderness value with the majority of the region having values more than zero and anthropogenic areas included in the classification. E.g. the SNH sub-indicator-map “Absence of Modern Artefacts” shows that there are very few areas remaining with very high characteristics, i.e. the absence of any artefacts (SNH, 2012). The final relative wilderness mapping has been created by adding the various attribute strengths together, this method can thus not take into consideration of how extremes in each the used attributes may affect wilderness. However, in several following phases the map is also narrowed down towards core wilderness areas (SNH, 2013, see small map figure 5.9a). All regional datasets seem more accurate in terms of resolution (European indicator = 1 km, e.g. Scotland uses a resolution of 25 m).

For a (statistical) GIS analysis only the Scottish dataset was made available. Table 5.6 shows the comparison of all CDDA areas in Scotland for the draft wilderness indicator and the Scottish indicator map. For consistency, the European threshold to define wilderness areas was used (see paragraph 5.4 and 5.5). The SNH uses a comparable methodology, but a slightly different scaling technique (SNH, 2013). When the proposed wilderness indicator method is applied on the Scottish map, it shows that the majority of CDDA-areas are classified identically. Both indicators are based on completely different spatial datasets, but they share the majority of used GIS techniques and physical attributes. It is not surprising that the correlation between both indicators, when (simply) looking at the amount of wild cells over all Scottish CDDA-areas, is more than 90%. Table 5.6 shows that also more than 90% of the CDDA areas is identically classified and that just <3% of the sites (covering <10% of the total CDDA-area) is classified differently.

*Table 5.6 Comparison between proposed European wilderness indicator and the SNH-indicator in Scottish CDDA areas.*

Category	Nr. of Scottish CDDA sites	Area of Scottish CDDA-sites
“Wilderness area” classified by both proposed European indicator- and SNH-indicator	5.12%	55.19%
“No Wilderness area” classified by both proposed European indicator and SNH-indicator	92.09%	35.25%
“Wilderness area” classified only by proposed wilderness indicator	0.93%	1.78%
“Wilderness area” classified only by SNH-indicator	1.86%	7.78%
<b>Grand Total</b>	<b>100.00%</b>	<b>100.00%</b>

## 5.9 Draft wilderness indicator: data improvement

We used the most relevant and best datasets available. The most important problem issues such as cross-border differences in mapped road densities, naturalness of vegetation cover and the scaling effects were underpinned by worked-out examples. Nevertheless, at the European-wide scale datasets used for compilation of a wilderness indicator, can be further improved.

To keep in mind the amount of effort to improve some datasets a review of the Scottish wildness map provides a useful insight. The map was reviewed thoroughly by SNH through a stakeholder approach (SNH, 2012<sup>68</sup>). One of the key remarks was *“that the (SNH) GIS analysis provided a realistic picture of the resource at the national level, but that its consideration at the local level required more detailed assessment and judgment (SNH, 2012)”*. So even with the best regional data available performed with regional scale thresholds, still the local opinion of about an indicator will be difficult to capture. Taking that in consideration, it seems appropriate to focus more on lacking datasets at the EU-level (which are definitely available at regional level), than to put much effort in the slight improvement of existing ones.

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<sup>68</sup> SNH, 2012. Analysis of response on phase I wildness mapping. 40 p. <http://www.snh.gov.uk/docs/A869935.pdf>

## 6 Achieved results

In this section the main achievements of the project are described and compared with the main objectives and the tasks as formulated in the technical description of the contract. From the completed tasks, the two main objectives of the project were achieved, i.e. a proposal for a wilderness indicator based on a spatial analysis using a multi-criteria evaluation approach, and a registry for protected wilderness areas in Europe.

### *(i) Working definition for wilderness*

A working definition for wilderness was developed compatible with the IUCN guidelines on protected area management class Ib 'Wilderness'. Several additions and modifications were included to make it applicable for filtering protected areas from the CDDA database (task v). Derived from the working definition, a clear set of measurable criteria for the main features of wilderness was developed. These criteria were used to evaluate if sites selected from the CDDA database qualified as wilderness. Information was made available by local stakeholders or site managers. This working definition was also used to select suitable datasets for developing a draft wilderness indicator (task iv).

### *(ii) Relevant datasets for the draft wilderness indicator*

The most relevant datasets for setting up a wilderness indicator (task iv) were explored and selected. Datasets to be used for the development of the indicator had to be consistent across national boundaries throughout the European territory, with a sufficient and coherent spatial resolution (lowest resolution for a EU coverage: 1 x 1 km). Selected were datasets on population density, landscape fragmentation and infrastructure, and on naturalness of land cover and vegetation. These datasets were combined for the compilation of a wilderness index, following a multi-criteria evaluation approach (task iv). Most problematic was the availability of valuable data on naturalness of the vegetation. European wide there is a lack of data, especially on naturalness of forests. However, by combining land cover data (CORINE), with datasets on potential natural vegetation and on land use intensity by livestock, a workable proxy for naturalness was compiled. The wilderness indicator might be further improved in the future, if mapping data of pristine forests in Europe become available. For compilation of a wilderness register (task v), the CDDA database was most useful, because it is the only dataset covering 39 European countries which encompasses information on management objectives. In certain cases the WDPA database provided some additional information, especially for those protected areas not included in CDDA.

### *(iii) Stakeholder consultations to acquire relevant additional data and ensure quality of the data*

Stakeholders in 39 countries (EEA members) were contacted to acquire relevant additional data on pre-selected protected sites and to ensure sufficient quality of the data available. A list of ca. 700 pre-selected protected areas with potential wilderness qualities was checked by national stakeholders for the quality of available data and additional information on attributes related to wilderness qualities was provided. Additionally, about 100 site managers of protected wilderness and wild areas provided information on attributes for those countries where no response was received from local stakeholders. Valuable data was received from them, in addition to the information received from local stakeholders. Based on these stakeholder and site managers consultations, information on wilderness qualities of protected areas was received for 72% of the pre-selected PAs, thereby ensuring the quality of available data for the main part of pre-selected PAs.

*(iv) Produce a draft indicator for monitoring wilderness in Europe*

The draft wilderness indicator will allow the quantitative assessment of trends in the extent of remote land throughout Europe using GIS techniques. By periodically quantifying trends in land use and development, this indicator will show changes in fragmentation rate, in remoteness from infrastructure, and in other aspects related to wilderness qualities. It will reflect the impacts on the natural environment from human activities such as settlement, transport, agriculture, and forestry. It is based on spatial landscape features which make the presence of wilderness areas likely, and is built upon four key-wilderness aspects derived from the wilderness working definition, i.e. naturalness of land cover and vegetation, remoteness from settlements and remoteness from access, and terrain ruggedness. Based on the datasets collected under task ii, a draft wilderness indicator was compiled using a multi-criteria evaluation approach. The four sub-indicators were combined within a simple weighted linear combination model. Several maps were delivered showing wilderness qualities throughout the European continent (Fig.4.5), and their overlap with CDDA or the Natura 2000 network. The wilderness indicator was also applied to detect protected areas, not being registered in CDDA, but potentially qualifying as wilderness area. These were either Natura 2000 areas not being registered in CDDA, or non-protected areas, mainly occurring in Nordic regions. Data handling is documented with arguments why certain datasets were either selected or rejected and how datasets were processed.

*(v) Produce a register of European wilderness building on CDDA*

A draft registry for European wilderness was produced. Quality of the data was checked in a verification process by National Focal Points. With the draft register, data availability on wilderness areas is strongly improved for 39 countries (EEA members). More than 500 protected areas were identified having wilderness qualities, of which 282 were qualified partly or total as wilderness category A, i.e. meeting the criteria set for wilderness, with an estimated total coverage of 4-5% of the Natura 2000 network. The register, however, cannot be considered complete yet, because for 16 countries no additional information was received yet from local stakeholders or from National Data Managers for verification. Data processing for compiling the register is documented in detail.

*(vi) Produce material for dissemination of the results*

Two summary leaflets were compiled for the general public separately on the draft wilderness indicator and the wilderness registry. Additionally, two power point presentations were prepared targeting stakeholders separately on the wilderness indicator and register.

*Threats and opportunities for European wilderness conservation*

One of the ‘messages from Prague’ was “the compilation of a wilderness register, by identifying in tandem with interested parties remaining areas of wilderness and wild lands, and their threats and opportunities related to this”. Within the current contract data availability on category A (wilderness) and B (wild areas) protected areas was largely improved in cooperation with local NGOs, stakeholders, site managers and National Data Managers. However, the *elucidation of threats and opportunities related to this* is an important aspect of European wilderness conservation, which still has to be analysed in close cooperation with site managers, local authorities and other relevant parties of the remaining wilderness and wild areas in Europe. Based on this, priorities for further action can be

assessed for enhanced protection of wilderness and related biodiversity, which will contribute in achieving the targets set out in the EU Biodiversity strategy to 2020 <sup>69</sup>.

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<sup>69</sup> <http://ec.europa.eu/environment/nature/biodiversity/comm2006/2020.htm>

## 7 Recommendations for future actions

### 7.1 Wilderness register: proposal on data management and updating

*Tabular data:* Several countries, such as Slovakia, Bulgaria and Czech Republic have IUCN management categories Ia/Ib ‘embedded’ in other categories (mainly categories II and V). By consequence, in statistics on protected areas there is ‘doubling’, leading to biased data on the amount of hectares protected at national levels. We strongly recommend to remove this doubling from the tabular part of the CDDA database.

*Spatial data:* The wilderness register holds tabular data of protected areas with wilderness quality. By their unique CDDA code identifier these tabular data can be coupled to spatial data (site boundaries) stored in CDDA. For most of these PAs, however, there is also spatial information of the wilderness core zones (boundaries) *within* each area. These data can be made available with the help of NFPs or site managers. This will further complete the wilderness register.

*Wilderness category A/B* (large wild areas in Nordic countries with high wilderness qualities, but without core areas): further investigations are needed here. It should be possible to get local Sámi people in Norway, Sweden and Finland, in cooperation with local agency representatives, willing to define these areas themselves as part of an online participatory GIS survey (e.g. using the fuzzy online GIS survey tool ‘MapMe’ developed by University of Leeds).

*European territory:* The wilderness register is built on the identification of wilderness areas in 39 European countries, i.e. EEA members and collaborating countries. Extension of the wilderness register to neighbouring European countries such as Ukraine, Georgia, Belarus, Russia and Armenia is recommended, as many (large) wilderness areas are located there. Data availability, however, might be a serious problem and it should be explored if this extension of the territory of the register is feasible.

*Update and hosting* It is important that the status of all protected areas in the wilderness register is monitored at a regular basis. Changes in protected area management should be monitored, as well as changes in zonation. The register should be regularly updated, also taking into account ‘wild areas’ qualifying as ‘wilderness category B’ to be considered for inclusion in the register. The method/workflow is dependent on the way data collation on protected areas is organised at the national level, which is strongly different among countries. The National Data Focal Points (EIONET) play a central role in this.

### 7.2 Wilderness indicator: proposal on data improvement

We used the most relevant and best datasets available nowadays. The most important problem issues such as cross border differences in mapped road densities, naturalness of vegetation cover and the scaling effects were underpinned by worked-out examples. Nevertheless, at the European-wide scale datasets used for compilation of a wilderness indicator, can be further improved.

Dataset improvement is urgently needed on:

- *Road data*: at the European level there is inconsistency in road data. For EU27 + Norway road data are consistently available. However, for other European countries such as Albania, Bosnia-Herzegovina, Croatia, Serbia, Macedonia and Turkey, the quality of road data is significantly lower. This leads to concerns over trans-boundary differences in the quality of road data and the effect that has on components of the wilderness indicator (e.g. sharp changes of remoteness/accessibility at national borders as a result of changes in data quality. The use of TeleAtlas will improve road data quality at a European-wide scale, but EEA has not prolonged its user license for this database and could not be used under this contract.
- *Naturalness of vegetation*: there are no European-wide databases available on vegetation management and utilisation (e.g. timber harvesting, grazing, drainage, peat cutting). This makes it rather difficult to correctly capture naturalness of vegetation based on land cover data. By using the Land-use intensity database of FAO (spatial data on domestic animal densities such as sheep, goats, cattle, pigs, buffalo and poultry), relevant information on 'naturalness' of open vegetation types was added. However, this was not the case for forest cover. Until today, a database is lacking with spatial data on the occurrence of pristine forests with non-intervention management. We strongly recommend that such a database is compiled in the near future. This can greatly improve the wilderness quality indicator.

### 7.3 Public access

The consortium contracted for the development of the wilderness register (led by Alterra with contributions of University of Leeds and PAN Parks Foundation) experienced a great interest from various sectors (government, academic, NGO, site management) in the outputs of the register. Data on wilderness areas throughout Europe were made available based on information provided by NGOs, site managers and National Focal Points. We suggest making this output available on a public domain.

There is certain information enclosed in this report which seems to raise the interest of the civil society and researchers:

- overlap between Europe's protected wilderness areas and Natura 2000 network;
- the coverage of protected areas which are currently registered as wilderness in various existing databases (CDDA/UNEP WCMC protected area database);
- the coverage of wilderness, which actually suit to the working definition of wilderness used in this project (true wilderness note: category A);
- the coverage of wild areas which might qualify as wilderness in the future after certain management measures have been taken (category B).

Each of these pieces of information should in our view be accessible per country and as an overall figure for Europe (the participating 39 countries). Country specific information will support the European Commission's work on guaranteeing proper management and planning of Natura 2000 sites and particularly to motivate protected area managers across the EEA members to take the right measures to protect wilderness areas.

The public access to this information will help to contribute to the implementation of the Agenda for Europe's wilderness (also known as Message from Prague, EC Presidency Conference in Prague, May 2009) especially on:

- a) generating a public debate about the state of art of wilderness protection in Europe
- b) increasing the awareness about wilderness among the general public
- c) defining the next steps towards a strategy to build a European Wilderness Preservation System (Prague recommendations).

Eventually the register will likely lead to further research projects aiming to further refine our knowledge on wilderness areas and wilderness attributes in Europe (for more details see Chapter 5). Therefore, it is recommended that the information enclosed in this report, together with the wilderness registry, will be made publicly available.



## Glossary

ASCI	Areas of Special Conservation Interest
BDC	Biodiversity Data Centre
BISE	Biodiversity Information System for Europe
CBD	Convention on Biological Diversity
CDDA	Common Database on Designated Areas
EEA	European Environment Agency
EIONET	European Environment Information and Observation Network
ESPON	European Spatial Planning Observation Network
ETC-BD	European Topic Centre on Biological Diversity
GIS	Geographical Information System
INSPIRE	Infrastructure for Spatial Information in Europe
NFP	National Focal Point
NLEP	Net Landscape Ecological Potential
IUCN	International Union for Conservation of Nature
IUCN-WCPA	World Commission on Designated Areas
pSCI	proposed Site of Community Importance
SAC	Special Area of Conservation
SCI	Sites of Community Importance
SDF	Standard Data Form
SEBI 2010	Streamlining European 2010 Biodiversity Indicators
SPA	Special Protection Area
UNEP	United Nations Environment Program
UNEP-WCMC	World Conservation Monitoring Centre
WDPA	World Database on Protected Areas



## References

- Beckmann, A. (2009). 'Protecting what's left of European wilderness', The Magazine of the Regional Environmental Center GreenHorizon-online.com (<http://www.greenhorizon-online.com/index.php/Insight/protecting-whats-left-of-european-wilderness.html>) accessed 15 November 2011.
- Böhn, U., G. Gollub, C. Hettwer, Z. Neuhauslova, H. Schlueter & H. Weber (2000). Karte der natürlichen Vegetation Europas. Map of the natural vegetation of Europe. Federal Agency for Nature Conservation, Bonn.
- Brus, D.J., G.M. Hengeveld, D.J.J. Walvoort, P.W. Goedhart, A.H. Heidema, G.J. Nabuurs & K. Gunia, (2011). Statistical mapping of tree species over Europe. *European Journal of Forest Research* 131 (1): 145–157.
- Carver, S., & S. Fritz (1999). Mapping remote areas using GIS. In M. Usher (Ed.), *Landscape character: Perspectives on management and change* (pp. 112–126). Natural Heritage of Scotland Series, HMSO: Edinburgh.
- Carver, S., A. Evans & S. Fritz (2002). Wilderness Attribute Mapping in the United Kingdom. *International Journal of Wilderness* 8: 24–29.
- Carver, S., A. Comber, R. McMorran & S. Nutter (2012). A GIS model for mapping spatial patterns and distribution of wild land in Scotland. *Landscape and Urban Planning* 104: 395– 409.
- Comber, A., S. Carver, S. Fritz, R. McMorran, J. Washtell & P. Fisher (2010). Different methods, different wilds: Evaluating alternative mappings of wildness using fuzzy MCE and Dempster-Shafer MCE Computers. *Environment and Urban Systems* 34: 142–152.
- Dudley, N. (Ed.) (2008). *Guidelines for Applying Protected Area Management Categories*. Gland, Switzerland: IUCN. x + 86pp.
- EEA (2006). Technical report No 9/2006. European forest types. Categories and types for sustainable forest management reporting and policy. 2nd edition, May 2007.
- EEA (2007). Technical report No 11/2007: Halting the loss of biodiversity by 2010: proposal for a first set of indicators to monitor progress in Europe.
- EEA (2010) Europe's ecological backbone: recognising the true value of our mountains. EEA report no 6/2010, Copenhagen. 248 p.
- EEA (2012). Streamlining European biodiversity indicators 2020: Building a future on lessons learnt from the SEBI 2010 process. EEA Technical report No 11/2012. Copenhagen. 48 p.
- EEA (2012). Protected areas in Europe –an overview. EEA Report No 05/2012. Copenhagen. 130 p.
- Eupen, M. van, M.J. Metzger, M. Pérez-Soba, P.H. Verburg, A. van Doorn, A. & R.G.H. Bunce (2012). A Rural Typology for Strategic European Policies. *Land Use Policy* 29: 473–482.
- EUROPARC & IUCN (2000). *Guidelines for Protected Area Management Categories. Interpretation and Application of the Protected Area Management Categories in Europe*. EUROPARC & WCPA, Grafenau, Germany. 48 pp.
- European Commission (2012). *Guidance on the management of wilderness and wild areas in Natura 2000* (in press).
- Fisher, M., S. Carver, Z. Kun, R. McMorran, K. Arrell & G. Mitchell (2010). *Review of Status and Conservation of Wild Land in Europe*. Project commissioned by the Scottish Government.
- IUCN/WCMC (1994). *Guidelines for Protected Area Management Categories*. Gland and Cambridge: IUCN.

- Jones-Walters, L. & K. Čivić (2010). Wilderness and biodiversity. *Journal of Nature Conservation* 18: 338-339.
- Metzger, M.J., R.G.H. Bunce, M. van Eupen & M. Mirtl (2010). An assessment of long term ecosystem research activities across European socio-ecological gradients. *Journal of Environmental Management* 91: 1357-1365.
- Sanderson, E.W., M. Jaiteh, M.A. Levy, K.H. Redford, A.V. Wannebo & G. Woolmer (2002). The Human Footprint and the Last of the Wild. *Bioscience* 52: 891-904.

## ANNEXES

### Annex 1: IUCN management categories relevant for wilderness protection

#### *Category Ia Strict nature reserve: protected area managed mainly for science*

Strict nature reserves are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.

#### Primary objective:

- To conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and/ or geodiversity features: these attributes will have been formed mostly or entirely by non-human forces and will be degraded or destroyed when subjected to all but very light human impact.

#### Other objectives:

- To preserve ecosystems, species and geodiversity features in a state as undisturbed by recent human activity as possible;
- To secure examples of the natural environment for scientific studies, environmental monitoring and education, including baseline areas from which all avoidable access is excluded;
- To minimize disturbance through careful planning and implementation of research and other approved activities;
- To conserve cultural and spiritual values associated with nature.

#### Distinguishing features:

- Have a largely complete set of expected native species in ecologically significant densities or be capable of returning them to such densities through natural processes or time-limited interventions;
- Have a full set of expected native ecosystems, largely intact with intact ecological processes, or processes capable of being restored with minimal management intervention;
- Be free of significant direct intervention by modern humans that would compromise the specified conservation objectives for the area, which usually implies limiting access by people and excluding settlement;
- Not require substantial and on-going intervention to achieve its conservation objectives;
- Be surrounded when feasible by land uses that contribute to the achievement of the area's specified conservation objectives;
- Be suitable as a baseline monitoring site for monitoring the relative impact of human activities;
- Be managed for relatively low visitation by humans;
- Be capable of being managed to ensure minimal disturbance (especially relevant to marine environments).

Strictly protected areas of category Ia are generally not large enough to ensure the integrity of their ecosystems (most of them are smaller than 2,000 ha)<sup>70</sup>.

Distinction with other Categories:

*Category Ib* protected areas will generally be larger and less strictly protected from human visitation than category Ia: although not usually subject to mass tourism they may be open to limited numbers of people prepared for self-reliant travel such as on foot or by boat, which is not always the case in Ia.

*Category VI* protected areas contain natural areas where biodiversity conservation is linked with sustainable use of natural resources, which is incompatible with category Ia. However, large category VI protected areas may contain category Ia areas within their boundaries as part of management zoning.

*Category Ib: Wilderness area: protected area managed mainly for wilderness protection*

Wilderness areas are protected areas usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.

Primary objective:

- To protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate, so that current and future generations have the opportunity to experience such areas.

Other objectives:

- To provide for public access at levels and of a type which will maintain the wilderness qualities of the area for present and future generations;
- To enable indigenous communities to maintain their traditional wilderness-based lifestyle and customs, living at low density and using the available resources in ways compatible with the conservation objectives;
- To protect the relevant cultural and spiritual values and non-material benefits to indigenous or non-indigenous populations, such as solitude, respect for sacred sites, respect for ancestors etc.;
- To allow for low-impact minimally invasive educational and scientific research activities, when such activities cannot be conducted outside the wilderness area.

Distinguishing features:

- Be free of modern infrastructure, development and industrial extractive activity, including but not limited to roads, pipelines, power lines, cellphone towers, oil and gas platforms, offshore liquefied natural gas terminals, other permanent structures, mining, hydropower development, oil and gas extraction, agriculture including intensive livestock grazing, commercial fishing, low-flying aircraft etc., preferably with highly restricted or no motorized access.
- Be characterized by a high degree of intactness: containing a large percentage of the original extent of the ecosystem, complete or near-complete native faunal and floral assemblages, retaining intact predator-prey systems, and including large mammals.

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<sup>70</sup> <http://data.iucn.org/dbtw-wpd/edocs/1999-048-2.pdf>

- Be of sufficient size to protect biodiversity; to maintain ecological processes and ecosystem services; to maintain ecological refugia; to buffer against the impacts of climate change; and to maintain evolutionary processes.
- Offer outstanding opportunities for solitude, enjoyed once the area has been reached, by simple, quiet and nonintrusive means of travel (i.e., non-motorized or highly regulated motorized access where strictly necessary and consistent with the biological objectives listed above).
- Be free of inappropriate or excessive human use or presence, which will decrease wilderness values and ultimately prevent an area from meeting the biological and cultural criteria listed above. However, human presence should not be the determining factor in deciding whether to establish a category Ib area. The key objectives are biological intactness and the absence of permanent infrastructure, extractive industries, agriculture, motorized use, and other indicators of modern or lasting technology.

They can include somewhat disturbed areas that are capable of restoration to a wilderness state, and smaller areas that might be expanded or could play an important role in a larger wilderness protection strategy as part of a system of protected areas that includes wilderness, if the management objectives for those somewhat disturbed or smaller areas are otherwise consistent with the objectives set out above.

Within the European context, large wilderness areas are largely lacking outside parks of the Nordic region. Category Ib areas can be found only in those parts of Europe which are scarcely suitable for any type of utilisation and which thus remained uninhabited. Wilderness may include areas exploited for a limited period in the past, without the natural diversity of habitats and species being significantly altered, and which have been returned to natural succession<sup>71</sup>.

#### Distinction with other categories:

*Category Ia* protected areas are strictly protected areas, generally with only limited human visitation. They are often (but not always) relatively small, in contrast to Ib. There would usually not be human inhabitants in category Ia, but use by indigenous and local communities takes place in many Ib protected areas.

*Category II:* Category Ib and II (National park) protected areas are often similar in size and in their aim to protect functioning ecosystems. But whereas II usually includes (or plans to include) use by visitors, including supporting infrastructure, in Ib visitor use is more limited and confined to those with the skills and equipment to survive unaided.

*Category VI* is predicated on setting internal zoning and management regimes to support sustainable use; although wilderness areas sometimes include limited traditional use by indigenous people this is incidental to management aims rather than an intrinsic part of those aims.

#### *Category II: National park: protected area managed mainly for ecosystem protection and recreation*

National parks are protected areas large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.

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<sup>71</sup> <http://data.iucn.org/dbtw-wpd/edocs/1999-048-2.pdf>

Primary objective:

- The primary objective is to protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.

Other objectives:

- To manage the area in order to perpetuate, in as natural a state as possible, representative examples of physiographic regions, biotic communities, genetic resources and unimpaired natural processes;
- To maintain viable and ecologically functional populations and assemblages of native species at densities sufficient to conserve ecosystem integrity and resilience in the long term;
- To contribute in particular to conservation of wide-ranging species, regional ecological processes and migration routes;
- To manage visitor use for inspirational, educational, cultural and recreational purposes at a level which will not cause significant biological or ecological degradation to the natural resources;
- To take into account the needs of indigenous people and local communities, including subsistence resource use, in so far as these will not adversely affect the primary management objective;
- To contribute to local economies through tourism.

Distinguishing features:

- Category II areas are typically large and conserve a functioning “ecosystem”, although to be able to achieve this, the protected area may need to be complemented by sympathetic management in surrounding areas.
- The area should contain representative examples of major natural regions, and biological and environmental features or scenery, where native plant and animal species, habitats and geodiversity sites are of special spiritual, scientific, educational, recreational or tourist significance.
- The area should be of sufficient size and ecological quality so as to maintain ecological functions and processes that will allow the native species and communities to persist for the long term with minimal management intervention.
- The composition, structure and function of biodiversity should be to a great degree in a “natural” state or have the potential to be restored to such a state, with relatively low risk of successful invasions by non-native species.

Distinction from other categories:

*Category Ia:* Category II will generally not be as strictly conserved as category Ia and may include tourist infrastructure and visitation. *However, category II protected areas will often have core zones where visitor numbers are strictly controlled, which may more closely resemble category Ia.*

*Category Ib:* Visitation in category II will probably be quite different from in wilderness areas, with more attendant infrastructure (trails, roads, lodges etc.) and therefore probably a greater number of visitors. *Category II protected areas will often have core zones where numbers of visitors are strictly controlled, which may more closely resemble category Ib.*

*Category VI:* Category II will not generally have resource use permitted except for subsistence or minor recreational purposes.

*Category VI: Protected area with sustainable use of natural resources*

Category VI protected areas conserve ecosystems and habitats, together with associated cultural values and *traditional natural resource management systems*. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.

This is a relatively new category that was introduced by IUCN to cover predominantly natural areas which “are managed to protect their biodiversity in such a way as to provide a sustainable flow of products and services for the community”. The principal purpose of management is the sustainable use of natural ecosystems. At least two-thirds of the area should be, and is planned to remain in its natural state<sup>72</sup>.

#### Primary objective

- To protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.

#### Other objectives:

- To promote sustainable use of natural resources, considering ecological, economic and social dimensions;
- To promote social and economic benefits to local communities where relevant;
- To facilitate inter-generational security for local communities’ livelihoods – therefore ensuring that such livelihoods are sustainable;
- To integrate other cultural approaches, belief systems and world-views within a range of social and economic approaches to nature conservation;
- To contribute to developing and/or maintaining a more balanced relationship between humans and the rest of nature;
- To contribute to sustainable development at national, regional and local level (in the last case mainly to local communities and/or indigenous peoples depending on the protected natural resources);
- To facilitate scientific research and environmental monitoring, mainly related to the conservation and sustainable use of natural resources;
- To collaborate in the delivery of benefits to people, mostly local communities, living in or near to the designated protected area;
- To facilitate recreation and appropriate small-scale tourism

#### Distinguishing features:

- Category VI protected areas, uniquely amongst the IUCN categories system, have the sustainable use of natural resources as a means to achieve nature conservation, together and in synergy with other actions more common to the other categories, such as protection.
- Category VI protected areas aim to conserve ecosystems and habitats, together with associated cultural values and natural resource management systems. Therefore, this category of protected areas tends to be relatively large (although this is not obligatory).
- The category is not designed to accommodate large-scale industrial harvest.
- In general, IUCN recommends that a proportion of the area is retained in a natural condition, which in some cases might imply its definition as a no-take management zone. Some countries

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<sup>72</sup> <http://data.iucn.org/dbtw-wpd/edocs/1999-048-2.pdf>

have set this as two-thirds; IUCN recommends that decisions need to be made at a national level and sometimes even at the level of individual protected areas.

Distinction from other categories:

*Category Ia:* Category VI protected areas do conserve biodiversity, particularly at ecosystem and landscape scale, but the aim would not be to protect them strictly from human interference. Although scientific research may be important, it would be considered a priority only when applied to sustainable uses of natural resources, either in order to improve them, or to understand how to minimize the risks to ecological sustainability.

*Category Ib:* *Category VI protected areas in certain cases could be considered close to “wilderness”,* however they explicitly promote sustainable use, unlike the situation in category Ib wilderness areas where such use will be minimal and incidental to conservation aims. They also contribute to the maintenance of environmental services, but not only by exclusive nature conservation, as the sustainable use of natural resources can also contribute to the protection of ecosystems, large habitats, and ecological processes.

*Category II:* Category VI protected areas aim to conserve ecosystems, as complete and functional as possible, and their species and genetic diversity and associated environmental services, but differ from category II in the role they play in the promotion of sustainable use of natural resources. Tourism can be developed in category VI protected areas, but only as a very secondary activity or when they are part of the local communities' socioeconomic strategies (e.g., in relation to ecotourism development).

The areas in Europe to which it might apply most readily include some parts of Scandinavia, including those inhabited by the Sámi people, and parts of marine environment<sup>73</sup>.

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<sup>73</sup> <http://data.iucn.org/dbtw-wpd/edocs/1999-048-2.pdf>

**Annex 2: Stakeholders involved in the consultation process**

Albania	Protection and Preservation of Natural Environment in Albania
Austria	WWF Austria
Belgium	EEB member
Bosnia and Herzegovina	WWF Mediterranean Programme Office
Bulgaria	BBF
Croatia	WWF Mediterranean Programme Office
Cyprus	WWF Mediterranean Programme Office
Cyprus	Terra Cypria
Czech Republic	Hnutí Duha
Czech Republic	Birdlife Czech Republic
Denmark	Verdens Skove
Estonia	Keskkonnaamet
Estonia	Estonian Fund for Nature
Finland	Metsähallitus
France	WWF France
Germany	Brandenburg Foundation
Germany	WWF Germany
Great Britain	John Muir Trust
Greece	Hellenic Ornithological Society
Hungary	WWF Hungary
Iceland	INCA
Ireland	Coillte
Italy	Legambiente
Italy	Federparchi
Kosovo	WWF Mediterranean Programme Office
Latvia	Baltic Environmental Fund
Liechtenstein	
Lithuania	Baltic Environmental Fund
Luxemburg	Birdlife Luxemburg
Macedonia	Bela Vista
Malta	
Montenegro	WWF Mediterranean Programme Office
Netherlands	State Forestry
Norway	Norwegian Directorate for Nature Management
Poland	Naturalistic Foundation
Portugal	EEB member
Portugal	WWF Mediterranean Programme Office
Romania	ProParks
Serbia	WWF Medpo
Slovakia	University of Matej Bel
Slovenia	WWF Mediterranean Programme Office
Spain	Europarc Spain

Sweden	Naturskyddsföreningen
Sweden	SEPA
Switzerland	Pro Natura
Turkey	WWF Turkey

**Annex 3: NFPs and the verification process**

Countries for which the wilderness qualification of PAs has been verified (73% of PAs on list of 522 PAs) (\* = no PAs in wilderness register). Verification for 17 countries is pending.

Country	Code	Organisation	Verification
Albania	ALB		*
Austria	AUT	Umweltbundesamt	Verified
Belgium	BEL		*
Bosnia-Herzegovina	BIH	Federal Ministry of Environment and Tourism	Verified
Bulgaria	BGR		Pending
Croatia	HRV	Croatia Environment Agency / State Institute for Nature Protection	Verified
Cyprus	CYP		Pending
Czech Republic	CZE		Pending
Denmark	DNK	European Environment Information and Observation Network	Verified
Estonia	EST		Pending
Finland	FIN	Metsähallitus	Verified
France	FRA		Pending
Germany	DEU	Bundesamt für Naturschutz	Verified
Greece	GRC		Pending
Hungary	HUN		*
Iceland	ISL		Pending
Ireland	IRE	National Parks and Wildlife Service, Dept of Arts, Heritage and the Gaeltacht	Verified
Italy	ITA	Italian National Reference Centre on Nature and Biodiversity of EIONET	Verified
Kosovo	XKX		Pending
Latvia	LTV	Nature Conservation Agency	Verified
Liechtenstein	LIE		*
Lithuania	LTU		Pending
Luxembourg	LUX		Pending
Macedonia	MKD	Ministry of Environment and Physical Planning	Verified
Malta	MLT		Pending
Montenegro	MNE	Environmental Protection Agency of Montenegro	Verified
Netherlands	NLD	Ministry for Economic Affairs	Verified
Norway	NOR	Directorate for Nature Management	Verified
Poland	POL		Pending
Portugal	PRT	Instituto da Conservação da Natureza e das Florestas	Verified
Romania	ROU		Pending
Serbia	SRB	Serbian Environmental Protection Agency	Verified
Slovakia	SVK	State Nature Conservancy of the Slovak Republic	Verified
Slovenia	SVN		Pending
Spain	ESP		Pending
Sweden	SWE	Swedish Environmental Protection Agency	Verified
Switzerland	CHE	Federal Office for the Environment	Verified
Turkey	TUR		Pending
United Kingdom	GBR		*

**Annex 4: Detailed information on PAs in the wilderness register**