Scoping document: information

related to European old growth forests

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Contents

1 Objectives and structure

Task 1.7.5.B.III.ii of ETC/BD 2015 Action Plan entails the "preparation of a scoping document on information related to old growth forests" from a European perspective. The main objectives of this document are to review the concept of old growth forest (and other related terms) in Europe and present in a synthetic and standardized way the information currently available in the EEA33 countries. As a result, a catalogue of the data/datasets/projects/initiatives/maps related to old growth forests in Europe is provided.

The scoping document is structured in the following chapters. Chapter 2 reviews the definitions of the term in a broad sense and briefly describes the used methodology. The presentation of available information is structured in a geographical manner. Thus, the following chapters comment the data/datasets (and existing definitions) first at the Pan-European scale (Chapter 3) and then in each of the European regions: Scandinavian (Chapter 4), Baltic (Chapter 5), Central and Eastern (Chapter 6), Mediterranean (Chapter 7) and Atlantic (Chapter 8). The chapters 4 and 6 are mainly based on the work made by ETC/BD partners SLU and AOPK respectively. Chapter 9 draws some conclusions and proposes a way-forward. Annexes 1 to 7 display the catalogue of available information in standardized forms and with the same geographical structure than the chapters. Countries within each region are presented in alphabetical order. Lastly, Annex 8 shows some additional references that were found in the bibliographical review.

2 Old growth forests from a European perspective

2.1 Definition overview

What is an old growth forest? As literature shows, there is not a single and unequivocal definition for this concept. Wirth et al. (2009), in a very relevant paper on the subject titled "Old-Growth Forest Definitions: a Pragmatic View", reviewed 39 publications devoted to defining the term and stated that "most definitions [of old growth-forest] today employ multiple criteria, and these criteria fall into three groups: the first group emphasises structural and compositional features; the second highlights the successional processes that have led to, and currently maintain, the old growth stage; while the third group summarises criteria related to biogeochemical processes". The results made clear that the structural criteria are the most employed. The authors also made a literature survey in English to investigate how scientist and land managers use the term "old-growth" and found out that there is a plethora of related competing terms that are commonly used and confused: ancient, antique, climax, frontier, heritage, indigenous, intact, late-seral, late-successional, natural, original, over-mature, pre-settlement, primary, primeval, pristine, relict, untouched or virgin. They fall broadly into two groups: "a first one specifies forests that have never or only rarely been impacted by humans" (ancient, intact, natural, primary, primeval, pristine, relict, virgin, etc.) and the second group is "closer to the definition of old-growth forests and emphasises the fact that forests are relatively old" (other terms included under this group are climax, late-seral, late-successional or overmature). In this context, old-growth forests may or may not have been impacted by humans and may originate from plantation after a clear-cut. The number of years that a certain forest can reach an "old-growth" state is also variable and depending on the type of vegetation and disturbances. As Wells et al. (1998) stated that "a single, precise definition of old-growth applicable to all forest types is neither possible nor desirable".

Several global and European organizations have attempted to provide concrete definitions of some of the above mentioned terms. In order to have them as a reference, Table 2.1 displays these international definitions:

Table 2.1   Definitions of old growth forest and related terms in global and European organizations

Indicative definitions taken from the Report of the ad hoc technical expert group on forest biological diversity of the Convention on Biological Diversity (https://www.cbd.int/forest/definitions.shtml, last accessed 6 November 2015):
Primary forest: "forest that has never been logged and has developed following natural disturbances and under natural processes, regardless of its age".   **Old growth forest stands:** "stands in primary or secondary forests that have developed the structures and species normally associated with old primary forest of that type have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class".
Terms and definitions used in Forest Resources Assessment 2005 (FAO, 2004):
Natural forest: "a forest composed of indigenous trees and not classified as forest plantation"
Terms and definitions used in Forest Resources Assessment 2010 (FAO, 2012):
Primary forest: "naturally regenerated forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed. Some key characteristics of primary forests are: - they show natural forest dynamics, such as natural tree species composition, occurrence of dead wood, natural age structure and natural regeneration processes;   - the area is large enough to maintain its natural characteristics;   - there has been no known significant human intervention or the last significant human intervention was long enough ago to have allowed the natural species composition and processes to have become re-established".
Terms and definitions applied in the UN-ECE/FAO Temperate and Boreal Forest Resources Assessment 2000 (http://www.unece.org/forests/fra/definit.html#undisturbed, last accessed 6 November 2015)
Forest/other wooded land undisturbed by man: "forest/other wooded land which shows 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".
Glossary of "Natura 2000 and Forests. Part I-II" (European Commission, 2015)
Ancient forests/woodlands: see old growth forests.   **Old growth forest:** "old growth forest stands are stands in primary or secondary forests that have developed the structures and species normally associated with old primary forest of that type".   **Primary forest:** FAO (2012) definition.
European Forest Institute ("Research in old-growth forests and forest reserves: implications for integrated forest management", Nagel et al. (2013))
Definition of old-growth forest based on natural processes: "forests that were initiated under a regime of natural disturbance and have developed with minimal human influence. Certainly, old-growth forests, like all forests, are subject to indirect human impact, such as climate change, air pollution, and altered population densities of ungulates. However, under this definition, stands in the process of recovery from severe natural disturbance would still be considered part of an old-growth ecosystem because they arose from natural processes and their development would not be guided by human interventions (e.g. through thinnings). Often, the terms "primary", "virgin" or "natural heritage" forests are used in this context.   **Definition based on structure:** Forests in a late stage of stand development, characterized by the

presence of old trees near their maximum longevity, large amounts of standing and lying deadwood, and heterogeneous stand structure, including both horizontal and vertical heterogeneity.

It is important to note that these old-growth definitions hold for any forest type, although disturbance regimes and structural features vary greatly among different old-growth ecosystems. For example, old-growth is often associated with large ancient trees and abundant deadwood, which may be typical characteristics of productive sites with ample precipitation. However, ancient stands can also develop on dry, less productive sites that may not be easily recognized as old-growth, such as thermophilic steep-slope forests.

From a European perspective, difficulties for providing a common definition of the term increase as the terms multiply by the number of existing languages in Europe. It must be noted that the goal of this scoping document is not to provide a rigid definition of old growth forest but to review the related information that is available in European countries. Therefore, an open and flexible approach to the subject has been used, showing not only the datasets strictly referred as old growth forests but also to some of the other related terms.

2.2   General methodology of the review

Firstly, a literature review on the terminology was made in the internet. The review was not only restricted to scientific papers but also to informative articles.

In order to elaborate an overarching document comprising the highest number of available data/datasets of old-growth forest across Europe (restricted to EEA33 Member Countries), an extensive review on a country base was also carried out in the internet. A first attempt to review the concept of "ancient forest" in the European countries was made by Abdul-Malak and Marín-Guerrero (2013).

The review for this scoping document was not exhaustive, i.e. it did not restricted to the term old-growth but also frequently related terms in English such as old, virgin, ancient, etc. Moreover, the search encompassed terms in other languages, concretely in Spanish (e.g. "bosque maduro"), Italian (e.g. "foresta vetusta") or French (e.g. "forêt ancienne"). A standardized form was designed for the catalogue of information that is shown in the Annexes.

The presentation of the information was structured by geographical regions. Note that some countries have extensive areas in other regions (e.g. France and Spain in the Atlantic), but for pragmatic reasons they were considered as follows:

- Scandinavian countries (4): Denmark, Finland, Norway and Sweden.

- Baltic countries (3): Estonia, Latvia and Lithuania

- Central and Eastern countries (10): Austria, Bulgaria, Czech Republic, Germany, Hungary, Liechtenstein, Poland, Romania, Slovakia and Switzerland. Some of these countries are also members of the Carpathian Convention, which is also expressed in the document.

- Mediterranean countries (10): Croatia, Cyprus, France, Greece, Italy, Malta, Portugal, Slovenia, Spain and Turkey. The Macaronesian Islands of both Portugal and Spain are included in this section for pragmatic reasons.

- Atlantic (6): Belgium, Iceland, Ireland, Luxembourg, the Netherlands and the United Kingdom.

ETC/BD partners SLU (Sweden) and AOPK (Czech Republic) were in charge of reviewing the concept and the available data/datasets/projects in the Scandinavian countries and the Central European countries. The datasets were collected from an extensive review on these countries and

information obtained from national organisms of each country. They provided the text to the related sections and filled in the standardized forms.

3   Data availability at the Pan-European scale

As previously mentioned, the term of old-growth forest does not have a common meaning across European countries. Broadly, "structural features (large old trees) and disturbance history (lack of human disturbance at least since the development of the trees now present) are considered to play a key role in the identification of old-growth forests in Europe" (Nilsson et al., 2002).

Currently there is no Pan-European map of old-growth forests *per se*. However, it is worth mentioning a few related projects or initiatives (see Annex 1):

- The World Map of Intact Forest Landscapes by Greenpeace (Potapov et al., 2014). Intact Forest Landscapes are defined as "an unbroken expanse of natural ecosystems within the zone of current forest extent, showing no signs of significant human activity and large enough that all native biodiversity, including viable populations of wide-ranging species, could be maintained". According to this map, in Europe these landscapes are only found extensively in Scandinavia and a very sparingly in Romanian Carpathians.

- The old-growth forest database of the Italian Academy of Forest Sciences (AISF). The term is here referred to "continuous woodlands where the absence of forest operations over at least several decades has allowed forest dynamics to return to successional pathways and to be mainly driven by site potential and natural disturbances". This database, which is progressively expanding, is based on scientific publications and also reports forest attributes.

- A reconstruction of historic land cover for Europe over the 1900-2010 period has been carried out in Wageningen UR (Fuchs et al., 2013). Although not directly related with the concept of old-growth forest, this model can be useful to explore the evolution of forests in Europe during the 20th century and identify which have remained in this period.

4   Data availability in the Scandinavian countries (SLU)

The review (see Annex 2) is not restricted to just data/datasets on "old-growth forest" due to the lack of a common terminology and the large number of related concepts (e.g. "virgin forest", "primary forest", "relict forest", "ancient forest" and "natural forest"). It covers also data/datasets on "natural forests" and "biodiversity hotspot habitats" in a broad perspective. As shown by the review, data/datasets on old or old-growth forests are usually included as part of data/datasets on natural forests and biodiversity hotspot habitats according to the definitions applied.

The definitions used in the data/datasets on old-growth, natural or hotspot forest habitats tend to rely on fairly similar criteria of naturalness and/or biodiversity importance. Definitions of naturalness vary internationally (Chirici et al., 2012; McRoberts et al., 2012; Tomppo et al. (eds.), 2010) as well as among the Scandinavian countries, but all reflect a theoretical continuum from natural forests to more or less artificial plantations. Definitions of biodiversity importance also vary among the countries, but usually rely on criteria for occurrence of specific indicators species, red-listed, rare or specialist species (Timonen et al., 2010).

Data/datasets covers both simple and complex definitions based on measurable (quantitative) or subjective (qualitative) indicators. Simple and measurable definitions of naturalness may involve a single criterion, e.g. a minimum threshold value for the indicator stand age. For instance, forests with an average stand age of at least 120 years (in the south) or 140 years (in the north) are defined as "old-

growth forests" (or just "old forests" as a synonym) in the statistics of the Swedish National Forest Inventory (NFI).

However, multiple criteria of several different indicators are usually proposed for defining the naturalness as well as biodiversity importance. Measurable but more complex definitions may typically combine minimum threshold values for forest structures, processes or species (Brumelis et al., 2011). For example, the NFIs of Finland, Norway and Sweden assess naturalness of forests by applying minimum threshold values for several different indicators of forest structures. In fact, even young successional forests may be included if they fulfil the minimum threshold values of the indicators used. For instance, both primary successional forests of landupheavel coast as well as secondary successional forests naturally developing after fire may fulfil Swedish minimum criteria of naturalness when mapping "natural" terrestrial habitat types of the EU Directive (European Commission, 2013).

Likewise, multiple criteria of several different indicators are typically also applied when countries map biodiversity hotspot habitats and woodland key habitats (WKHs). These definitions usually combine criteria for observations of indicators species, red-listed, rare or specialist species with criteria for indicators of forest structures and processes (Gjerde et al., 2007; Timonen et al., 2010).

"Negatively correlated indicators" that relate to evidence of human activity are frequently used; e.g. the number of cut stumps and other signs of silvicultural management or industrial land use. However, "positively correlated indicators" that relate to evidence of natural ecosystem processes and features are also applied; e.g. forest age (number of old and large trees), forest structure (species composition, number of canopy layers), regeneration and the amount of coarse deadwood. Positively correlated indicators in form of focal species or indicator species are important when defining and identifying biodiversity hotspot habitats and WKHs.

The review reveals that the Scandinavian countries have compiled an impressing amount of data/datasets on old, old-growth, natural or hotspot forest habitats. Data/datasets have been compiled through several large-scale national inventories of various natural forests or biodiversity hotspot habitats. Two main conclusions can be drawn from the review:

- There is a lack of prepared maps of old, old-growth or natural forests: particularly the sample data collected by the NFI seems to be comparable among countries with regards to aims, definitions or methods. NFI may therefore be used to extract consistent statistics on the area or the proportion of old, old-growth or natural forest at a coarse spatial scale (county level) both within and among the countries. However, such maps are not regularly produced by the NFI in the different countries (but see the Swedish example).
  The use of the spatial data/datasets listed is less straightforward because they usually have been compiled for quite different purposes; i.e. the mapping of forest areas have been done by using somewhat different aims, definitions or methods. The spatial data/datasets generally differ with regard to the forest habitat types included but also the availability and the type of attribute data on tree species composition, stand structure, vegetation, etc. that have been collected in individual sites. Thus, there are no complete maps of old, old-growth or natural forest based on spatial data/datasets that easily can be accessed for comparison within or among the Scandinavian countries.

- There is a lack of access to critical forest data: accordingly, maps of defined classes of old, old-growth or natural forests have to be prepared manually by analyzing and combining the different spatial data/datasets. All countries have easily accessible web portals where users can view and generally also download most data/datasets. However, there is often a lack of easily accessible data on critical forest features that can be used to classify and identify old, old-growth or natural forests within the data/datasets. The required data on forest features usually have to be ordered from the data sources (national authorities).

5   Data availability in the Baltic countries

Little information has been found in English on old growth forests in the Baltic countries (see Annex 3). It must be highlighted the Baltic Forest Mapping project (BFM), which aimed at identifying high conservation value forests in the Baltic States from forest databases (Kurlavicius et al., 2004). One of the forest types defined by this project were "old growth spruce dominated forests on dry soil". Results from this study show that old-growth spruce forest covered 10,4%, 11,9% and 3,3% of Estonian, Latvian and Lithuanian BFM stands respectively.
A study was done in Estonia aimed at quantifying functionally important structural features in a representative set of old-growth forests in hemi-boreal Europe (Lõhmus and Kraut, 2010).

6   Data availability in the Central and Eastern European countries

6.1   Data availability in the Central European Countries (AOPK)

A database of "natural forests" can be a very useful instrument for forest conservation (strategic planning, Natura 2000 network, etc.) and management (management planning in Protected Landscape Areas and National Parks etc.). It could also serve as network for ecological research of natural forest development and biodiversity.

Altogether six countries from the Central European region were inspected by ETC/BD partner AOPK for old growth forest or natural forest databases, projects and topic related initiatives (see Annex 4). These countries were the Czech Republic and its surrounding countries: Germany, Austria, Hungary, the Slovakia and Poland. Unfortunately, no information was obtained in the case of Poland. The following paragraphs examine the approach in more detail in the five mentioned countries.

Three different concepts have been identified. The first concept is represented by Germany, Austria and Hungary, where the strict forest reserves databases have been proposed. The second approach is represented by the Czech Republic, where a natural forests database was created. The third is the old-growth forests database represented by Slovakia.

These different concepts presumably stem from different definitions and criteria used.

- Strict forest reserves databases (Austria: 195 areas, 8 403 ha; Germany: 729 areas, 34 948 ha; Hungary: 63 areas, 3 600 ha):

    Definition: Strict forest reserves are areas determined to the natural forest ecosystem development without intervention of human activities (e.g. forest management, logging, sowing or planting is forbidden) according to Germany and Austria conception. They were established for nature protection, scientific research of natural forest development and education. These areas are heading to develop in old-growth forests in the future, which are supposed to have those restrictions stated above. According to Hungary forest reserves, these are protected areas where all human activities are ultimately stopped so that the natural processes are able to prevail.

    From these definitions it can be understood that the concept of strict forest reserve evaluates present status of the forest only and does not take its historical development into account. These databases include not only forests without or nearly without historical human interventions (old-growth forests) but also forests that were more or less influenced in the past and are developing towards old-growth forests in the following years.

Criteria: For all three states following criteria are used: area should be protected, natural forest development without outer impacts, representative natural vegetation stand, minimum area of the reserve (20 ha in Germany and 10 ha in Austria). In Austria also diversification of the forest vegetation, representation of all rare and endangered forest associations, presence of seedlings and young trees, the topography of the terrain and buffer zones are given as criteria. Representation of all forest associations/types existing within the state are added as a criterion in the Hungarian database.

- Natural forest database (The Czech Republic: 493 localities, 30 000 ha):

Definition: The Czech project works with the concept of "natural forest" and distinguishes three categories according to the degree of naturalness.

1) Original forest (virgin or primary forest): forest more or less unaffected by humans and left to spontaneous development, where tree species composition and spatial structure correspond to habitat, i.e. potential natural vegetation. As original forests are included also forests that were influenced by humans in the past but the intervention did not affect natural developmental trajectory and the traces of such intervention are not obvious, e.g. selective cutting of individual trees more than 100 years ago or removal of dead trees from the forest edges more than 50 years ago.

2) Natural forest: forest formed by natural processes but influenced by human activities in the past (namely selective cutting and grazing, not planting or sowing). The species composition as well as spatial and age structure predominantly correspond to defined habitat; they may differ in some places due to e.g. spontaneous development that occurred in altered conditions (e.g. after grubbing in the Middle Ages and subsequent long-term spontaneous development, long-term influence of higher density of game, etc.)

3) Near-natural forest: forest whose composition largely corresponds to habitat but the spatial structure is simpler than in the original forest. These forests were formed under the human influence and their status could have been achieved intentionally. Their development was influenced in a long term and the traces of such influence is still present (removal of dead wood, logging, thinning, etc.)

Criteria: area size at least 5 ha, intensively managed stands are excluded, historical development, intervention (direct and indirect), deadwood presence and actual forest status (tree species composition, current management, etc.).

- Old-growth forest database: (Slovakia: 122 locations with old-growth forests (>20ha), 8 849 ha; 136 locations with old-growth forest fragments (5 - 20 ha), 1 634 ha)

Definition: The Slovak project works with the concept of the old-growth forest. The old-growth forest is defined as relatively untouched nature forest with natural vegetation structure (trees species composition, age, horizontal and vertical structure) in climax stage, without or nearly without human impacts, with enough old trees and deadwood in different stage of decomposition. Also younger succession forest stages arisen by natural way are included.

Three categories distinguished according to degree of naturalness and area size were set:

1) and 2) Old-growth forest (>50 ha) and old-growth forest fragments (5-25 ha): forest with natural vegetation structure (tree species composition, age, horizontal and vertical structure), without or nearly without human impact, presence of old trees, wood biomass and deadwood in all degrees of decomposition, natural ecosystem processes, nearly no tracks of invasive species

and no tracks of game grazing. In younger succession stages only naturally arisen forests are included, absence of old trees and pioneer tree species presence is tolerated.

3) Influenced old-growth forest (>25 ha): old-growth forest as defined above but slightly influenced in the past (individual wood cutting, grazing), artificial elements (for example presence of invasive species, tracks of game grazing) cover ≤ 10 % of the area.

Also potential old-growth forests (forest which could be declared as old-growth forest in following 30 - 50 years of non-intervention) were identified during the project.

Criteria: biotope type, natural vegetation structure (tree species, age, vertical and horizontal structure), succession state, old trees, wood and deadwood biomass and signs of human impacts, size limit (minimum of 5 ha for naturally small area biotopes, minimum of 25 ha for naturally broadly extended biotopes), accessibility to the location, invasive species presence and influence of the game.

To be able to compare the "natural/old-growth forest databases" in all European countries it is necessary to unify the definition and select criteria. For the setting of an "old-growth forest database", the best approach seems to be the model of the Czech or the Slovak databases, which have more sophisticated criteria (e.g. deadwood and old trees presence), and include not only reserves but all areas which fulfil criteria. Natural vegetation stand, development without human impact and size of the forest (except Hungary) are criteria mentioned in each database. At least 5 ha large forest area has been chosen for minimal limit. It seems that smaller areas are insufficient with respect to stand stability and impact of adjacent forest patches.

6.2   The Carpathian Convention member countries

"The Framework Convention on the Protection and Sustainable Development of the Carpathians (Carpathian Convention) was adopted and signed by the seven Parties (Czech Republic, Hungary, Poland, Romania, Serbia, Slovak Republic, Ukraine) in May 2003 in Kyiv, Ukraine, and entered into force in January 2006" (http://www.carpathianconvention.org/the-convention-17.html, last accessed 3 October 2015). Article 10 of the Convention's Protocol on Sustainable Forest Management (Carpathian Convention, 2011), requires that "each Party shall take measures in its national territory aimed at identifying and protecting natural, especially virgin forests of the Carpathians, by establishing Protected Areas in sufficient size and number and implementing other specific measures of protection". This protocol defines the term "virgin forests" generically as "natural forests which have not been influenced directly by human activities in their development". Object 6 of the Strategic Action Plan for the implementation of this protocol specifies that, among others, these two results are expected: "criteria and indicators for identifying natural and virgin forests harmonized" and "work on compiling, analysing and updating the scientific data, national inventories and maps of natural and especially virgin forests conducted; inventory data of virgin forests based of the format approved by the Parties included in Carpathian Convention joint information system". A Working Group has been constituted to provide guidance and actions with regard to the establishment of a "Carpathian Inventory on Virgin Forests".

The criteria and indicators for identification of virgin forests in the Carpathians have already been harmonized (see details in Annex 5). In summary, there are two main criteria: (1) based on naturalness, with indicators such as being formed of native/autochthonous species, naturally regenerated, include all successional phases in a mosaic structure, occurrence of old trees with signs of physiological decline, presence of deadwood and no visible traces of human disturbances, and (2) based on area (minimum of 20 ha) and shape (minimum of 200 m).

A geoportal of the CCIBIS (Carpathian Integrated Biodiversity Information System) allows the visualization of many thematic maps, particularly of old-growth forests (consult Annex 4 to see the

source datasets that were used). On the other hand, Zsolt (2002) listed and mapped virgin and virgin-like forests remaining in the Carpathians.

Approximately half of the surface of the Carpathian Mountains lies in Romania (see Annex 4). In this country a number of projects have been implemented to identify virgin forests. The Pin-Matra project (2002-2005) identified 238.000 ha of virgin forests that are displayed in a Map viewer. Another project had the goal of supporting Responsible Forest Management for a Sustainable Development in the Danube – Carpathian Ecoregion (2011-2014). Results of a national inventory of virgin forests made in 2005 are shown in Veen et al. (2010). Another study focused on mapping the distribution of old-growth forest patches in a study area in Romanian Carpathians, and the distribution of old-growth forest disturbance patches (Knorn et al., 2012). Back in 1990, an identification of virgin and natural forests in Romania was made by Donita et al. (1990).

6.3 Data availability in other Central or Eastern European countries

Broadly, virgin forests and forest reserves in the Central and Eastern European countries were first reviewed in a meeting of COST Action E4 "Forest Reserves Research Network" (Diaci (ed.), 1999).

In Bulgaria, virgin forests have been mapped by the Bulgarian Forest Research Institute (see Annex 4). The term virgin forest is used as "a unifying concept for forests which are not influenced directly by man in their development. The species composition (connected with the biogeographical zone), structure and dynamic processes are important features for the identification of this type of forests compared to intensively managed forests". On the other hand, WWF has put in place a GIS online platform in Bulgarian delimiting old-growth forests, protected areas and Natura 2000 sites.

In Poland (and Belarus) it is located an emblematic European forest, the Białowieża Forest, which is included in the UNESCO World Heritage List due to the scale of its old growth forests, which contain extensive undisturbed areas where natural processes are on-going (see Annex 4). Furthermore, at national level there is a High Conservation Value Forest (HCVF) mapping project that aims at investigating the spatial distribution of potentially valuable forests using 13 criteria of high conservation value (Stachura-Skierczyńska, 2015).

Switzerland is considered to have three virgin forests that have not been influenced by human activity thanks to their impenetrable location: Bödmeren, Derborence and Scatlé. They have become natural reserves and access to them is only permitted for scientific purposes.

No information on old growth forests has been found in Liechtenstein.

7 Data availability in the Mediterranean countries

In the Mediterranean region, old-growth forests are rare due to the long history of use of natural resources. According to Gilg (2005), "old-growth forests are very scarce in the Mediterranean region. There are fine chestnut formations in Bulgaria, Macedonia and Greece, and Zelkova formations in Crete; fine riparian forests in Spain, Portugal and Turkey; and interesting coniferous forests, often endemic (*Pinus*, *Abies*, *Juniperus*, *Tetraclinis*), in Macedonia, Bosnia, Albania, Italy, Greece, Sicily, Spain, Cyprus, Crimea, Turkey, Corsica, Crete and Malta". The datasets with information related to old growth forests in the Mediterranean countries can be seen in Annex 6.

An interesting report that reviews the concept and identifies actual and potential ancient forests in the Northern Mediterranean countries was elaborated by WWF France (Mansourian et al., 2013) on the basis of questionnaires and interviews to the countries. According to the report, "a jungle of words emerged when reviewing which specific terms were used to define ancient forests in each language of

the Mediterranean". For the purpose of the report "ancient forest" was used as "a general, relatively loose term to signify those forests that exhibit a number of fundamental forest ecological qualities, including ancientness (applied in the strict scientific sense, i.e., number of years of continuous forest cover) but also complex structures, presence of deadwood, diversity of species and habitats, evidence of disturbance, etc.". The gaps in knowledge and recommendations were also reported: "important gaps in knowledge that should be urgently addressed include surveys of species, mapping of ancient forests, land use history, monitoring, valuing ancient forests, improving awareness and understanding, integrating ancient forests into relevant policies and applying improved understanding of these relict forests to protection, management and restoration of Mediterranean forests".

In France, a review on the subject was made by Gilg (2005). These paragraphs are extracted from the English version of the report: "in France, different terms are used: "virgin forest" (not altered by modern man), "primary" (having an uninterrupted natural dynamics since their spontaneous origin), "natural" and "original" are a few examples. French forests have all or almost all been altered by human activities (even if only ancient activities, atmospheric pollution or the elimination of large carnivores), the most conciliatory terms of "forêt à caractère naturel", "subnatural forest" or " subprimary forest" have been suggested to designate those that still have a high degree of naturalness". "The term "old-growth forests" used in this technical report characterizes: ecosystems that are differentiated by the presence of old trees and by the structural characteristics that are included; forests including the final stages of site development, stages typically different from more recent stages by tree size, the accumulation of large quantities of dead wood, the number of arborescent storeys, specific composition and ecological functions; forests without signs of recent logging and comprised of native species". According to this review, "of the 144 nature reserves (NR) in France in 1999, a hundred harbour forests and sixty support old-growth forests (mostly public forests)" and "more than a third (13,310 ha) of the forests protected by nature reserves in Metropolitan France are old-growth forests". Also, the report states that "smaller cores of old-growth mountain forests remain in France in the Vosges, the Jura, the Pyrenees and the Massif Central".

Several mapping projects have been developed in France at national and regional level. They focus on the identification of ancient forest lands through the historical comparison between ancient maps (Cassini's map (XVIIIth Century); "Carte de l'Etat-major" (circa 1860)) and current maps (Corine Land Cover 2006; recent National Forest Inventories). Another project aims at characterizing naturalness of ancient Forests in France's Mediterranean region and surrounding mountains (Rossi et al., 2013).

A definition of old-growth forest from an Italian perspective (in Italian, "foreste vetuste") has been developed in the framework of a research project funded by the Italian Ministry of Environment and Protection of Land and Sea: "Forests in which human disturbance is absent or negligible, and in which natural dynamics create a mosaic of all the forest regeneration phases, including the senescing one. Such phase is characterised by large old trees, deadwood (snag logs and coarse woody debris) and a vascular plant species composition that is consistent with the biogeographical context and includes highly specialized taxa related to the small-scale disturbance and the microhabitats resulting from structural heterogeneity" (Blasi et al., 2010). A research programme has also been put in place for the development of an Old-growth Forests Network in Italian National Parks. "The ultimate goal of this research programme is the creation of a network old-growth stands that represent, as closely as possible, the Italian forest types from an ecological and phytogeographic point of view". An "old-growthness level" is assigned to each stand based on three structural features: diameter distribution of living trees, amount of deadwood (volume) and quality of deadwood (decomposition classes). Also in Italy, a regional study was also made to measure stand structure attributes in 10 forest reserves across the Apennines that were considered as potential old-growth forests (Calamini et al., 2011).

In Spain, a report made by EUROPARC-Spain (2015) reviews the concept and the role of old-growth forests ("bosques maduros" in Spanish) in biodiversity conservation. This document discusses the importance of the scale to provide a definition. As a result, it proposes the clarification of the terminology, distinguishing between "old-growth forest" (i.e. "bosque maduro") and "old forest

stands" (i.e. "rodal viejo", those that have characteristics of maturity). According to this report, an "old-growth forest" is a forest whose dynamics are free of human intervention and that has enough area to be comprised by stands in all the stages of development or maturity, including the "senescence stage". The report also points out that in Spain the identification and monitoring of old-growth forests has not been implemented at a national scale yet. Some regional initiatives that have been put in place are the following: creation of nature reserves in the old-growth forests of Muniellos (Asturias), Aztaparreta and Lizardoia (both in Navarra); inventory of old-growth forests in the district of Garrotxa and the Natural Parcs of Alt Pirineu and Montseny (Catalonia); creation of 58 forest reserves with the programme SELVANS in the province of Gerona; inventory of singular forests in Catalonia (Comas et al., 2013); analysis of the characteristics of the old-growth pine forest "Umbría de Siete Picos" located in the "Monte Pinar de Valsaín" (province of Segovia). On the other hand, the aim of the project LIFE+ BIGTREES4LIFE is to divulgate the presence of old-growth forests and singular trees in the Central, Atlantic and Pyrenaic areas of Spain (Fundación Félix Rodríguez de la Fuente, 2015). It is worth mentioning as well that in Galicia still remain a few examples of Atlantic primary forests (so-called "fragas"), such as the "Fragas do Eume".

As a complementary note, it must be highlighted that the Macaronesian islands of Spain (Canary Islands) and Portugal (Azores and Madeira), contain forests of "laurisilva", a vegetation type that is now confined to these islands. In particular "The Laurisilva of Madeira" in included in the UNESCO World Heritage List because it is the largest surviving area of primary laurel forest ("laurisilva").

In Slovenia, locations of old-growth forests and forests reserves were identified in a review by Nagel et al. (2012). In the paper, some of the basic characteristics of Slovenian old-growth forest remnants and the history of their protection are described. Overall, 14 old-growth forests (officially referred to as "virgin forests" in Slovenia) were identified.

The Fraktos Forest is considered to be the only virgin forest in Greece. "This woodland ecosystem was registered as a virgin forest in 1979, and a year later was declared a protected monument of nature. Since then the area has been under a framework of absolute protection and no human activity apart from scientific research is allowed. It is described as virgin forest because it followed natural processes in its development and has not been disturbed by humans for at least 500 years. Here the term "virgin" does not imply that there has never been any human presence or activity but rather that human influence has been mild and has not affected the character of the undisturbed forest ecosystem. Various species of broadleaved trees and conifers of different ages and heights co-exist with aged and dried out trees of great height" (http://1lyk-dramas.dra.sch.gr/drama/fraktoForest.htm, last accessed 2 October 2015).

No country-specific information was found in English for Croatia, Cyprus, Malta or Turkey.

8   Data availability in the Atlantic countries

The datasets with information related to old growth forests in the Atlantic countries can be seen in Annex 7. In Ireland and the United Kingdom the most commonly-used term related to old-growth forests is "ancient woodlands".

A manual reporting the provisional inventory of ancient and long-established woodland in Ireland (Perrin and Daly, 2010) defined "ancient woodland" as "those woods that have had a continuous history of cover since before the period when planting and afforestation became common practice (mid-1600s)" and "long-established woodland" as "those that have been continuously wooded since 1830".

In the United Kingdom, inventories of ancient and long-established woodland have defined ancient woodland as land continuously wooded since at least 1600. Map viewers of the Forestry Commission

(for Wales and Scotland) and the Woodland Trust (for all UK) allow the visualization of ancient woodlands and other types of woodland.

In the Benelux, only two related information sources have been found in English. In Belgium, a forest age map (1771-2001) of Flanders is displayed in a map viewer. In the Netherlands, a digitalization of old forests (forests which were planted before 1900 and forest areas which were already present before 1900) in 325 localities was carried out (Daamen, 2008). Although old-growth forest maps cannot be directly derived from these projects, the historical information that they contain may be useful for its identification.

9 Conclusions and way-forward

- It is very difficult to set a common terminology due to the varied definitions given to the term and the different criteria and indicators. Moreover, a myriad of related terms are used daringly as synonymous without reflection on their actual meaning. In the case of Europe, this problematic is multiplied by the number of languages spoken in the continent.
- The review of the available data/datasets has revealed that the amount of information is very uneven across Europe. In some countries, the identification, inventory and protection of old growth forests is well advanced whereas in others it has not been implemented yet.
- In general, there is a lack of apropriate spatial information and access to critical forest data. Mapping is essential and historical research is needed, as well as in-situ work to identify old-growth attributes.
- The availability of more systematized information on old growth forest across Europe could provide critical input to conservation programmes and European indicators on forest naturalness and management intensity.
- As a follow-up of this scoping document, a harmonized European register of information (and maps if possible) on old growth forests could be developed and populated. For that purpose, a flexible but operative working definition and common criteria and indicators (as in the Carpathian Convention) would be needed.

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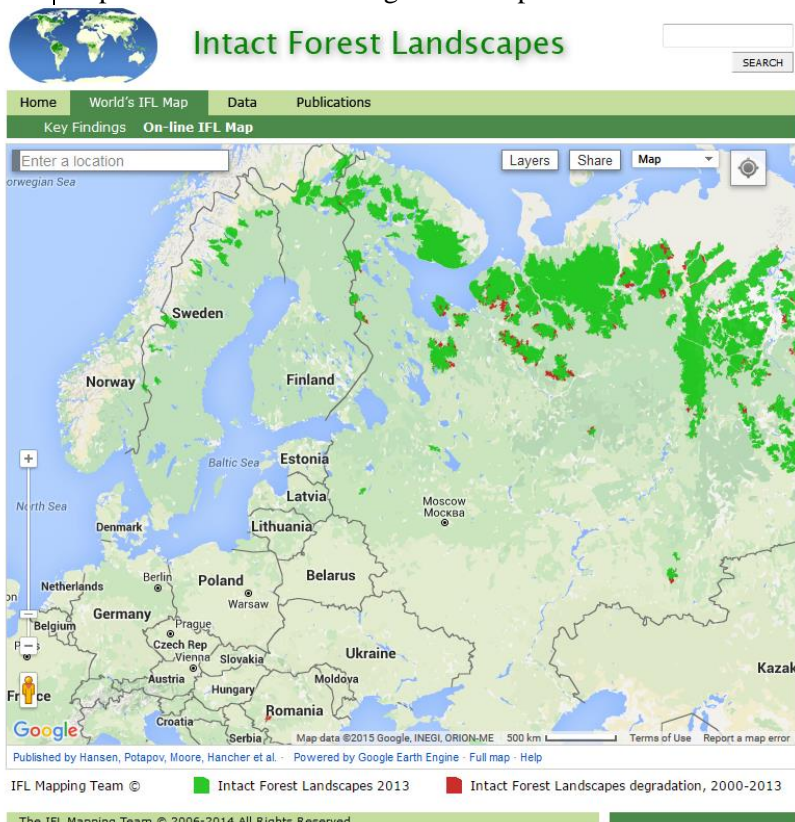
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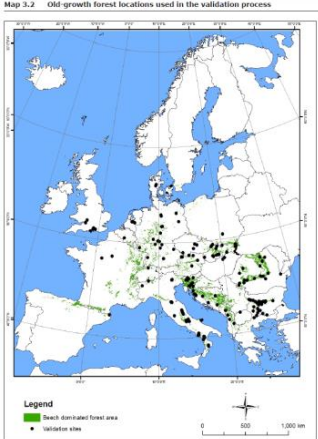
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➤ **The main references of the datasets with information related to old growth forest are shown in the standardized forms displayed in the Annexes 1 to 7.**

➤ **Additional references from the bibliographical review on the concept and other information sources can be seen in Annex 8 table classified by geographical focus.**

Annex 1   Pan-European datasets

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**EUROPE**
MAP TITLE	**The World Intact Forest Landscapes (IFLs)**
ORIGINAL TITLE	
SOURCE	Greenpeace, University of Maryland, Transparent World, World Resource Institute, WWF Russia.
CLASSES	IFLs, 2013 (Forest, Non forest), IFL degradation 2000-2013, Non intact forests.
SHAPE/SPATIAL RESOLUTION	Scale 1:1.000.000
YEAR	2014
AVAILABILITY	Available to download in GIS/Google Earth format
DEFINITION/ CRITERIA/ INDICATORS	An Intact Forest Landscape (IFL) is defined as an unbroken expanse of natural ecosystems within the zone of current forest extent, showing no signs of significant human activity and large enough that all native biodiversity, including viable populations of wide-ranging species, could be maintained. Although all IFL are within the forest zone, some may contain extensive naturally tree-less areas, including grasslands, wetlands, lakes, alpine areas, and ice. This definition builds on the definition of Frontier Forest that was developed by the World Resources Institute (Bryant et al., 1997).
MAIN REFERENCES	Potapov P., Yaroshenko A., Turubanova S., Dubinin M., Laestadius L., Thies C., Aksenov D., Egorov A., Yesipova Y., Glushkov I., Karpachevskiy M., Kostikova A., Manisha A., Tsybikova E., Zhuravleva I. 2008. Mapping the World's Intact Forest Landscapes by Remote Sensing. Ecology and Society, 13 (2)
MAIN WEBPAGES	http://www.intactforests.org/world.map.html

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**EUROPE**
MAP TITLE	**Old-growth beech forest locations used in the validation process of HNV likelihood map**
ORIGINAL TITLE	
SOURCE	Old-growth forest database of the Italian Academy of Forest Sciences (AISF)
CLASSES	
SHAPE/SPATIAL RESOLUTION	
YEAR	2014
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Extracts from EEA Technical report No 13/2014: "Old-growth forests are continuous woodlands where the absence of forest operations over at least several decades has allowed forest dynamics to return to successional pathways, and to be mainly driven by site potential and natural disturbances". "Information from a meta-analysis of scientific publications on old-growth forest in Europe has been produced as part of a cooperative project coordinated by the Italian Academy of Forest Sciences (AISF). The old-growth forest database is still progressively expanding. At the present time, it contains approximately 150 old-growth forests described in more than 80 scientific publications. The original database, which is the property of AISF, reports for each old‑growth forest the following information: extension, geographical location, growing stock volume, deadwood volume, forest type, and date of the last disturbance or age. For validation, a total of 136 beech-dominated old‑growth forests were used. Most of the old-growth forests have a size smaller than the minimum mapping unit used in the HNV suitability analysis: only 24 forests are larger than 100 ha, and the 136 old-growth forests have an average size of 68 ha, ranging between 1 ha and 1 434 ha (with a standard deviation of 136)".
MAIN REFERENCES	European Environment Agency, 2014. Developing a forest naturalness indicator for Europe. Concept and methodology for a high nature value (HNV) forest indicator. EEA Technical report No. 13/2014. 60 pp. 21 x 29.7 cm. ISBN 978-92-9213-478-5. doi:10.2800/20177
MAIN WEBPAGES	http://www.eea.europa.eu/publications/developing-a-forest-naturalness-indicator

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**EUROPE**
MAP TITLE	**Interactive comparison of Europe's land cover between 1900 and 2010**
ORIGINAL TITLE	
SOURCE	Wageningen UR
CLASSES	Forest (incl. transitional shrub and woodland, tree nurseries, reforested areas for forestry purposes) and other land covers
SHAPE/SPATIAL RESOLUTION	1 km resolution
YEAR	2013
AVAILABILITY	Interactive viewer and data available to download
DEFINITION/ CRITERIA/ INDICATORS	A reconstruction of historic land cover for Europe over the 1900-2010 period; processed by the HIstoric Land Dynamics Assessment model (HILDA v2.0) @ the Department of Geoinformation Science and Remote Sensing, Wageningen University, Netherlands.
MAIN REFERENCES	Fuchs, R., Herold, M., Verburg, P.H., Clevers, J.G.P.W., 2013. A high-resolution and harmonized model approach for reconstructing and analysing historic land changes in Europe. Biogeosciences 10 (2013). - ISSN 1726-4170 - p. 1543 - 1559. Fuchs, R., Herold, M., Verburg, P.H., Clevers, J.G.P.W. , Eberle, J., 2015. Gross changes in reconstructions of historic land cover/use for Europe between 1900 and 2010. Global Change Biology 21 (2015)1. - ISSN 1354-1013 - p. 299 - 313.
MAIN WEBPAGES	http://www.wageningenur.nl/en/Expertise-Services/Chair-groups/Environmental-Sciences/Laboratory-of-Geoinformation-Science-and-Remote-Sensing/Models/Hilda.htm
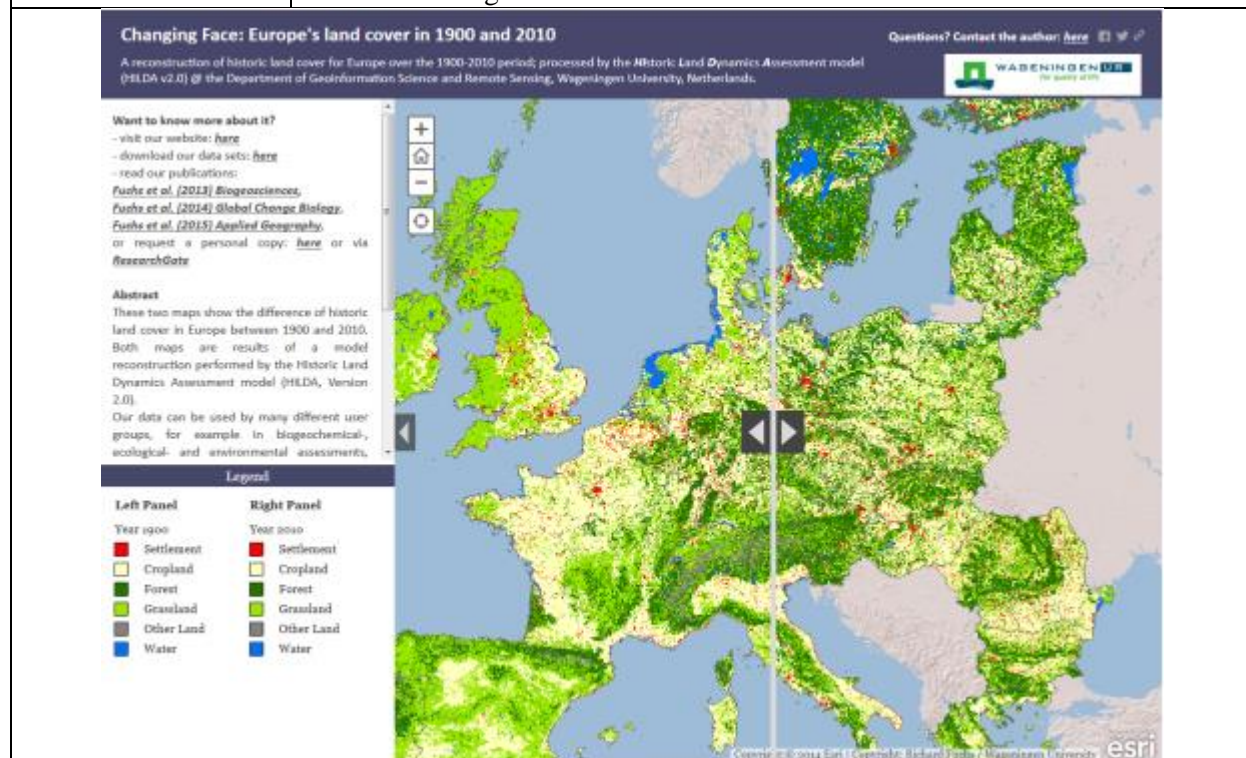
Annex 2 Datasets in the Scandinavian countries

These datasets have been collected by Håkan Berglund (SLU).

Note that many of the data/datasets listed contain data that overlap. For instance, forest areas registered in national databases of "protected areas" may also be registered in databases of "Natura 2000 sites" or "Natura habitat types". Note also that novel maps on old, old-growth, natural or hotspot forest habitats may be constructed by analyzing and combining the datasets listed in different ways.

The Swedish Species Information Centre (SSIC, SLU) express thanks to the following experts for valuable information and comments on available data/datasets in the Scandinavian countries:
- Vivian Kvist Johannsen, Department of Geosciences and Natural Resource Management (IGN), University of Copenhagen, Denmark;
- Olli Ojala, Natural Environment Centre, and Liisa Tuominen-Roto, Data and Information Centre/Environmental Information Systems, both at the Finnish Environment Institute (SYKE), Helsinki, Finland;
- Anne Sverdrup-Thygeson, Department of Ecology and Natural Resource Management, Norwegian University of Life Sciences (NMBU), Ås, Norway.

DENMARK

National forest inventory, NFI

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**DENMARK**
MAP TITLE	**Area estimates of old, old-growth or natural forests**
ORIGINAL TITLE	Area estimates of old, old-growth or natural forests
SOURCE	Processed statistics the National Forest Inventory (NFI)
CLASSES	It is possible to compute statistics for all forest land and to further divide data into classes with regard to e.g. stand type based on tree species, productivity, etc.
SHAPE/SPATIAL RESOLUTION	The NFI is designed to give a statistical representation of the country based on five years data while a subsample of sample plots are laid out systematically and covering the whole country every year. The inventory on sample plots may form the basis for area estimates at the national, regional and county level (presented as average values with standard errors).
YEAR	Any year (or five years averages)
AVAILABILITY	Tables (or maps) with area estimates at the national, regional and county level. No display of the map available.
DEFINITION/ CRITERIA/ INDICATORS	Different definitions may be applied when computing area estimates of old, old-growth or natural forests based on the collected field data. Simple and measurable definitions may involve a criterion for stand age. More complex definitions may involve multiple criteria of several different indicators[1,2,3].
MAIN REFERENCES	University of Copenhagen, the Department of Geosciences and Natural Resource Management (IGN)
MAIN WEBPAGES	Information:http://ign.ku.dk/samarbejde-raadgivning/myndighedsbetjening/skovovervaagning/danmarks-skovstatistik/. There are no web services for viewing or downloading data. Data for specific age classes or habitat types need to be ordered from NFI.

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[1] There is no URL with information or a copy of the field manual used by the NFI.

[2] Nord-Larsen, T., et al. 2014. Skove og plantager 2013. University of Copenhagen, Department of Geosciences and Natural Resource Management (IGN), Denmark (download PDF)

[3] The class "Natural forests" is defined as forests with an uneven age structure of trees according to Nord-Larsen et al. (2014).

Spatial datasets

The data listed can generally be viewed and downloaded via two main web portals; Miljøportalen (http://arealinformation.miljoeportal.dk/distribution/) and Det digitale Naturkort/Miljøgis (http://miljoegis.mim.dk/cbkort?profile=miljoegis-plangroendk).

Protected areas

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**DENMARK**
MAP TITLE	**Protected areas**
ORIGINAL TITLE	Protected areas
SOURCE	The Danish Nature Agency. The data originates from the central register of protected areas (centrale fredningsregister CFR[4]).
CLASSES	Forest areas within different types of protected areas or reserves according to national definitions[5,6].
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA	Forest areas within different types of protected areas or reserves according to national definitions (see above).
MAIN REFERENCES	The Danish Nature Agency
MAIN WEBPAGES	Information: http://naturstyrelsen.dk/naturbeskyttelse/national-naturbeskyttelse/fredninger/vejledning/. View and download data via: http://miljoegis.mim.dk/cbkort?profile=miljoegis-plangroendk or http://arealinformation.miljoeportal.dk/distribution/ (linked to the nature database http://naturdata.miljoeportal.dk/searchnew.aspx)

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[4] URL with information
[5] Miljøministeriet, By- og Landskabsstyrelsen 2009. Vejledning om naturbeskyttelseslovens § 3 beskyttede naturtyper (Guidance on the Nature Conservation Act § 3 protected habitats). Copenhagen, Denmark (downlad PDF).
[6] URL with information

Map of protected areas (blue polygons) in mid Denmark. Compiled and copied from the interactive environmental web portal (http://arealinformation.miljoeportal.dk/distribution/). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

## Forests classified as habitat types of the EU Habitats Directive in Natura 2000 sites

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**DENMARK**
MAP TITLE	**Habitat types of the EU Habitats Directive in Natura 2000 sites[7]**
ORIGINAL TITLE	Habitat types of the EU Habitats Directive in Natura 2000 sites
SOURCE	The Danish Nature Agency. Some 19 000 hectares across ca 6 500 individual sites has been mapped by the DEVANO programme[8]. There has not been any complete field inventory of forests with high conservation values in Denmark besides the mapping of forest habitats in Natura 2000 sites[9].
CLASSES	Forest areas classified as habitat types of the EU Habitats Directive. It is possible to further divide data into classes with regard to the collected data on tree species composition, stand structure and herbal vegetation.
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Forest areas fulfill the criteria for local site conditions and species composition of the habitat types[10]. Note that no criterion of naturalness is applied; the forest habitat types may show signs of extensive and recent silvicultural management.
MAIN REFERENCES	The Danish Nature Agency
MAIN WEBPAGES	Information: http://naturstyrelsen.dk/naturbeskyttelse/natura-2000/natura-2000-omraaderne/. View and download data via: http://miljoegis.mim.dk/cbkort?profile=miljoegis-plangroendk or http://arealinformation.miljoeportal.dk/distribution/ (linked to the nature database http://naturdata.miljoeportal.dk/searchnew.aspx).

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[7] Sites established according to the EU Habitats Directive 92/43/EEC and the Birds Directive 79/409 / EEC

[8] DEVANO is the acronym for ''DEcentral VAnd- og NaturOvervågning'' (Decentralized Water and Nature Monitoring)
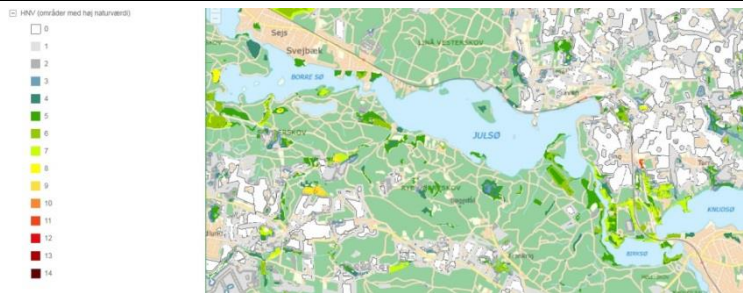
[9] Johannsen, V. K., et al. 2013. Evaluering af indsatsen for biodiversiteten i de danske skove 1992 – 2012. University of Copenhagen, Department of Geosciences and Natural Resource Management (IGN), Denmark (download PDF).

[10] Skov- og Naturstyrelsen, Miljø- og Energiministeriet. 2000. Danske naturtyper i det europæiske NATURA 2000 netværk. (The Danish interpretation manual of Natura 2000 habitat types). Copenhagen, Denmark (download PDF).
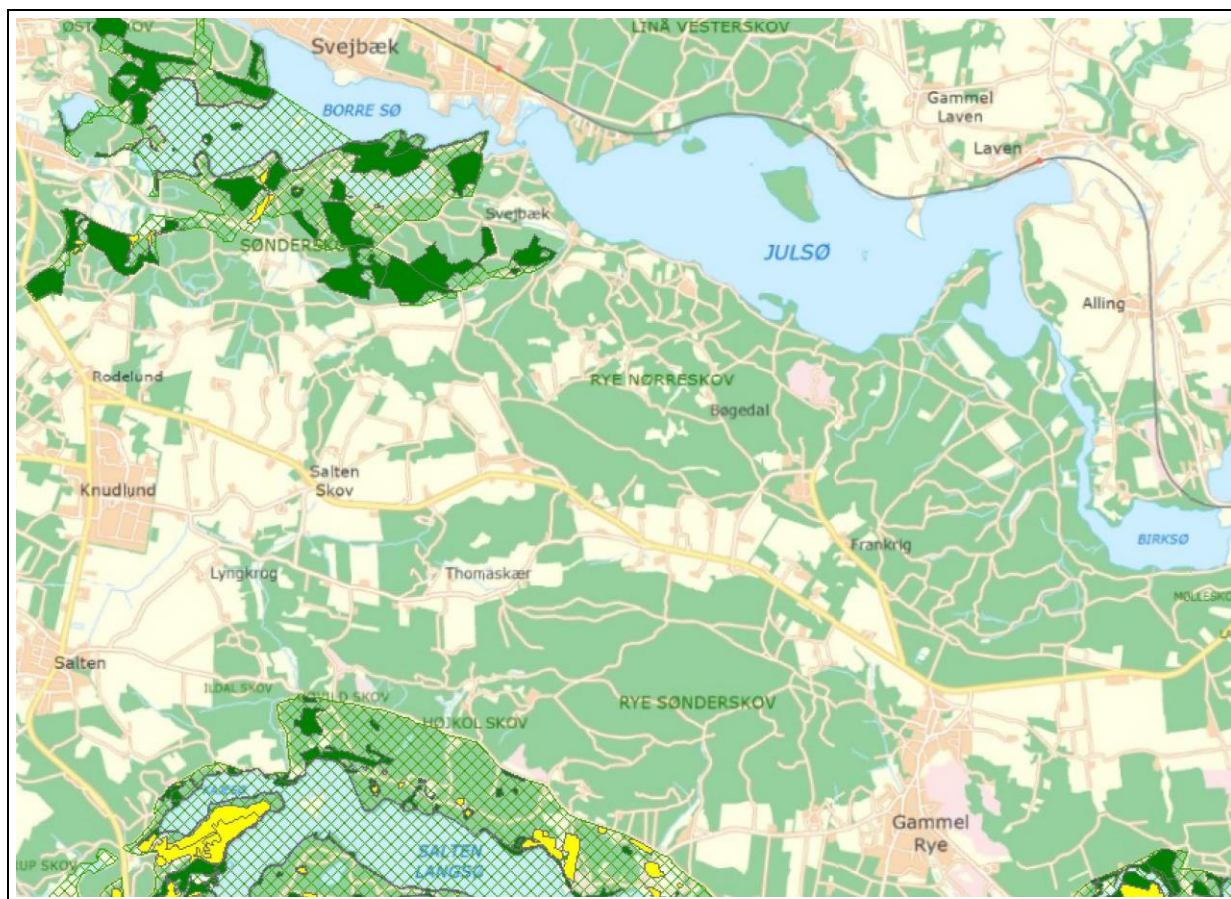
Map of mapped habitat types (yellow and green polygons for treeless habitats and forests, respectively) within Natura 2000 sites (green raster polygons) in mid Denmark. Compiled and copied from the interactive environmental web portal (http://arealinformation.miljoeportal.dk/distribution/). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

Biodiversity map / Forest areas of particular high nature value, HNV

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**DENMARK**
MAP TITLE	**Biodiversity map / Forest areas of particular high nature value, HNV**
ORIGINAL TITLE	Biodiversitetskortet / Forest areas of particular high nature value, HNV
SOURCE	The Danish Nature Agency
CLASSES	The identified areas can potentially be indexed (ranked) and thereby classified based on the available data on e.g. forest history and species observations (applies to both the biodiversity map and the HNV map).
SHAPE/SPATIAL RESOLUTION	Polygon / Raster
YEAR	2014 / 2015
AVAILABILITY	The Biodiversity map: Image. The biodiversity map is currently updated and a new version will be available in the end of 2015. The HNV map: image. The new map has been released in 2015.
DEFINITION/ CRITERIA/ INDICATORS	The Biodiversity map: individual forest areas are currently mapped by combining historical maps of the forest cover circa 200 years ago (continuity) and experts' knowledge about areas with high conservation values (observations of especially endangered species)[11]. The HNV map: the forest area have been mapped to forest polygons, and a set of 9 proxy layers combined with observations of especially endangered species result in a ranking of the forest area outside state forests and Natura 2000 sites.
MAIN REFERENCES	The Danish Nature Agency, the University of Copenhagen and the Aarhus University
MAIN WEBPAGES	Get information[12], view and download data via: http://miljoegis.mim.dk/cbkort?profile=miljoegis-plangroendk

Map of Biodiversity (ranking) / Map of areas with high nature value, HNV, (predicted index value indicated in different colors) in mid Denmark. Compiled and copied from the interactive environmental web portal (http://arealinformation.miljoeportal.dk/distribution/). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

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[11] Vivian Kvist Johannsen, personal communication. 2015. University of Copenhagen, Department of Geosciences and Natural Resource Management (IGN).

[12] Ejrnæs, R., et al. 2014. Biodiversitetskort for Danmark (The Biodiversity Map of Danmark). Scientific report from the Danish Centre for Environment and Energy (DCE), Aarhus University, Denmark (download PDF).
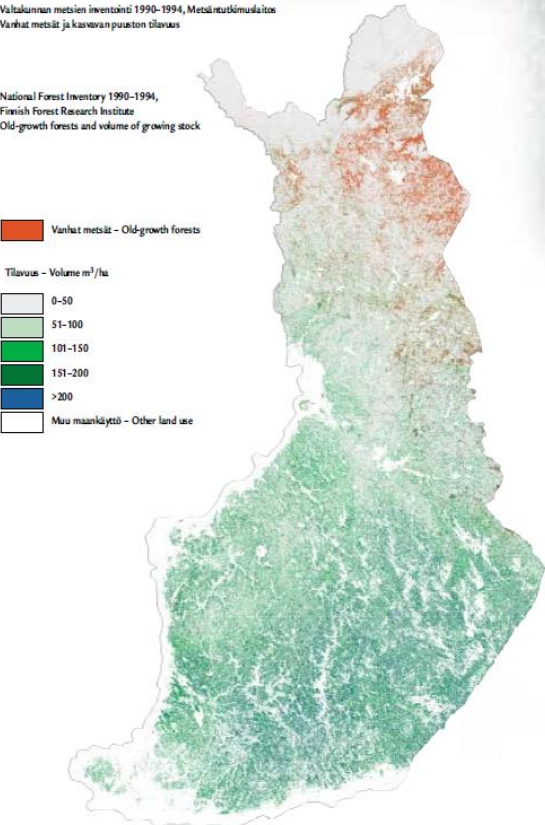
FINLAND

National forest inventory, NFI

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**FINLAND**
MAP TITLE	**National forest inventory estimates of old, old-growth or natural forests**
ORIGINAL TITLE	Valtakunnan metsien inventointi, VMI
SOURCE	Processed statistics the National Forest Inventory (NFI)
CLASSES	Like in Sweden, it is possible to compute statistics for all forest land and to further divide data into classes with regard to e.g. stand type based on tree species, productivity, etc.
SHAPE/SPATIAL RESOLUTION	Like in Sweden, the NFI is designed to give a statistical representation of the country based on five years data while a subsample of sample plots are laid out systematically and covering the whole country every year. The inventory on sample plots may form the basis for area estimates at the national, regional and county level (presented as average values with standard errors).
YEAR	Any year (or five years averages)
AVAILABILITY	Tables (or maps) with area estimates at the national, regional and county level. No display of the map available.
DEFINITION/ CRITERIA/ INDICATORS	Different definitions may be applied when computing area estimates of old, old-growth or natural forests based on the collected field data. Simple and measurable definitions may involve a criterion for stand age. More complex definitions may involve multiple criteria of several different indicators[13,14].
MAIN REFERENCES	The Finnish Forest Research Institute (METLA)
MAIN WEBPAGES	Information: http://www.metla.fi/ohjelma/vmi/info-en.htm. There are no web services for viewing or downloading data. Interactive statistical web service: http://www.metla.fi/metinfo/vmi/vmi-taulukot.htm. Data for specific age classes or habitat types need to be ordered from NFI.

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[13] VMI1 1 Maastotyöohje 2009 (The field manual of the 11th national forest inventory). In Finnish. The Finnish Forest Research Institute METLA (download PDF).

[14] SSIC have not been able to review the potential classes of forests identified based on field data while the field manual is in Finnish. However, NFI may use a specific definition of "old-growth natural forests" while estimates of the area cover of this class of forest are presented in the Finnish Statistical Yearbook of Forestry (Peltola, A (ed.) 2014. METLA. No download PDF available. URL with information).

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**FINLAND**
MAP TITLE	**National Forest Inventory 1990-1994. Old-growth forests and volume of growing stock**
ORIGINAL TITLE	
SOURCE	Finish Forest Research Institute
CLASSES	Old-growth forests (in red) and Volume (m^3/ha)
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2003
AVAILABILITY	Only image
DEFINITION/ CRITERIA/ INDICATORS	The structure of Finnish forests according to the National Forest Inventories conducted in 1990–94. The forest stand volume is indicated by the darkness of the green colour, while red colour shows the presence of old-growth (stands older than 150 years) (Figure courtesy of Professor Erkki Tomppo).
MAIN REFERENCES	Harkki, S., Savola, K., Walsh, M. (Eds.), 2003. A Comprehensive Conservation Programme for Finland's Forests in the 21st Century– with English language figure texts and summaries of the main chapters
MAIN WEBPAGES	

Valtakunnan metsien inventointi 1990–1994, Metsäntutkimuslaitos
Vanhat metsät ja kasvavan puuston tilavuus

National Forest Inventory 1990–1994,
Finnish Forest Research Institute
Old-growth forests and volume of growing stock

Vanhat metsät – Old-growth forests

Tilavuus – Volume m³/ha
- 0–50
- 51–100
- 101–150
- 151–200
- >200
- Muu maankäyttö – Other land use

Kuva 3.1. Suomen metsien rakenne valtion metsien vuosien 1990–94 inventoinnin perusteella. Vihreällä värillä on esitetty puuston tilavuus, punaisella värillä vanhojen metsien esiintyminen (ikä yli 150 vuotta). (Kuva prof. E. Tompon laatima.)

Figure 3.1. The structure of Finnish forests according to the National Forest Inventories conducted in 1990–94. The forest stand volume is indicated by the darkness of the green colour, while red colour shows the presence of old-growth (stands older than 150 years) (Figure courtesy of Professor Erkki Tomppo).

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Spatial datasets

The data listed can generally be viewed and downloaded via two main web portals; OIVA (HTTP://WWW.YMPARISTO.FI/OIVA) and Latauspalvelu LAPIO (http://paikkatieto.ymparisto.fi/lapio/lapio_flex.html#app=3d81&c3ad-selectedIndex=0).

Nationally designated nature protected areas and wilderness reserves

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**FINLAND**
MAP TITLE	**Nationally designated nature protected areas and wilderness reserves**
ORIGINAL TITLE	Luonnonsuojelu- ja erämaa-alueet
SOURCE	The web service OIVA by Finland's environmental administration[15]. The Finnish Environment Institute (SYKE) is responsible for the data.
CLASSES	Forest areas within different types of protected areas or reserves according to national definitions[16,17]. However, the data on the forests within individual sites is incomplete. Forest data is available for private protected areas only; it is generally not possible to classify forest areas within sites unless additional data is made available by authorities[18,19].
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	See "Classes" above and the metadata[20]. Some sites are classified as "Old growth forest reserve" and "Herb rich forest reserve" in the available data.
MAIN REFERENCES	Finland's environmental administration.
MAIN WEBPAGES	Information: http://wwwd3.ymparisto.fi/d3/paikkatieto.htm and http://metatieto.ymparisto.fi:8080/geoportal/catalog/search/resource/details.page?uuid=%7B9871C541-9E84-4241-A1E5-51C596A5A4E2%7D. View and download data via: HTTP://WWW.YMPARISTO.FI/OIVA or http://paikkatieto.ymparisto.fi/lapio/lapio_flex.html#

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[15] The Ministry of the Environment, The Finnish Environment Institute (SYKE), 13 Centres for Economic Development, Transport and the Environment (ELY Centres), and Regional State Administrative Agencies (AVI). URL with information
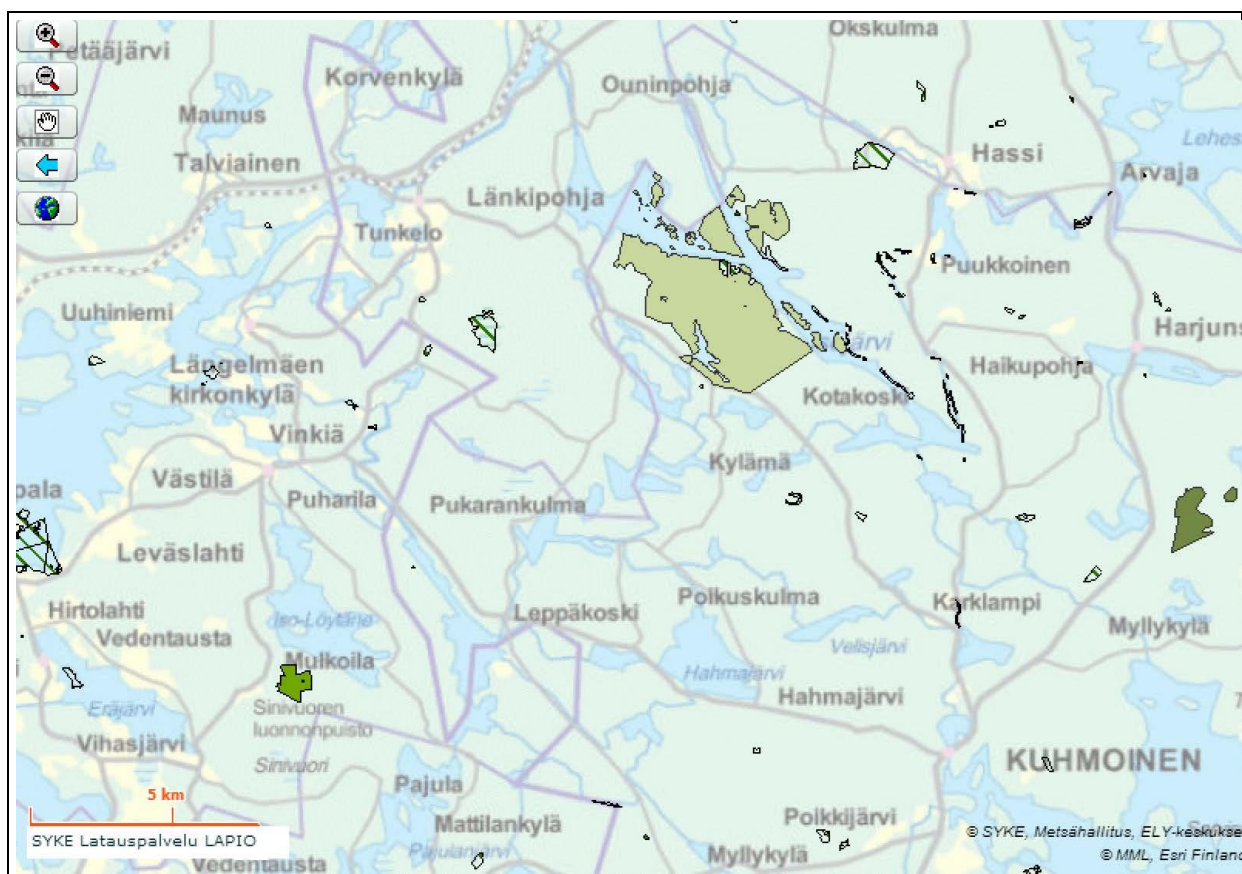
[16] URL with information

[17] URL with information

[18] Authorities have data on forest areas classified as habitat types of the EU Habitats Directive in protected areas and Natura 2000 sites, but data is not publicly available.

[19] Olli Ojala, personal communication. 2015. Natural Environment Centre, SYKE, Helsinki.

[20] Download PDF

Map of nationally designated nature protected areas and wilderness reserves on state owned and private land (green and striped polygons, respectively) in mid Finland. Compiled and copied from the interactive environmental web portal (http://paikkatieto.ymparisto.fi/lapio/lapio_flex.html#app=3d81&c3ad-selectedIndex=0). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

Forest areas within Natura 2000 sites

| DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**FINLAND**
MAP TITLE	**Forest areas within Natura 2000 sites[21]**
ORIGINAL TITLE	The Finnish title of the dataset is Natura 2000 alueet
SOURCE	The web service OIVA by Finland's environmental administration[22]. The Finnish Environment Institute (SYKE) is responsible for the data.
CLASSES	Forest areas within Natura 2000 sites. However, the data on the forests within individual sites is incomplete. Forest data is available for private protected areas only; it is generally not possible to classify forest areas within sites unless additional data is made available by authorities[23,24].
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	See "Classes" above and the metadata[25].
MAIN REFERENCES	Finland's environmental administration.
MAIN WEBPAGES	Information: http://wwwd3.ymparisto.fi/d3/paikkatieto.htm and http://metatieto.ymparisto.fi:8080/geoportal/catalog/search/resource/details.page?uuid=%7B385564E1-F944-4BE0-B16E-4CC8DAD411F1%7D. View and download data via: HTTP://WWW.YMPARISTO.FI/OIVA or http://paikkatieto.ymparisto.fi/lapio/lapio_flex.html#

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[21] Sites established according to the EU Habitats Directive 92/43/EEC and the Birds Directive 79/409 / EEC

[22] The Ministry of the Environment, The Finnish Environment Institute (SYKE), 13 Centres for Economic Development, Transport and the Environment (ELY Centres), and Regional State Administrative Agencies (AVI). URL with information

[23] Authorities have data on forest areas classified as habitat types of the EU Habitats Directive in protected areas and Natura 2000 sites, but data is not publicly available.

[24] Olli Ojala, personal communication. 2015. Natural Environment Centre, SYKE, Helsinki.

[25] Download PDF
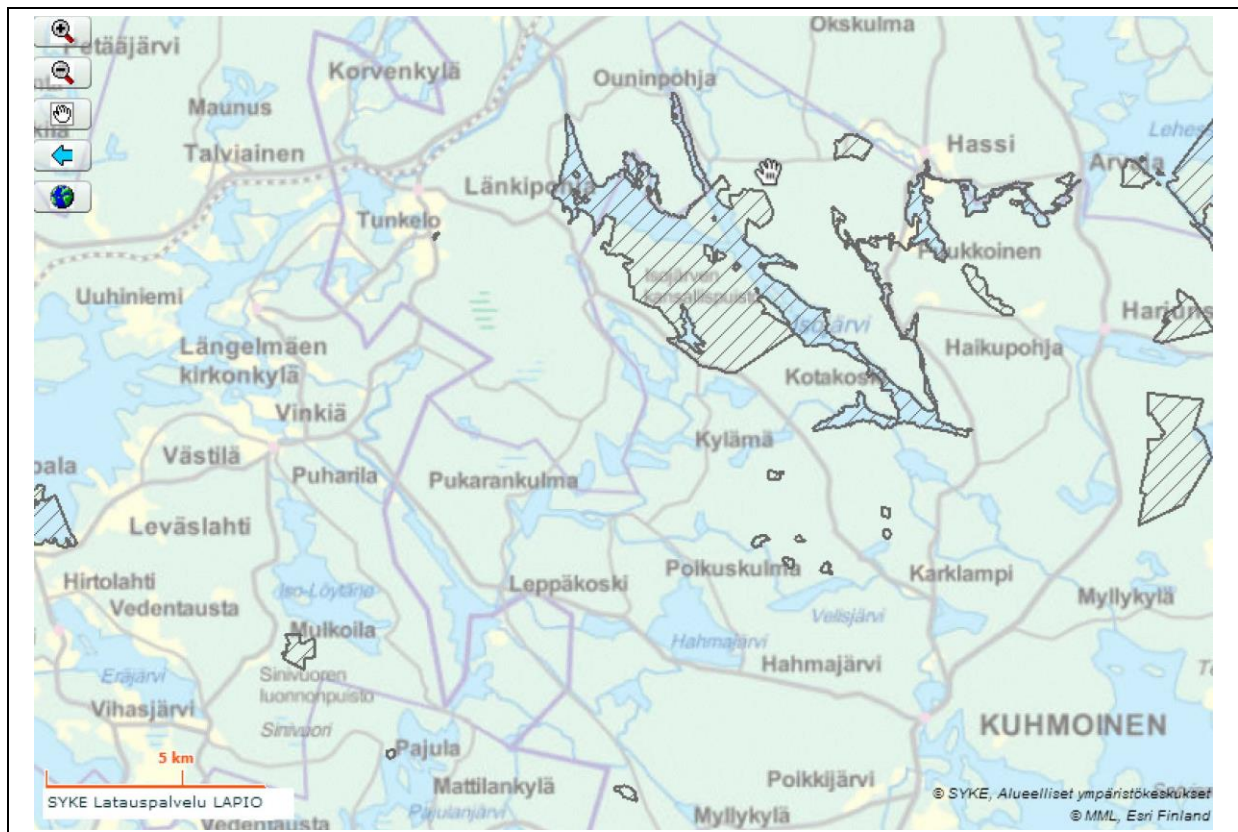
Map of Natura 2000 sites in mid Finland (striped polygons). Compiled and copied from the interactive environmental web portal (http://paikkatieto.ymparisto.fi/lapio/lapio_flex.html#app=3d81&c3ad-selectedIndex=0). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

Areas included in national conservation programmes

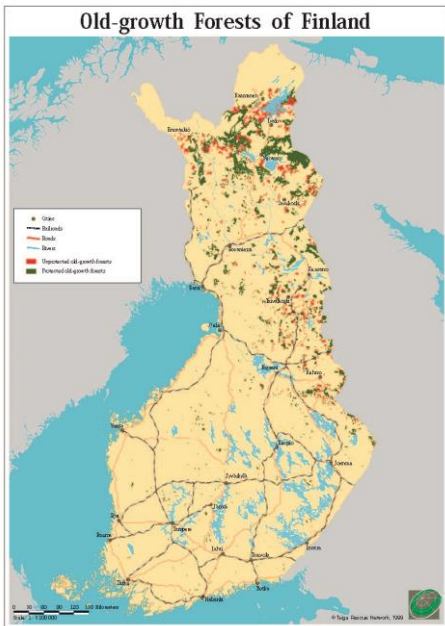| DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**FINLAND**
MAP TITLE	**Areas included in national conservation programmes**
ORIGINAL TITLE	Luonnonsuojeluohjelma-alueet
SOURCE	The web service OIVA by Finland's environmental administration[26]. The Finnish Environment Institute (SYKE) is responsible for the data.
CLASSES	Forest areas in protected areas described in national conservation programmes covering national parks and strict nature reserves, mires, bird wetlands, eskers, herb-rich woodland, shores and old-growth forests. However, the data on the forests within individual sites is incomplete. It is generally not possible to classify forest areas within sites unless additional data is made available by authorities.
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	See "Classes" above and the metadata[27].
MAIN REFERENCES	Finland's environmental administration.
MAIN WEBPAGES	Information: http://wwwd3.ymparisto.fi/d3/paikkatieto.htm and http://metatieto.ymparisto.fi:8080/geoportal/catalog/search/resource/details.page?uuid={A0C487D4-968B-4553-9EFB-870D6D2A728C}. View and download data via: HTTP://WWW.YMPARISTO.FI/OIVA or http://paikkatieto.ymparisto.fi/lapio/lapio_flex.html#

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[26] The Ministry of the Environment, The Finnish Environment Institute (SYKE), 13 Centres for Economic Development, Transport and the Environment (ELY Centres), and Regional State Administrative Agencies (AVI). URL with information

[27] Download PDF

Map of areas included in national conservation programmes (different colored polygons) in mid Finland. Compiled and copied from the interactive environmental web portal (http://paikkatieto.ymparisto.fi/lapio/lapio_flex.html#app=3d81&c3ad-selectedIndex=0). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

Forest areas mapped by the Taiga Rescue Network

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**FINLAND**
MAP TITLE	**Old-growth Forests of Finland**
ORIGINAL TITLE	Click here to enter text.
SOURCE	Taiga Rescue Network
CLASSES	Old-growth forests from 100 to 1000 hectares (unprotected and protected); Old growth forests greater than 1000 hectares (unprotected and protected)
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	1999
AVAILABILITY	Only image
DEFINITION/ CRITERIA/ INDICATORS	"Old-growth forests are characterized by stands originating through natural succession with a significant contribution of old trees and dead wood, often with a multi-layered tree structure. These forest contain globally, regionally or nationally significant concentrations of biodiversity values (e.g., endemism, endangered or threatened species, endangered or threatened ecosystems, refugia), or are large landscape level forests, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance". History of human disturbance does not necessarily exclude forests from being defined as old-growth, especially in case of the Fennoscandian forests.
MAIN REFERENCES	Lloyd (ed.), 1999. The last of the last: The Old-growth Forests of Boreal Europe. Taiga Rescue Network.
MAIN WEBPAGES	http://old.forest.ru/eng/publications/last/maps/finland.html

Old-growth Forests of Finland

NORWAY

National forest inventory, NFI

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**NORWAY**
MAP TITLE	**National forest inventory estimates of old, old-growth or natural forests**
ORIGINAL TITLE	Landsskogtakseringens estimering av gammelt skog og naturskog
SOURCE	Processed statistics the National Forest Inventory (NFI)
CLASSES	Like in Sweden, it is possible to compute statistics for all forest land and to further divide data into classes with regard to e.g. stand type based on tree species, productivity, etc.
SHAPE/SPATIAL RESOLUTION	Like in Sweden, the NFI is designed to give a statistical representation of the country based on five years data while a subsample of sample plots are laid out systematically and covering the whole country every year. The inventory on sample plots may form the basis for area estimates at the national, regional and county level (presented as average values with standard errors).
YEAR	Any year (or five years averages)
AVAILABILITY	Tables (or maps) with area estimates at the national, regional and county level. No display of the map available.
DEFINITION/ CRITERIA/ INDICATORS	Different definitions may be applied when computing area estimates of old, old-growth or natural forests based on the collected field data. Simple and measurable definitions may involve a criterion for stand age. More complex definitions may involve multiple criteria of several different indicators[28,29].
MAIN REFERENCES	The Norwegian Institute of Bioeconomy Research (NIBIO)
MAIN WEBPAGES	Information: http://www.nibio.no/en/topics/national-forest-inventory; http://www.skogoglandskap.no/artikler/2013/fakta_om_landsskogtakseringen. There are no web services for viewing or downloading data. Interactive statistical web service: http://www.skogoglandskap.no/temaer/statistikk_fra_landsskogtakseringen. Data for specific age classes or habitat types need to be ordered from NFI.

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[28] "Forests with the characteristics of natural forest" is defined as areas that fulfill minimum threshold values for several different indicators of forest structures.

[29] Landsskogtakseringens feltinstruks 2008. Håndbok fra Skog og landskap 05/08 (The field manual of the national forest inventory). In Norwegian. The Norwegian Institute of Bioeconomy Research NIBIO.

Spatial datasets

The data listed can be accessed via the national geographical web portal Kartkatalog (http://www.kartverket.no/geonorge). Data can be viewed via the web portals Kilden (http://kilden.nibio.no) and Naturbase (http://kart.naturbase.no). Data can be downloaded from the web portal Karteksport (http://karteksport.miljodirektoratet.no).

Protected areas and areas proposed for protection

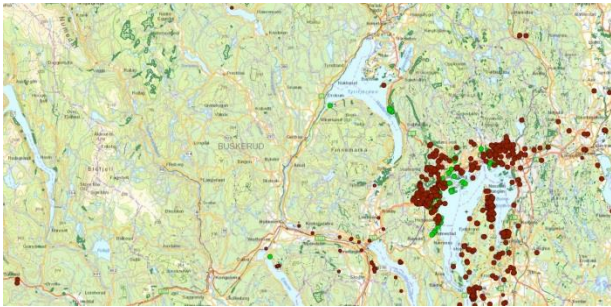| DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**NORWAY**
MAP TITLE	**Protected areas and areas proposed for protection**
ORIGINAL TITLE	Naturvernområder og foreslåtte naturvernområder
SOURCE	The Norwegian Environment Agency
CLASSES	Forest areas within different types of protected areas and areas proposed for protection according to national definitions. However, the data on the forests within individual sites is incomplete. It is generally not possible to classify forest areas within sites unless additional data is made available by authorities.
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	See "Classes" above and the metadata[30,31]. The available attribute data of the conservation plans may potentially indicate areas with conservation values in form of broad-leaved deciduous and rich deciduous forests as well as valuable forests in general.
MAIN REFERENCES	The Norwegian Environment Agency
MAIN WEBPAGES	Information: http://www.miljødirektoratet.no/no/Tema/Verneomrader. View and download data via: http://kart.naturbase.no/ and http://karteksport.miljodirektoratet.no/#page=tab1 (reachable from http://www.miljodirektoratet.no/no/Tjenester-og-verktoy/Database/Naturbase/)

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[30] Download PDF
[31] Download PDF
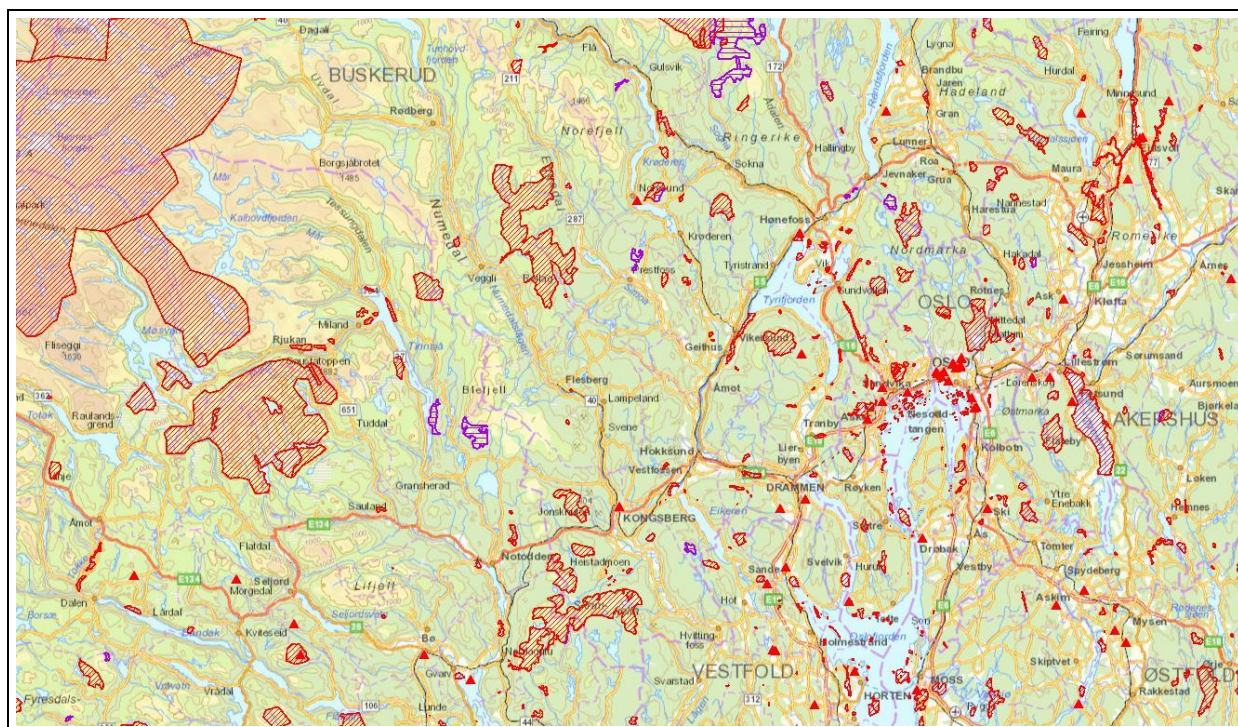
Map of protected areas (red polygons) and areas suggested for protection (purple polygons) nearby the capital Oslo in southern Norway. Compiled and copied from the interactive web portal of nature areas (http://kart.naturbase.no/). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

Important and selected habitat types

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**NORWAY**
MAP TITLE	**Important and selected habitat types**
ORIGINAL TITLE	Viktige og utvalgte naturtyper
SOURCE	The Norwegian Environment Agency
CLASSES	Important and selected habitat types according to national definitions[32,33].
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Important habitats types include different types of forests[34]; e.g. old broad-leaved deciduous forest, rich boreal deciduous forest, old boreal deciduous forests and old coniferous forest. Selected habitat types include hollow oaks and Tilia cordata forests on lime soils[35].
MAIN REFERENCES	The Norwegian Environment Agency
MAIN WEBPAGES	Information: http://www.miljostatus.no/Tema/Naturmangfold/Viktige-naturtyper and http://www.miljodirektoratet.no/no/Tema/Arter-og-naturtyper/Prioriterte-arter/Utvalgte-naturtyper. View and download data via: http://kart.naturbase.no/ and http://karteksport.miljodirektoratet.no/#page=tab1 (reachable from http://www.miljodirektoratet.no/no/Tjenester-og-verktoy/Database/Naturbase/)

Map of important (green polygons indicate forests) and selected habitat types (red and green points indicate hollow oaks and Tila cordata forests on lime soils, respectively) nearby the capital Oslo in southern Norway. Compiled and copied from the interactive web portal of nature areas (http://kart.naturbase.no/). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

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[32] Direktoratet for naturforvaltning. 2007. Kartleggning av naturtyper – Verdisettning av biologisk mangfold. DN-håndbok 13. Trondheim, Norway.
[33] URL with information
[34] Download PDF
[35] URL with information

Habitat types mapped by the complementary hotspot inventory

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**NORWAY**
MAP TITLE	**Habitat types mapped by the complementary hotspot inventory**
ORIGINAL TITLE	Miljøregistrering i skog (MiS)
SOURCE	The Norwegian Institute of Bioeconomy Research (NIBIO)
CLASSES	12 habitat types mapped by the complementary hotspot inventory[36]
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Image. Data need to be ordered by the data owners.
DEFINITION/ CRITERIA/ INDICATORS	12 habitat types of particular importance for red-listed forest species which are considered vulnerable to the impact of forestry[37]; e.g. forest habitats with snags or logs, late successions of deciduous trees and recently burned forests. Mapped areas are further classified with regards to their positions along main environmental gradients (productivity and humidity).
MAIN REFERENCES	The Norwegian Institute of Bioeconomy Research (NIBIO)
MAIN WEBPAGES	Information: http://www.skogoglandskap.no/temaer/miljoregistrering_i_skog. View and download data via: http://kart.naturbase.no/.

Map of 12 different habitat types (polygons of different colors indicate different habitat types) mapped by the complementary hotspot inventory nearby the capital Oslo in southern Norway. Compiled and copied from the interactive web portal of nature areas (http://kart.naturbase.no/). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

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[36]Baumann, C., et al. 2002. Handbok i registrering av livsmiljøer i Norge. Miljøregistrering i skog: biologisk mangfold. Instruks for registrering 2001 (Hefte 3) [Environmental inventories in forests: Biodiversity. Part 3: Instructions for inventories]. Skogforsk and the Norwegian Ministry of Agriculture. (In Norwegian.). Download PDF (all chapters of the handbook are available at the URL of the handbook).

[37] Gjerde, I., et al. 2007. Biological Conservation 137: 549-557.

Forest areas mapped by the Taiga Rescue Network

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**NORWAY**
MAP TITLE	**Old-growth Forests of Norway**
ORIGINAL TITLE	Click here to enter text.
SOURCE	Taiga Rescue Network
CLASSES	Old-growth forests from 100 to 1000 hectares (unprotected and protected); Old growth forests greater than 1000 hectares (unprotected and protected)
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	1999
AVAILABILITY	Only image
DEFINITION/ CRITERIA/ INDICATORS	"Old-growth forests are characterized by stands originating through natural succession with a significant contribution of old trees and dead wood, often with a multi-layered tree structure. These forest contain globally, regionally or nationally significant concentrations of biodiversity values (e.g., endemism, endangered or threatened species, endangered or threatened ecosystems, refugia), or are large landscape level forests, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance". History of human disturbance does not necessarily exclude forests from being defined as old-growth, especially in case of the Fennoscandian forests.
MAIN REFERENCES	Lloyd (ed.), 1999. The last of the last: The Old-growth Forests of Boreal Europe. Taiga Rescue Network.
MAIN WEBPAGES	http://old.forest.ru/eng/publications/last/maps/norway.html

SWEDEN

National forest inventory, NFI

| DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SWEDEN**
MAP TITLE	**National forest inventory estimates of old, old-growth or natural forests**
ORIGINAL TITLE	Riksskogstaxeringens skattning av gammal eller naturlig skog
SOURCE	Processed statistics the National Forest Inventory (NFI)
CLASSES	It is possible to compute statistics for different indicators of old, old-growth or natural forest. Statistics can be compiled for different productivity or vegetation classes. It is also possible to produce statistics for different classes with regard to protection or stand type based on tree species, productivity, etc.
SHAPE/SPATIAL RESOLUTION	The NFI is designed to give a statistical representation of the country based on five years data while a subsample of sample plots are laid out systematically and covering the whole country every year. The inventory on sample plots may form the basis for area estimates at the national, regional and county level (presented as average values with standard errors). Interpolated maps (see figure below) may be produced to illustrate spatial patterns and trends at large resolution. The maps are produced in ArcMap by the interpolation method "Inverse Distance Weighted." The map below is based on the sample plot estimates of old-growth forest on productive forest land (forest land that can produce an average of one cubic meter of timber per hectare per year) excluding national parks, nature reserves and nature protection areas that are protected from forestry as of 2013.
YEAR	Any year (or five years averages)
AVAILABILITY	Tables (or maps) with area estimates at the national, regional and county level
DEFINITION/ CRITERIA/ INDICATORS	Different definitions may be applied when computing area estimates of old, old-growth or natural forests based on the collected field data. Simple and measurable definitions may involve a criterion for stand age[38,39]. More complex definitions may involve multiple criteria of several different indicators[40,41].
MAIN REFERENCES	Swedish University of Agricultural Sciences (SLU)
MAIN WEBPAGES	Information: http://www.slu.se/en/collaborative-centres-and-projects/swedish-

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[38] "Old-growth forest" (or just "old forest" as a synonym) is defined as being over 140 years in northern Sweden (Norrland, Dalarna, Värmland and Örebro counties), and over 120 years in the rest of the country.
[39] Christiansen, L (ed.) 2014. Swedish Statistical Yearbook of Forestry. The Swedish Forestry Agency, Jönköping, Sweden (download PDF).
[40] "Forests with the characteristics of natural forest" is defined as areas that fulfill minimum threshold values for several different indicators of forest structures.
[41] Fältinstruktion 2014. Riksinventering av skog (The field manual of the national forest inventory). In Swedish. Department of Forest Resource Management, Swedish University of Agricultural Science, Umeå, Sweden (download PDF).

Andel
gammal skog

0 - 5 %
5 - 10 %
10 - 20 %
20 - %

Sjöar
och inga data

Skyddad areal
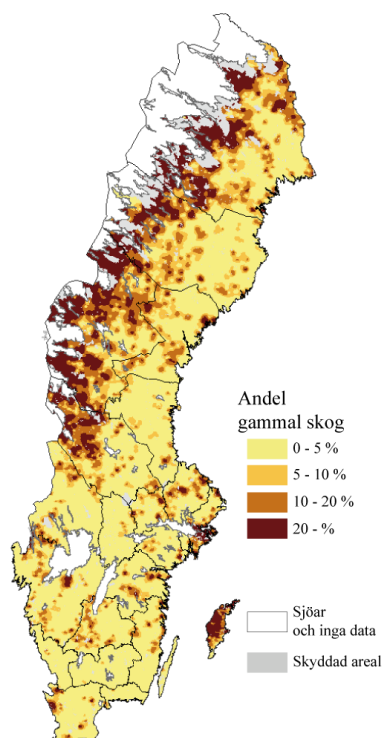
Interpolated map. Proportion (%) of old forest of the total productive forest land area 2010-2014 in
Sweden. Productive forest land excluding national parks, nature reserves and nature protection areas
that are protected from forestry as of 2013. "Old-growth forest" (or just "old forest" as a synonym) is
defined as being over 140 years in northern Sweden (Norrland, Dalarna, Värmland and Örebro
counties), and over 120 years in the rest of the country. Areas marked in white indicate lakes and lack
of data. Areas marked in grey indicate protected areas. Source:
http://www.slu.se/Documents/externwebben/webbtjanster/statistik-om-skog/Diagram/2010-
2014/fig36.png.

National terrestrial habitat monitoring, THUF

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SWEDEN**
MAP TITLE	**National terrestrial habitat monitoring estimates of habitat types of EU Habitats Directive**
ORIGINAL TITLE	Den terrestra habitatuppföljningens skattning av naturtyper i EU:s habitatdirektiv
SOURCE	Processed statistics from the Swedish National Forest Inventory (NFI) and the National Inventory of Landscapes in Sweden (NILS)
CLASSES	Forests classified as habitat types of the EU Directive[42]. It is possible to further divide data into classes with regard to protection (unprotected and protected) or stand type based on tree species, productivity, etc.
SHAPE/SPATIAL RESOLUTION	Both NFI and NILS are designed to give a statistical representation of Sweden based on five years data while a subsample of sample plots are laid out systematically and covering the whole country every year. The inventory on sample plots forms the basis for area estimates at the national, regional and county level. The map format that may be used to report information from the NFI is county or regional maps. These maps include average estimates with relatively low standard errors. Spatial data in form of raster or polygon data are not available. The inventories of EU habitat types started in 2008.
YEAR	Any year (or five years averages)
AVAILABILITY	Tables (or maps) with area estimates at the national, regional and county level. No display of the map available
DEFINITION/ CRITERIA/ INDICATORS	"Forests classified as habitat types of the EU Directive" cover a minimum area ($\geq$0.25 hectares for habitats on mineral soils), have a canopy cover of trees $\geq$10% and fulfil a set of minimum criteria of naturalness, i.e. forests should have been naturally regenerated, not extensively affected by forestry during the last 25 years, and exhibit natural stand structure characteristics. The latter implies that the stand age is at least 40 (or in some cases 20) years higher the lowest recommended age of clear cutting, or that natural disturbances or management mimicking such disturbances affect the stand structure[43].
MAIN REFERENCES	Swedish University of Agricultural Sciences (SLU)
MAIN WEBPAGES	Information: http://www.slu.se/en/departments/forest-resource-management/environment/. There are no web services for viewing or downloading data. Data for specific age classes or habitat types need to be ordered from NFI and NILS.

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[42] 92/43/EEC

[43] Gardfjell, H., Hagner, Å. 2014. Instruktion för Habitatinventering i NILS och MOTH, 2014. Version 2014-03-25. (The field manual of the terrestrial habitat inventory). In Swedish. Department of Forest Resource Management, Swedish University of Agricultural Science, Umeå, Sweden (download PDF).

Spatial datasets

The data listed can generally be viewed and downloaded from two main web portals; geodataportalen (https://www.geodata.se/GeodataExplorer/index.jsp?loc=sv) and miljöportalen (http://mdp.vic-metria.nu/miljodataportalen/).

Protected areas

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SWEDEN**
MAP TITLE	**Protected areas in the Swedish Register of Environmental Conservation**
ORIGINAL TITLE	Skyddade områden, naturvårdsregistret
SOURCE	Swedish Environmental Protection Agency (SEPA). However, the data originates from the database VIC Nature, which is a joint administration tool for the County administration, Lantmäteriet (the National Land Survey) and SEPA.
CLASSES	Different types of protected area or reserves according to national definitions; forests within national parks, nature reserves, conservation areas, animal and plant protection areas, natural memorial areas, habitat protection areas decided by municipality or county administrations, water protection areas, cultural reserves and forest-habitat protection areas decided by the Swedish Forest Agency (SFA). Many, but not all protected areas, are Natura 2000 sites.
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Different types of protected area or reserves according to national definitions (see above).
MAIN REFERENCES	SEPA
MAIN WEBPAGES	Information: http://www.naturvardsverket.se/kartverktyget-skyddad-natur. View data via: http://skyddadnatur.naturvardsverket.se/. Download data via: http://gis-services.metria.se/arcgis/services/InspireNV_WFS_NVR/MapServer/InspireFeatureDownloadService

Map of protected areas (green polygons) in mid Sweden in the Swedish Register of Environmental Conservation. Compiled and copied from the interactive web portal of protected areas (http://skyddadnatur.naturvardsverket.se/). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

Forest areas within Natura 2000 sites

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SWEDEN**
MAP TITLE	**Forest areas within Natura 2000 sites**[44]
ORIGINAL TITLE	Skyddade områden, Sveriges Natura 2000 områden
SOURCE	Swedish Environmental Protection Agency (SEPA). However, SEPA is responsible for the information in the database, but the County Administrations are the primary source of all data.
CLASSES	Forest areas classified as habitat types of the EU Habitats Directive. It is possible to further divide data into classes with regard to protection (unprotected and protected), habitat or stand type based on tree species, etc.
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Forest areas classified as habitat types of the EU Habitats Directive within Natura 2000 sites[45]. They cover a minimum area (≥0.5 or 1 hectares for different habitat types), have a canopy cover of trees ≥30% and fulfil a set of minimum criteria of naturalness, i.e. forests should have been naturally regenerated, show no signs of extensive and recent forestry, and exhibit natural stand structure characteristics (the stand age is high compared to managed forests, or that natural disturbances affect the stand structure)[46].
MAIN REFERENCES	SEPA
MAIN WEBPAGES	Information: http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledningar/Natura-2000/. View data via: http://skyddadnatur.naturvardsverket.se/. Download data via: http://gis-services.metria.se/ArcGIS/services/InspireNV_N2K/MapServer/InspireViewService?Layers=PS.N2K.Habitatdirektivet.

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[44] Established according to the EU Habitats Directive 92/43/EEC and the Birds Directive 79/409 / EEC

[45] Not all areas of Natura 2000 sites are formally protected in form of parks, reserves, etc.

[46] Kellner, O. 2007. Manual för basinventering av skogshabitat (fältinventering) (Field manual for inventory of forest habitat types). Version 5.5. 2007-06-21. Swedish Environmental Protection Agency, Stockholm, Sweden (no download PDF available); Skånäs, H., et al. 2007. Flygbildstolkningsmanual för Basinventeringen Natura 2000 (Manual for aerial photo interpretation of EU habitat types). Version 7.1. 2007-12-14. Swedish Environmental Protection Agency, Stockholm, Sweden (no download PDF available).
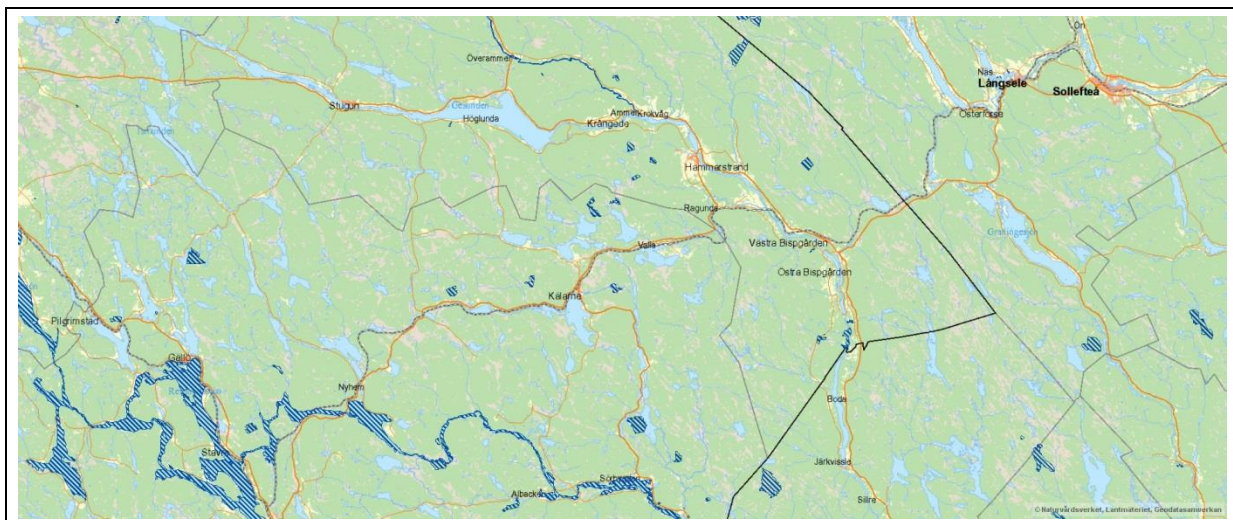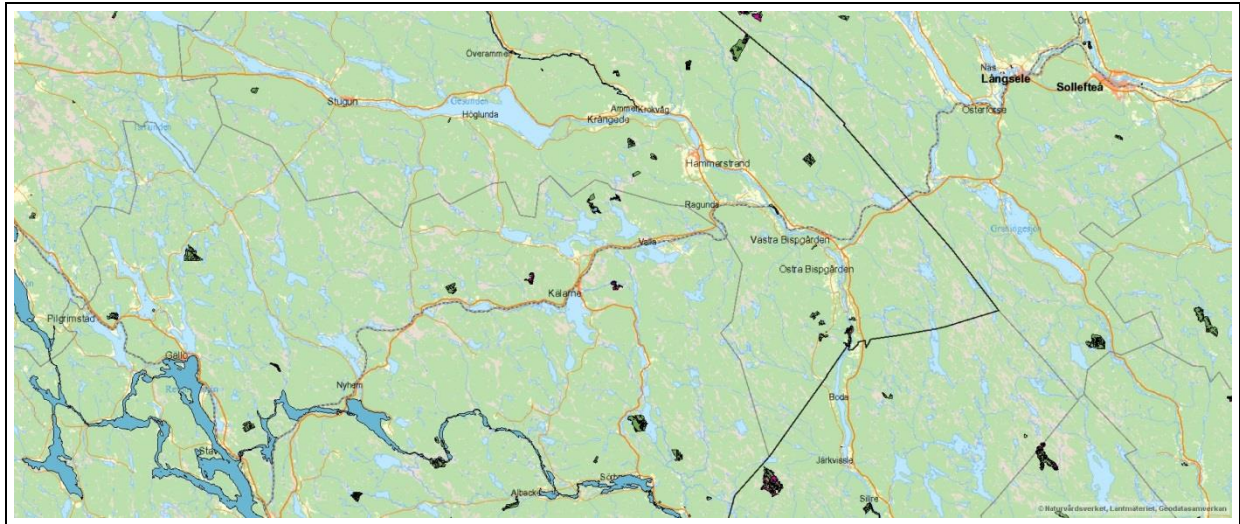
Map of Natura 2000 sites in mid Sweden (blue polygons) in the Swedish Register of Environmental Conservation. Compiled and copied from the interactive web portal of protected areas (http://skyddadnatur.naturvardsverket.se/). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

Natura habitat types mapped in protected areas and Natura 2000 sites

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SWEDEN**
MAP TITLE	**The map of Natura habitat types**
ORIGINAL TITLE	Naturtyper och biotoper: Natura naturtypskarta
SOURCE	Swedish Environmental Protection Agency (SEPA). However, SEPA is responsible for the information in the database, but the Metria AB and County Administrations are the primary sources of all data.
CLASSES	Forest areas classified as habitat types of the EU Habitats Directive[47]. It is possible to further divide data into classes with regard to protection (unprotected and protected), habitat or stand type based on tree species, etc.
SHAPE/SPATIAL RESOLUTION	Objects as areas/polygons, points or lines
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Forest areas classified as habitat types of the EU Habitats Directive cover a minimum area (≥0.5 or 1 hectares for different habitat types), have a canopy cover of trees ≥30% and fulfil a set of minimum criteria of naturalness, i.e. forests should have been naturally regenerated, show no signs of extensive and recent forestry, and exhibit natural stand structure characteristics (the stand age is high compared to managed forests, or that natural disturbances affect the stand structure)[48].
MAIN REFERENCES	SEPA
MAIN WEBPAGES	Information: http://gpt.vic-metria.nu/data/naturtypskartan/NNK_publik_produktbeskrivning_20140411.pdf. View data via: http://gis-services.metria.se/arcgis/services/InspireNV_NNK/MapServer/InspireViewService. Download data via: WFS: http://gis-services.metria.se/nvfeed/nnk/NNK.xml

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[47] 92/43/EEC

[48] Kellner, O. 2007. Manual för basinventering av skogshabitat (fältinventering) (Field manual for inventory of forest habitat types). Version 5.5. 2007-06-21. Swedish Environmental Protection Agency, Stockholm, Sweden (no download PDF available); Skånäs, H., et al. 2007. Flygbildstolkningsmanual för Basinventeringen Natura 2000 (Manual for aerial photo interpretation of EU habitat types) . Version 7.1. 2007-12-14. Swedish Environmental Protection Agency, Stockholm, Sweden (no download PDF available).

Map of Natura habitat types in Natura 2000 sites in mid Sweden (blue, red and green polygons indicate fresh waters, wetlands and forests, respectively). Compiled and copied from the interactive web portal of protected areas (http://skyddadnatur.naturvardsverket.se/). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

# Forest areas identified for protection and primeval forests on state-owned land

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SWEDEN**
MAP TITLE	**Forests identified for protection and primeval forests on state-owned land**
ORIGINAL TITLE	Skyddsvärda statliga skogar
SOURCE	Swedish Environmental Protection Agency (SEPA).
CLASSES	Forest areas larger than 20, 40 or 100 hectares in different vegetation zones
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	Inventory 2014
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	"Primeval forests" have characteristics and structures that develop provided that natural processes primarily in form of wind, water, and forest fire may operate undisturbed for a sufficiently long time. The areas are often characterized by trees of different ages, gaps and overall a large structural variation. Dead wood is usually available in large quantities. Downed logs of different tree species and varying size, humidity and age as well as the occurrence of natural stumps and broken stems are very common features. However, a scarcity of dead wood may exist in dry and pine-dominated forests that previously have been affected by forest fires, or used extensively. In these forests, high tree age and continuity of trees may indicate the local conservation values. Forest areas less than 20 hectares have generally not been included. However, the inventory adapted minimum areas of 40 and 100 hectares in the boreal zone and subalpine zone, respectively.
MAIN REFERENCES	SEPA[49]
MAIN WEBPAGES	Information: http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledningar/Skyddade-omraden/Skyddsvarda-statliga-skogar/. View data via: http://nvpub.vic-metria.nu/arcgis/services/planeringsunderlag_o_strategier/MapServer/WMSServer?layers=Statlig_Natur_och_Urskogsinventering Download of data: http://gpt.vic-metria.nu/data/land/Skyddsvarda_statliga_skogar.zip

[49] Löfgren, R., et al. (eds). 2004. Skyddsvärda statliga skogar och urskogsartade skogar. Report 5339. Swedish Environmental Protection Agency, Stockholm, Sweden. (download PDF part 1 and part 2).
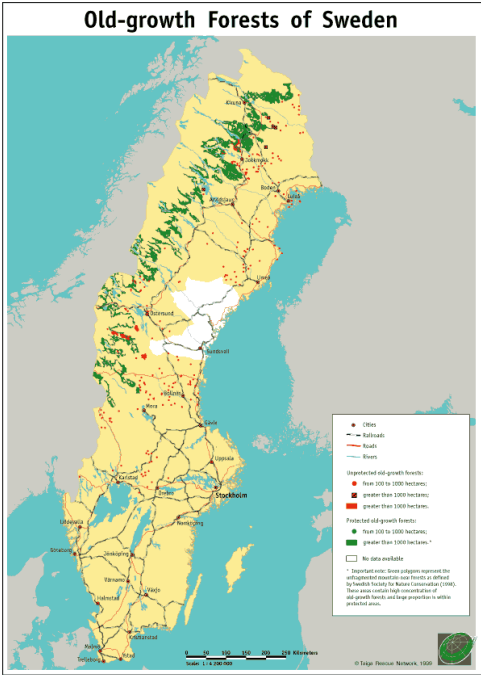
Map of forests identified for protection and primeval forests on state-owned land (light green polygons). Compiled and copied from the interactive web portal of protected areas (http://skyddadnatur.naturvardsverket.se/). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

Woodland key habitats

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SWEDEN**
MAP TITLE	**Woodland key habitats, objects of conservation value and swamp forests**
ORIGINAL TITLE	Nyckelbiotoper, områden med naturvärden och sumpskogar, Skogsstyrelsen
SOURCE	Swedish Forest Agency (SFA)
CLASSES	Click here to enter text.
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	
AVAILABILITY	Image. The datasets includes the following attributes / variables: case register number, county, municipality, area (hectares), object name, date of inventory, type of WKH (up to three different types), and key word at the habitat level (up to eight key words). Users can apply to SFA to get access to additional variables.
DEFINITION/ CRITERIA/ INDICATORS	A woodland key habitat (WKH) is a forest locality that is considered to be of great importance for the flora and fauna of the forest based on a comprehensive assessment of the habitat structure, species occurrence, history and current physical environment. Red-listed species occur or are expected to occur in the area. WKHs are inventoried according to the methods described in the Handbook for Inventory of WKHs[50].
MAIN REFERENCES	SFA.
MAIN WEBPAGES	Information: http://www.skogsstyrelsen.se/Aga-och-bruka/Skogsbruk/Karttjanster/Skogens-Parlor. View data via: https://minasidor.skogsstyrelsen.se/skogensparlor/ Download of data: http://geodpags.skogsstyrelsen.se/geodataport/feeds/Nyckelbiotoper.xml; http://geodpags.skogsstyrelsen.se/geodataport/feeds/StorskogsbrNyckelb.xml http://193.183.24.45/geodataport/feeds/Naturvarden.xml http://geodpags.skogsstyrelsen.se/geodataport/feeds/Sumpskogar.xml

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[50] Skogsstyrelsen 2014. Handbok för inventering av nyckelbiotoper. Swedish Forestry Agency, Jönköping, Sweden (download PDF).
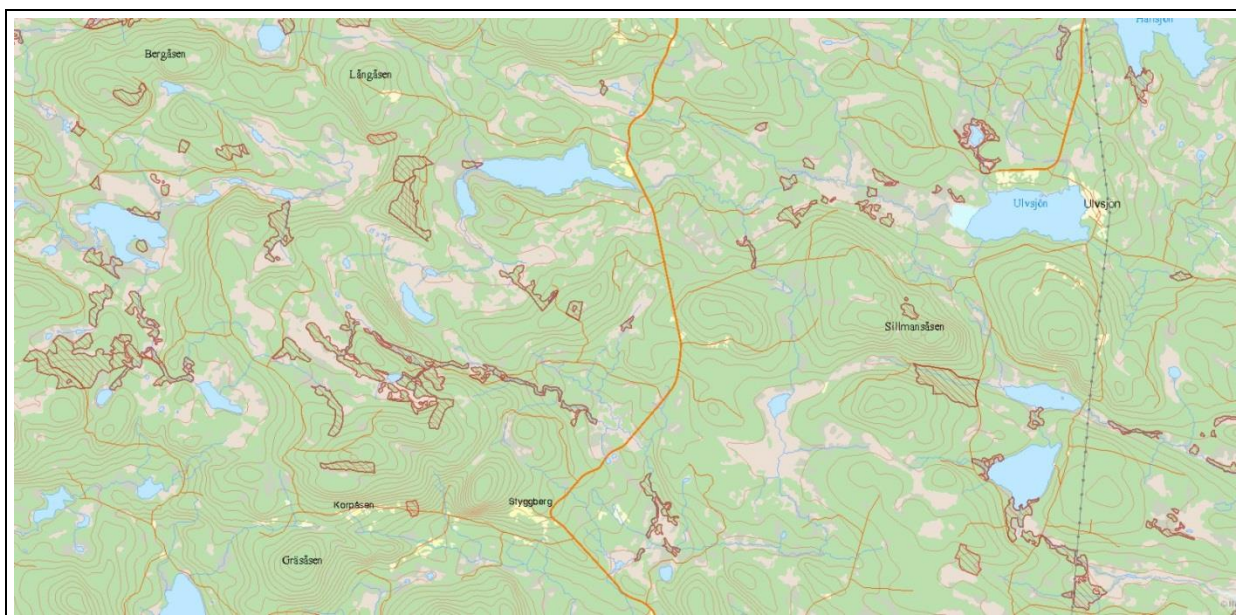
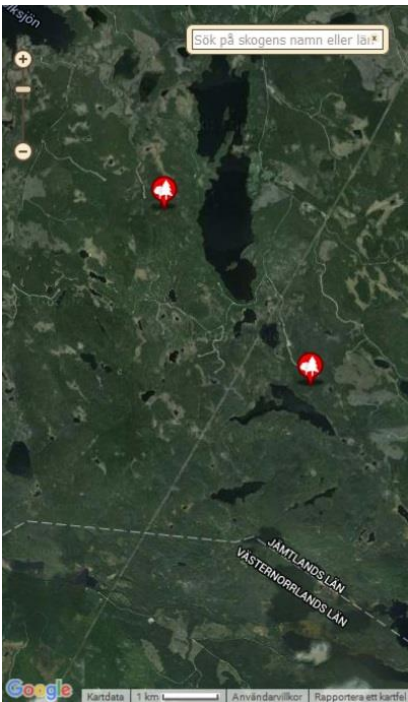**Map of woodland key habitats (red polygons) on in mid Sweden.** Compiled and copied from the interactive web portal of protected areas (http://skyddadnatur.naturvardsverket.se/). Data are available for the whole country, but a map with higher resolution is shown here for illustrative reasons.

Forest areas mapped by the Taiga Rescue Network

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SWEDEN**
MAP TITLE	**Old-growth Forests of Sweden**
ORIGINAL TITLE	Click here to enter text.
SOURCE	Taiga Rescue Network
CLASSES	Old-growth forests from 100 to 1000 hectares (unprotected and protected); Old growth forests greater than 1000 hectares (unprotected and protected)
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	1999
AVAILABILITY	Only image
DEFINITION/ CRITERIA/ INDICATORS	"Old-growth forests are characterized by stands originating through natural succession with a significant contribution of old trees and dead wood, often with a multi-layered tree structure. These forest contain globally, regionally or nationally significant concentrations of biodiversity values (e.g., endemism, endangered or threatened species, endangered or threatened ecosystems, refugia), or are large landscape level forests, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance". History of human disturbance does not necessarily exclude forests from being defined as old-growth, especially in case of the Fennoscandian forests.
MAIN REFERENCES	Lloyd (ed.), 1999. The last of the last: The Old-growth Forests of Boreal Europe. Taiga Rescue Network.
MAIN WEBPAGES	http://old.forest.ru/eng/publications/last/maps/sweden.html

Old-growth Forests of Sweden

Forest areas mapped by the Swedish Society of Nature Conservation

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SWEDEN**
MAP TITLE	**Forest areas mapped by the Swedish Society of Nature conservation**
ORIGINAL TITLE	Skogskartan
SOURCE	Swedish Society of Nature conservation (SSNC)
CLASSES	No classes
SHAPE/SPATIAL RESOLUTION	It is possible to overview the forest areas via an interactive map.
YEAR	2015
AVAILABILITY	It is possible to overview the forest areas as points objects on a coarse spatial resolution, but there is no other web services. Detailed data need to be ordered from SSNC.
DEFINITION/ CRITERIA/ INDICATORS	The forest areas might host threatened and rare plants and animals. The areas might be old and undisturbed, or be characterized by old deciduous trees, i.e. qualities that are becoming increasingly rare. If the areas do not host threatened species, they might be importance for recreation or visits.
MAIN REFERENCES	SSNC. Information: http://news.cision.com/se/naturskyddsforeningen/r/folj-hotade-skogar-pa-webbkarta,c9135815
MAIN WEBPAGES	Overview of mapped forest areas: http://www.naturskyddsforeningen.se/vad-vi-gor/skog/skogskartan

Map of forests with high conservation values (red points) in mid Sweden by the Swedish Society of Nature Conservation (SSNC). Copy of the SSNC's interactive map (http://www.naturskyddsforeningen.se/vad-vi-gor/skog/skogskartan). Data are presented for the whole country, but a map with higher resolution is shown here for illustrative reasons.
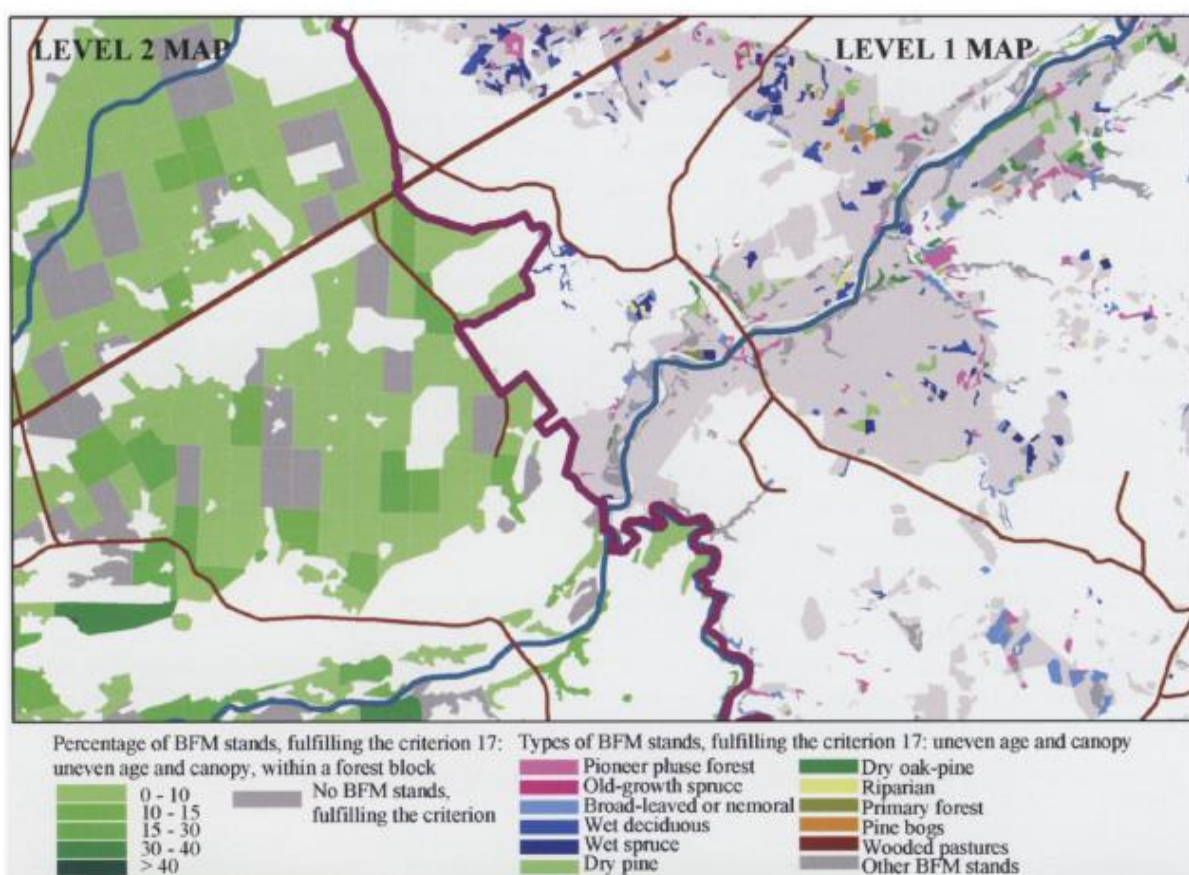
Voluntarily set-aside forest areas by the Swedish Forest Industries Federation

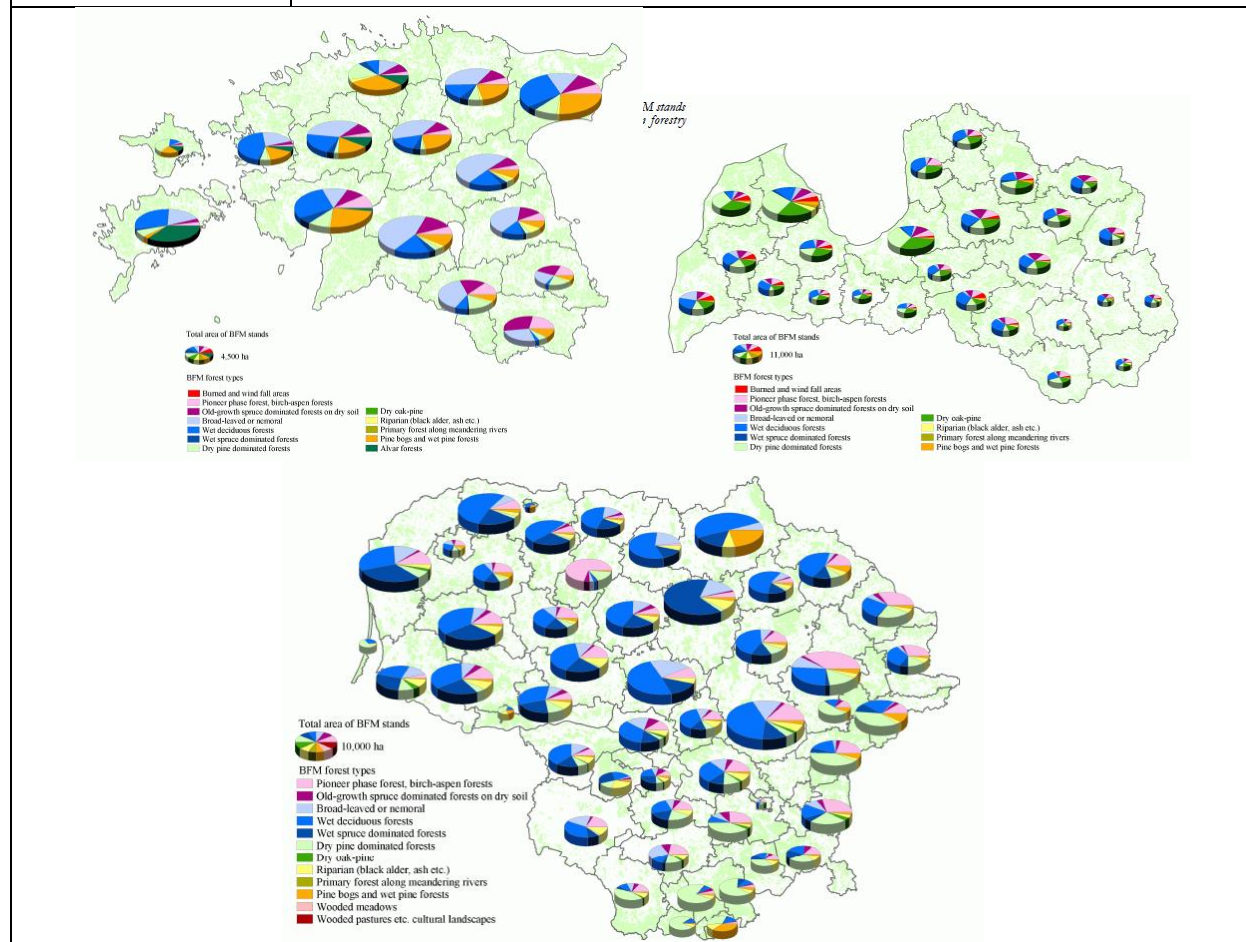| DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SWEDEN**
MAP TITLE	**Voluntarily set-aside forest areas by the Swedish Forest Industries Federation**
ORIGINAL TITLE	Frivilliga avsättningar / Voluntarily set-aside forests
SOURCE	The Swedish Forest Industries Federation (SFIF)
CLASSES	The voluntarily set-aside forest areas of different land owners; Bergvik Skog, the National Property Board, Holmen Skog, SCA Skog, Sveaskog and the Church of Sweden's forests. The areas vary in size from about 0.5 to 1000 hectares.
SHAPE/SPATIAL RESOLUTION	It is possible to overview the forest areas via an interactive map.
YEAR	2015
AVAILABILITY	It is possible to overview the forest areas as polygon objects on a coarse spatial resolution (about 1:100 000), but there is no other web services. Detailed data need to be ordered from the land owners.
DEFINITION/ CRITERIA/ INDICATORS	Set-aside areas is a forest locality that is considered to be of great importance for the flora and fauna of the forest based on a comprehensive assessment of the habitat structure, species occurrence, history and current physical environment (similar to the woodland key habitat inventory done by the Forestry Agency, see section above).
MAIN REFERENCES	SFIF
MAIN WEBPAGES	Information and overview of voluntarily set aside forest areas: http://protectedforests.com/. Detailed data need to be ordered from the land owners.

Map of voluntarily set-aside forest areas (purple polygons) in mid Sweden by the Swedish Forest Industries Federation (SFIF). Copy of SFIF's interactive map (http://protectedforests.com/). Data are presented for the whole country, but a map with higher resolution is shown here for illustrative reasons.

Annex 3 Datasets in the Baltic countries

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**BALTIC COUNTRIES**
MAP TITLE	**Example of the Baltic Forest Mapping (BFM) database output at level 2 scale map.**
ORIGINAL TITLE	
SOURCE	Kurlavicius et al., 2004
CLASSES	One of the BFM forest types is "old growth spruce dominated forests on dry soil"
SHAPE/SPATIAL RESOLUTION	
YEAR	2004
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	The Baltic Forest Mapping project (BFM) aimed at identifying high conservation value forests in the Baltic States from forest databases.
MAIN REFERENCES	Kurlavicius et al., 2004. Identifying high conservation value forests in the Baltic States from forest databases. Ecological Bulletins 51:351-366
MAIN WEBPAGES	http://www.jstor.org/stable/20113321?seq=1#page_scan_tab_contents

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**BALTIC COUNTRIES**
MAP TITLE	**Distribution of Baltic Forest Mapping (BFM) stands by forest families within Estonian, Latvian and Lithuanian forest enterprises**
ORIGINAL TITLE	
SOURCE	Kurlavicius et al., 2004
CLASSES	One of the BFM forest types is "old growth spruce dominated forests on dry soil"
SHAPE/SPATIAL RESOLUTION	
YEAR	2004
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	The Baltic Forest Mapping project (BFM) aimed at identifying high conservation value forests in the Baltic States from forest databases.
MAIN REFERENCES	Kurlavicius et al., 2004. Identifying high conservation value forests in the Baltic States from forest databases. Ecological Bulletins 51:351-366
MAIN WEBPAGES	http://www.jstor.org/stable/20113321?seq=1#page_scan_tab_contents http://wwf.panda.org/wwf_news/?9241/Baltic-forests-mapped-for-value

ESTONIA

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**ESTONIA**
MAP TITLE	**Locations of the old-growth stands studied in Estonia**
ORIGINAL TITLE	
SOURCE	Lõhmus and Kraut, 2010
CLASSES	
SHAPE/SPATIAL RESOLUTION	
YEAR	2010
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	"23 old-growth stands of four site-type groups were compared with mature commercial stands nearby in the Estonian state forests that hold the Forest Stewardship Council (FSC) certificate of sustainable forestry"
MAIN REFERENCES	Lõhmus, A., Kraut, A., 2010. Stand structure of hemiboreal old-growth forests: Characteristic features, variation among site types, and a comparison with FSC-certified mature stands in Estonia. Forest Ecology and Management 260 (2010) 155–165.
MAIN WEBPAGES	
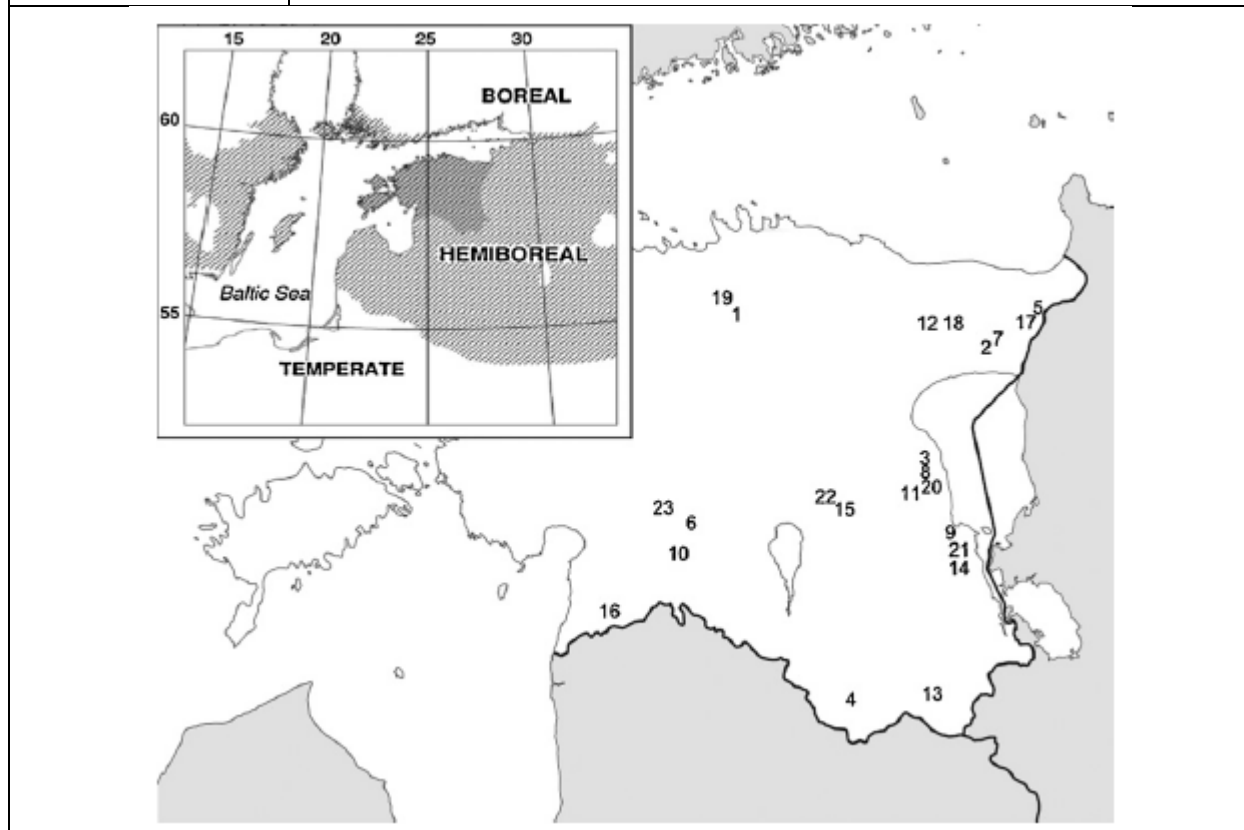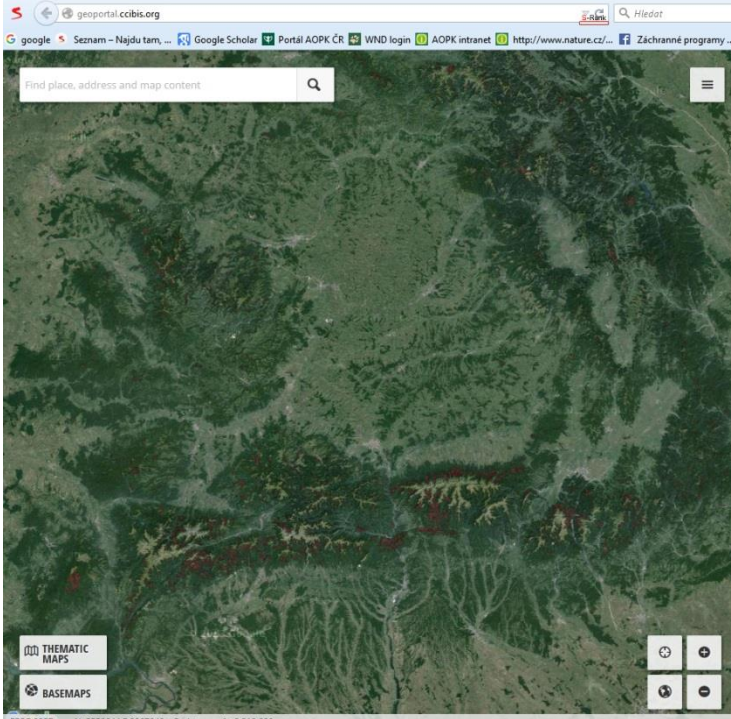
Annex 4 Datasets in the Central and Eastern countries
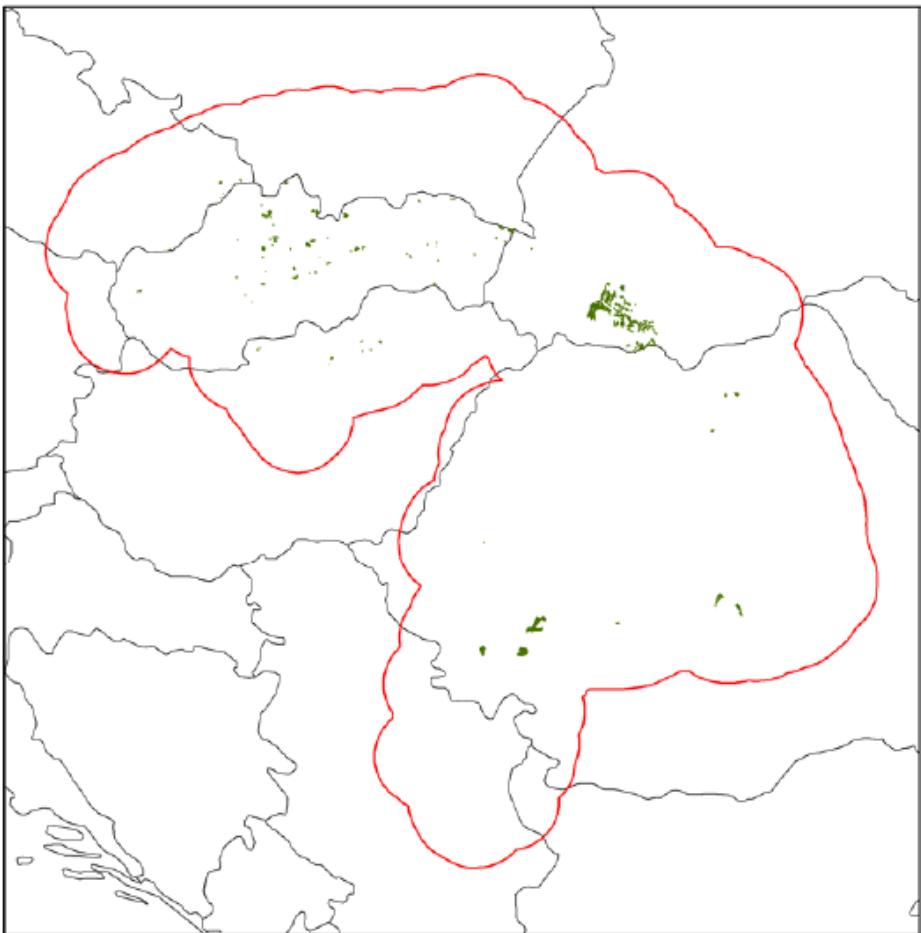
Some of these datasets have been collected by Martin Strnad (AOPK).

CARPATHIAN COUNTRIES

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**CARPATHIAN COUNTRIES**
MAP TITLE	**Thematic map of old-growth forests of The Carpathian Countries Integrated Biodiversity information system (CCIBIS) geoportal**
ORIGINAL TITLE	
SOURCE	The Carpathian Countries Integrated Biodiversity information system (CCIBIS)
CLASSES	
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2002-2003, 2011-2014
AVAILABILITY	Geoportal. Shapefile possibly available on reques
DEFINITION/ CRITERIA/ INDICATORS	Brief information on databases on old-growth forests available at the CCIBIS Geoportal (from http://www.ccibis.org/carpathian-values/96-forests-in-the-carpathians, last accessed 5 November 2015): Old-growth forests in the Carpathians During 2002 and 2003, a mapping project financed by the Dutch government through the PIN Matra project identified about 300,000 ha of virgin and old-growth forests in the Carpathians displayed here with the exception of Slovakia where the data were derived from a more recent study. The criteria used for determination of these forests are not accepted entirely today and ongoing investigations indicate that only a part of these forests still exists today. More recent and up-to-date data are available for Slovakia and six counties in Romania (Braşov, Covaşna, Harghita, Maramureş, Mureş, and Sibiu). Old-growth forests in Romania The OGF were identified in the project (Jul 2011 – Jun 2014) "Support Responsible Forest Management for a Sustainable Development in the Danube – Carpathian Ecoregion", goal nr 2.4 "Identification and mapping of forests with non-interventions management in the priority regions" carried out between July 2011 and June 2014 carried out by WWF Danube-Carpathian Programme and supported by WWF Sweden and IKEA. In Romania the priority regions for the project include the following counties: Braşov (BV), Covaşna (CV), Sibiu (SB), Mureş (MS), Harghita (HR),

	Maramureş (MM). Method 1) Preliminary identification of OGF was done based on desk research. The specialist identified possible OGF based on written information, ortho photomaps and satellite images. In this stage all forests were eliminated which did not qualify OGF. The preliminary identification was finalised at the national level. 2) The second step was that forest specialists cross-checked in the field whether the results of the desk research match with reality according to the established criteria. The result of the identification of OGF were presented to the public and stakeholders (owners, forest administrators forest management units, state institutions, NGOs, protective areas managers etc.). Finally, the map of OGF was sent to key decision makers for their support to protect them. _Old-growth forests in Slovakia_ During 2009 and 2010 FSC Slovakia conducted a complex survey to identify and map old-growth forests (OGFs), within the project "Protection of old-growth forests in Slovakia", which was funded by EEA Financial Mechanism, Norway Financial Mechanism and the State budget of the Slovak Republic through the Ekopolis Foundation. Other activities of the project included improving the protection of OGF, increasing public awareness and exploring possibilities for sensitive use of LGF for research and ecotourism. Method Using the database of forest stands of the National Forestry Centre and a survey of ortho photomaps, 324 localities covering over 53,000 ha were selected for the filed mapping, which identified the borders or the OGFs and completed data forms for each locality. These data were processed using GIS and the database of OGFs of Slovakia was created.
MAIN REFERENCES	
MAIN WEBPAGES	http://geoportal.ccibis.org/ -> thematic maps Old-growth forests http://www.ccibis.org/carpathian-values/96-forests-in-the-carpathians

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**CARPATHIAN COUNTRIES**
MAP TITLE	**Virgin forests in the Carpathians**
ORIGINAL TITLE	
SOURCE	Zsolt , 2002
CLASSES	
SHAPE/SPATIAL RESOLUTION	
YEAR	2002
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	List and map of the virgin and virgin-like forests remaining in the Carpathian Mountains. "Each area description involves location (on map and in the text with the name of the mountain), extension, tree species composition or forest community type. Besides these attributes, information on local aspects, detailed location, or rare species present are often also indicated".
MAIN REFERENCES	Zsolt, B., 2002. List of virgin forest fragments in the Carpathians, their most relevant data and attributes. ER 2(1): 397-423.
MAIN WEBPAGES	

Kárpáti őserdők

Virgen forest
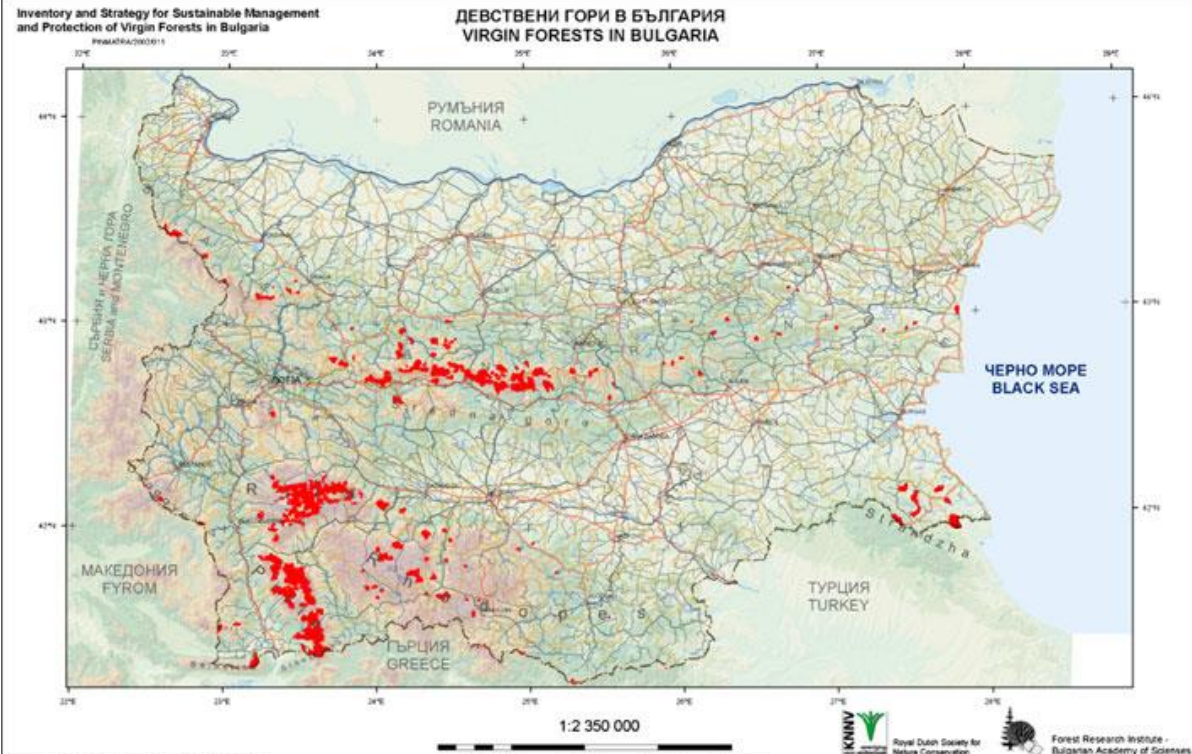
AUSTRIA

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**AUSTRIA**
MAP TITLE	**Strict forest reserves (SFRs) in Austria (state in 2015)**
ORIGINAL TITLE	Project: Strict forest reserves programme in Austria
SOURCE	http://www.naturwaldreservate.at/ (in German) **Authors:** Austria Research Center for Forests (Bundesforschungszentrum für Wald, Naturgefahren und Landschaft; BFW) administration - Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft)
CLASSES	protected areas < 20ha, 20-50ha, 50-100ha, >100ha
SHAPE/SPATIAL RESOLUTION	Point
YEAR	project started in 1995
AVAILABILITY	Only image
DEFINITION/ CRITERIA/ INDICATORS	**Definition:** SFRs are reserves determined to the natural forest ecosystem development without intervention of human activities. They should preserve diversity and serve as areas for scientific research and education. Their species composition, vegetation structure and natural development should represent potential forest associations. **Criteria:** diversification of the vegetation (age, texture, structure), natural vegetation structure, min. area 10 – 50 ha (depended on the type of forest associations), rare and endangered forest associations in Austria should be present, topographical unity, buffer zone (1-3 tree length), natural development without outer impacts, present of seedlings and young trees as a long-term perspective of the forest existence. Main principles of SFRs programme: - nature protection is voluntary and based on the contract (in some specific conditions there is a possibility to back out of the contract) - concept of SFRs should be planned as long-term - yearly payment for owners who are not allowed to economically manage the forest - involve owners and reward them for care and control of areas Aims of SFRs programme: - network of nature forest reserves including all forest association in Austria - forest natural development research (without human impacts) - preserving diversity of forest associations - recommendation for designation and management of new reserves - network of research areas
MAIN REFERENCES	Frank G., Jelinek B., Lackner Ch., Nöbauer M., Tichy K., Weber A., 2010: *Naturwaldreservate in Österreich: Schätze der Natur.* Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Wien: 24 S. (in German) Steiner H., Frank G., Schweinzer K.-M. (2014): *Naturwaldreservate in Österreich.* Bundesforschungszentrum für Wald, Bundesministerium für Land-

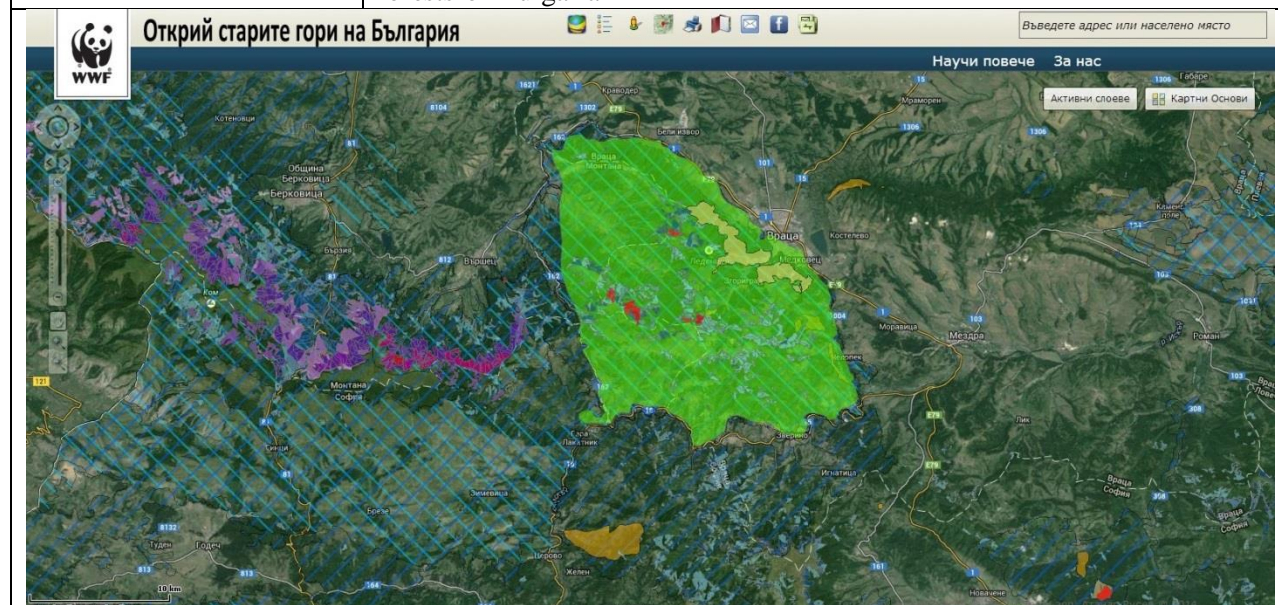|	
	und Forstwirtschaft, Umwelt und Wasserwirtschaft, Wien: 6 S. (in German)
	other references are on the webpage: http://www.naturwaldreservate.at/index.php/wissensvermittlung
MAIN WEBPAGES	http://www.naturwaldreservate.at/ http://www.umweltbundesamt.at/umweltsituation/naturschutz/sg/nwr/
OBSERVATIONS	195 areas, 8 403 ha (state in 2015), the highest number of SFRs is situated in federal state of Carinthia, the largest area occupy SFRs in federal state of Tyrol

Naturwaldreservate in Österreich

Legende

Wuchsgebiete

Größenklassen

- <20 ha
- 20-50 ha
- 50-100 ha
- >100 ha

BULGARIA

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**BULGARIA**
MAP TITLE	**Distribution of mapped virgin forests in Bulgaria**
ORIGINAL TITLE	
SOURCE	Forest Research Institute. Bulgarian Academy of Sciences
CLASSES	Virgin forests
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2006
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	In this approach it is proposed to use the term virgin forest as a unifying concept for forests which are not influenced directly by man in their development. The species composition (connected with the biogeographical zone), structure and dynamic processes are important features for the identification of this type of forests compared to intensively managed forests.
MAIN REFERENCES	Veen, P., Fanta, J., Raev, I., Biris, I-A., Smidt, J., Maes, B., 2010. Virgin forests in Romania and Bulgaria: results of two national inventory projects and their implications for protection. Biodiversity Conservation 19:1805–1819. Veen, P., Raev, I. (eds), 2006. Virgin forests in Bulgaria. GEA-2000, Sofia.
MAIN WEBPAGES	DOI 10.1007/s10531-010-9804-2

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**BULGARIA**
MAP TITLE	**Old-growth forests of Bulgaria (only in Bulgarian)**
ORIGINAL TITLE	
SOURCE	WWF DCP Bulgaria
CLASSES	Old-growth forests, protected areas and Natura 2000 sites
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2014
AVAILABILITY	GIS Online platform
DEFINITION/ CRITERIA/ INDICATORS	
MAIN REFERENCES	
MAIN WEBPAGES	http://gis.wwf.bg/forests/ http://wwf.panda.org/?215230/An-online-platform-maps-the-old-growth-forests-of-Bulgaria

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**BULGARIA**
MAP TITLE	**Areas of old-growth forests in Bulgaria unaffected by human activities**
ORIGINAL TITLE	
SOURCE	Forest Research Institute
CLASSES	Click here to enter text.
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2005
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	
MAIN REFERENCES	WWF Booklet 2013. Old-growth forests: the unknown treasures of Bulgaria
MAIN WEBPAGES	http://d2ouvy59p0dg6k.cloudfront.net/ downloads/wwf_brochure_bulgaria_old_growth_forests.pdf

CZECH REPUBLIC

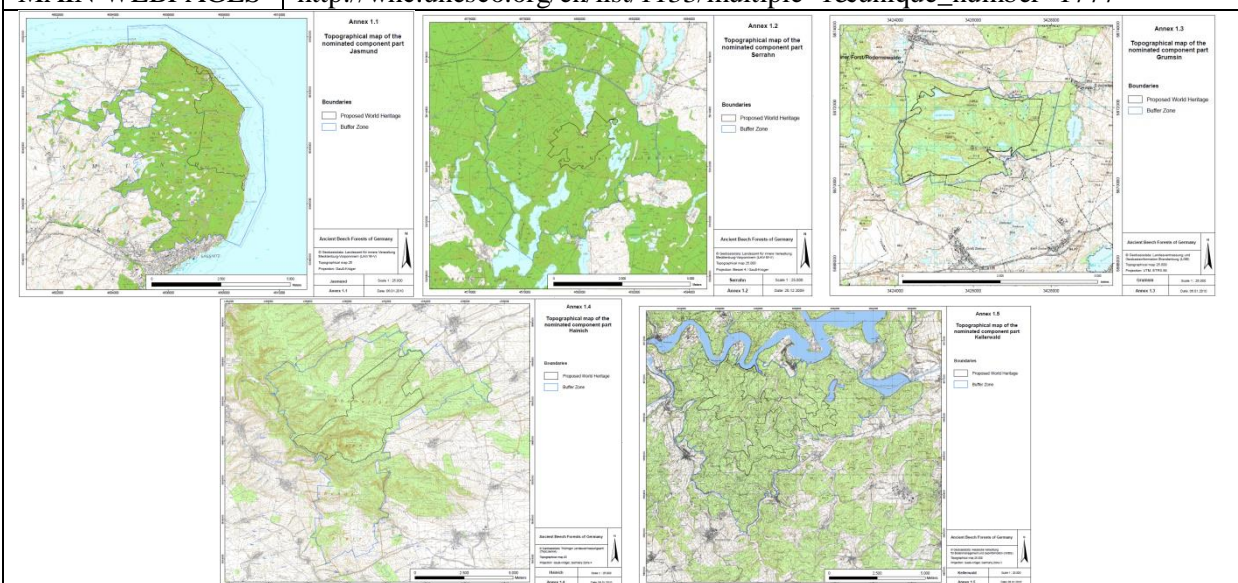| DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**CZECH REPUBLIC**
MAP TITLE	**Old-growth forests national databank (state in 2008)**
ORIGINAL TITLE	Project: Czech natural forests database
SOURCE	http://www.pralesy.cz/?id=6767 (in English) **authors: The Silva Tarouca Research Institute for Landscape and Ornamental Gardening (RILOG), Department of Forest Ecology** (in Czech: VÚKOZ, v.v.i. Odbor ekologie lesa)
CLASSES	natural forests, classes: 10-49,9 ha, 50-99,9 ha, 100-249,9 ha, 250-499,9 ha, 500 ha and more
SHAPE/SPATIAL RESOLUTION	Point
YEAR	since 2002
AVAILABILITY	Only image
DEFINITION/ CRITERIA/ INDICATORS	**Definition:** Three categories are determined: 1. original forest (never managed forests left to spontaneous development) 2. natural forest (historically by man affected forests, actually left to spontaneous development) 3. near-natural forest (actually by man affected forests, restoration management is acceptable) size limit: at least 5 ha Parameters used for naturalness assessment of old-growth forests: 1. Direct impact on stand development by forest management 2. Deadwood 3. Indirect human impact on stand development 4. Current tree species composition as compared with the potential natural tree composition and current management for details (definition and criteria) see this poster: http://www.pralesy.cz/publik_syst2/files/POSTER_Tasmania_08.gif
MAIN REFERENCES	**Nature Conservation Agency of the Czech Republic (NCA), Institute of Forest Ecosystem Research (IFER),** The Forest Management Institute (FMI), Protected Landscape Areas (2004): *Research and gathering of knowledge on the condition and distribution of natural forests in the Czech Republic; final report of the project* VAV 610/6/02 (2002-2004), 202 pp. (in Czech) Hort L., Tesař V., Vrška T. (1999*): Forest Reserve Research Network - The Czech Republic Country Report. In: Virgin forests and forest reserves in central and east European countries: history, present status and future development.* Biotechnical Faculty, Ljubljana, Slovenia, pp. 25-44. (in Czech)

MAIN WEBPAGES	http://www.pralesy.cz/?lang=en
OBSERVATIONS	493 localities, 30 000ha, more details about individual localities are on the webpage: http://www.pralesy.cz/?id=6796, regularly updated

Old-growth forests national databank: 493 localities; 30,000 ha of old-growth forest

Scoping document: information related to European old growth forests
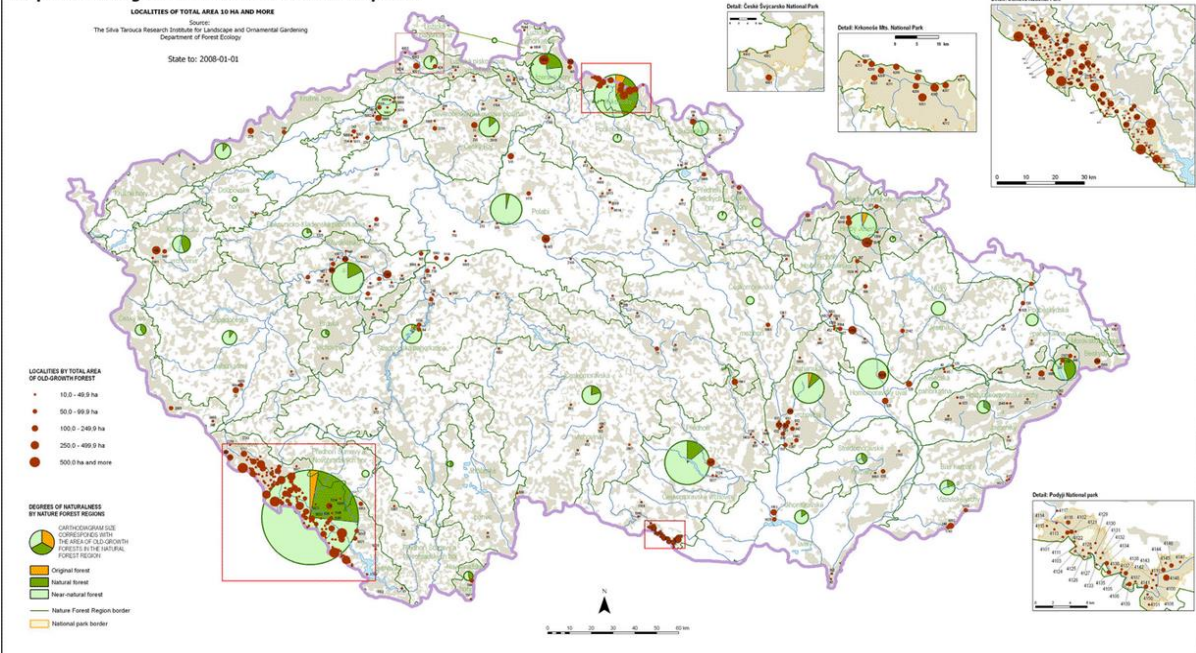
GERMANY

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**GERMANY**
MAP TITLE	**Ancient Beech Forests of Germany**
ORIGINAL TITLE	
SOURCE	UNESCO World Heritage List
CLASSES	Proposed World Heritage and Buffer Zone
SHAPE/SPATIAL RESOLUTION	Scale 1:25000
YEAR	2011
AVAILABILITY	5 Topographical maps
DEFINITION/ CRITERIA/ INDICATORS	"The Primeval Beech Forests of the Carpathians and the Ancient Beech Forests of Germany are a serial property comprising fifteen components. They represent an outstanding example of undisturbed, complex temperate forests and exhibit the most complete and comprehensive ecological patterns and processes of pure stands of European beech across a variety of environmental conditions. They contain an invaluable genetic reservoir of beech and many species associated and dependent on these forest habitats".
MAIN REFERENCES	UNESCO World Heritage Centre
MAIN WEBPAGES	http://whc.unesco.org/en/list/1133/multiple=1&unique_number=1777

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**GERMANY**
MAP TITLE	**Strict forest reserves (SFRs) distribution in Germany (state in 2010)**
ORIGINAL TITLE	Project: Database of Strict forest reserves in Germany
SOURCE	http://www.naturwaelder.de (in German) **authors:** The Natural Forests project group (der Projektgruppe Naturwälder in der Arbeitsgemeinschaft Forsteinrichtung) and The Information and Coordination Centre for Biological Diversity of the Federal Agency for Agriculture and Food (das Informations- und Koordinationszentrum für biologische Vielfalt der Bundesanstalt für Landwirtschaft und Ernährung)
CLASSES	No classes
SHAPE/SPATIAL RESOLUTION	Point
YEAR	Project database since 2007
AVAILABILITY	Only image
DEFINITION/ CRITERIA/ INDICATORS	**Definition:** SFRs are reserves determined to the natural forest ecosystem development without intervention of human activities. They were established for nature protection, scientific research of natural forest development and education. In future these areas are heading to develop in old-growth forests. **Criteria** of SFRs for all federal states of Germany: - SFRs are chosen according to the representative native vegetation, - for the research only non-invasive methods are used, - forestry impacts are forbidden, - orders and bans concerning SFRs are in written form and binding - areas are protected - minimum size is 20 hectares. According to IUCN category, SFR belong to Ia (Strict nature reserve), Ib (Wilderness Area) or II (National park)
MAIN REFERENCES	Münch (2007): Die Datenbank Naturwaldreservate in Deutschland. Forstarchiv 78, 197-201. (in German) Meyer et al. (2007): Das Netz der Naturwaldreservate in Deutschland: Flächenumfang, Repräsentativität und Schutzstatus im Jahr 2007, Forstarchiv 78, 188-196. (in German)
MAIN WEBPAGES	http://www.naturwaelder.de (in German) http://www.nw-fva.de/ (in German) http://www.genres.de/en/forest-plants/national-inventory/ (short text about SFRs in English)
OBSERVATIONS	729 areas, 34 948 ha (actual to the date 11. 3. 2015), more details about individual reserves are on the project website: http://www.naturwaelder.de

HUNGARY

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE

COVERAGE	**HUNGARY**
MAP TITLE	**Forest reserves in Hungary (state to 2001)**
ORIGINAL TITLE	Project: Forest reserves programme in Hungary
SOURCE	http://www.erdorezervatum.hu/en/ (in English) **authors:** National Authority for Nature Conservation, Ministry of Environment and Regional Policy (today Ministry of Rural Development) **Institute of Ecology and Botany Centre for Ecological Research of the Hungarian Academy of Science**
CLASSES	No classes
SHAPE/SPATIAL RESOLUTION	Point
YEAR	1994 (Hungarian Forest Reserve Network was established)
AVAILABILITY	Only image
DEFINITION/ CRITERIA/ INDICATORS	**Definition:** Forest reserves are protected forested areas (consist of strictly protected core area and buffer zone) where all human activities are ultimately stopped so that the natural processes of the forest can prevail and thus become easier to recognize and study. **Criteria for the selection of forests:** - Network should include each forest type of Hungary; - Network should cover each silvicultural landscape entity; - Network should represent all forest association types; - Structure of the forests and species composition should be as close to the potential natural forest community as possible. **The main aims of the programme:** - Gaining knowledge about the natural lifecycle, varied structure, long-term processes and rich wildlife of the forests - Establishment and maintaining a network of forest stands representing the landscapes and characteristic forest habitats of Hungary - The presentation and transfer of this new knowledge towards conservation, forest management and other interested stakeholders
MAIN REFERENCES	F. Horváth, A. Bidló, B. Heil, G. Király, G. Kovács, G. Mányoki, K. Mázsa, E. Tanács, G. Veperdi, J. Bölöni (2012): *Abandonment status and long-term monitoring of strict forest reserves in the Pannonian biogeographical region.* Plant Biosystems 146(1): 189-200 (in English). Czajlik P, Standovár T. 1999. Hungary. In: Parviainen J, Little D, Doyle M, O'Sullivan A, Kettunen M, Korhonen M, editors. *Research in forest reserves and natural forests in European Countries.* EFI Proc 16: 133–143. (in English) more publications are on the project website:

	http://www.erdorezervatum.hu/en/node/83
MAIN WEBPAGES	http://www.erdorezervatum.hu/en/forestreserves
OBSERVATIONS	SFRs: 63 areas, 3 600 ha, more details about individual reserves on the project website: http://www.erdorezervatum.hu/en/forestreserves

POLAND

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	BIAŁOWIEŻA FOREST (POLAND AND BELARUS)
MAP TITLE	**Białowieża Forest – map of inscribed extension**
ORIGINAL TITLE	
SOURCE	UNESCO World Heritage List
CLASSES	Click here to enter text.
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2014
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	This site includes a complex of lowland forests that are characteristics of the Central European mixed forests terrestrial ecoregion. The area has exceptionally conservation significance due to the scale of its old growth forests, which include extensive undisturbed areas where natural processes are on-going. A consequence is the richness in dead wood, standing and on the ground, and consequently a high diversity of fungi and saproxylic invertebrates.
MAIN REFERENCES	UNESCO World Heritage Centre
MAIN WEBPAGES	http://whc.unesco.org/en/list/33/multiple=1&unique_number=2005

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**POLAND**
MAP TITLE	**Distribution of forests fulfilling at least one criterion of high conservation value (in % per 25 ha)**
ORIGINAL TITLE	
SOURCE	Stachura-Skierczyńska, 2015
CLASSES	Click here to enter text.
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	The aim of High Conservation Value Forest (HCVF) Mapping project is to investigate the spatial distribution of potentially valuable forests. The analysis used 13 different criteria of high conservation value. Results were shown as a generalized map of HCVF distribution.
MAIN REFERENCES	Stachura-Skierczyńska, K., 2015. Studia i Materiały Centrum Edukacji Przyrodniczo-Leśnej. OCENA WARTOŚCI BIOLOGICZNEJ LASÓW W POLSCER. 9. Zeszyt 2/3 (16) / 2007
MAIN WEBPAGES	

Ryc. 1. Mapa rozmieszczenia lasów spełniających przynajmniej 1 kryterium wartości przyrodniczej (udział lasów cennych przyrodniczo ukazany w % na 25 ha)

Fig. 1. Distribution of forests fulfilling at least one criterion of high conservation value (in% per 25 ha)

Udział lasów cennych przyrodniczo (w % na 25 ha)
- 00,1 - 20%
- 20,1 - 40%
- 40,1 - 60%
- 60,1 - 80%
- 80,1 - 100%

Całkowita powierzchnia leśna (w % na 25 ha)
- 00,1 - 20%
- 20,1 - 40%
- 40,1 - 60%
- 60,1 - 80%
- 80,1 - 100%

Studia i Materiały Centrum Edukacji Przyrodniczo-Leśnej   R. 9. Zeszyt 2/3 (16) / 2007   349

ROMANIA

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**ROMANIA**
MAP TITLE	**Virgin forests in Romania**
ORIGINAL TITLE	
SOURCE	Forest Research and Planning Institute of Romania
CLASSES	Old growth forest (in red), National and Natural Parks
SHAPE/SPATIAL RESOLUTION	
YEAR	2001-2004
AVAILABILITY	Map viewer
DEFINITION/ CRITERIA/ INDICATORS	238.000 ha of virgin forests were identified in Romania. This project was carried out and financed in the framework of the Programme International Nature Management (PIN-MATRA 2002-2005) of the Dutch Ministry of Agriculture, Nature and Food Quality and Ministry of Foreign Affairs. It was endorsed by the Romanian Ministry of Environment and Water Management.
MAIN REFERENCES	
MAIN WEBPAGES	

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**ROMANIA**
MAP TITLE	**Distribution of mapped virgin forests in Romania**
ORIGINAL TITLE	
SOURCE	
CLASSES	Virgin forests
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2005
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	In this approach it is proposed to use the term virgin forest as a unifying concept for forests which are not influenced directly by man in their development. The species composition (connected with the biogeographical zone), structure and dynamic processes are important features for the identification of this type of forests compared to intensively managed forests.
MAIN REFERENCES	Veen, P., Fanta, J., Raev, I., Biris, I-A., Smidt, J., Maes, B., 2010. Virgin forests in Romania and Bulgaria: results of two national inventory projects and their implications for protection. Biodiversity Conservation 19:1805–1819 Biris¸ I-A, Veen P (eds) (2005) Virgin forests in Romania: inventory and strategy for sustainable management and protection of virgin forests in Romania. Document ICAS, Bucharest
MAIN WEBPAGES	DOI 10.1007/s10531-010-9804-2

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**ROMANIA**
MAP TITLE	**Study area in the Carpathian Mountains in Romania including the distribution of old-growth forest patches, and distribution of old-growth forest disturbance patches.**
ORIGINAL TITLE	
SOURCE	
CLASSES	Old-growth forest patches and old-growth forest disturbance patches
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2012
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	The paper uses the term 'old-growth forests', following Wirth et al. (2009b) and Burrascano (2010), that includes widely accepted criteria for moist temperate old-growth forests: relatively old stand age, abundance of large old tree species, deadwood components (both standing and downed), dominance by late-successional tree species, vertically complex canopies and horizontal structural heterogeneity (namely gap mosaics). These elements of stand structural complexity correlate with a variety of habitat functions for late successional forests; these are frequently missing or underrepresented in younger or managed forests (Keeton 2006; Smith et al. 2008).
MAIN REFERENCES	Knorn et al., 2012. Continued loss of temperate old-growth forests in the Romanian Carpathians despite an increasing protected area network. Environmental Conservation 40 (2): 182–193
MAIN WEBPAGES	doi:10.1017/S0376892912000355

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**ROMANIA**
MAP TITLE	**Virgin and natural forests in Romania**
ORIGINAL TITLE	
SOURCE	Romania-Forest Map. Editors: Donita et al. (1990)
CLASSES	National parks, Forest reserves and protected areas
SHAPE/SPATIAL RESOLUTION	
YEAR	1990
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	
MAIN REFERENCES	Donita, N., Chirita, C., Stanescu, V. (eds.), 1990. Tipuri de ecosisteme forestiere din Romania, ICAS, seria II, Bucharest.
MAIN WEBPAGES	
OBSERVATIONS	

Virgin and natural forests in Romania

○ National parks

● Forest reserves and protected areas

SLOVAKIA

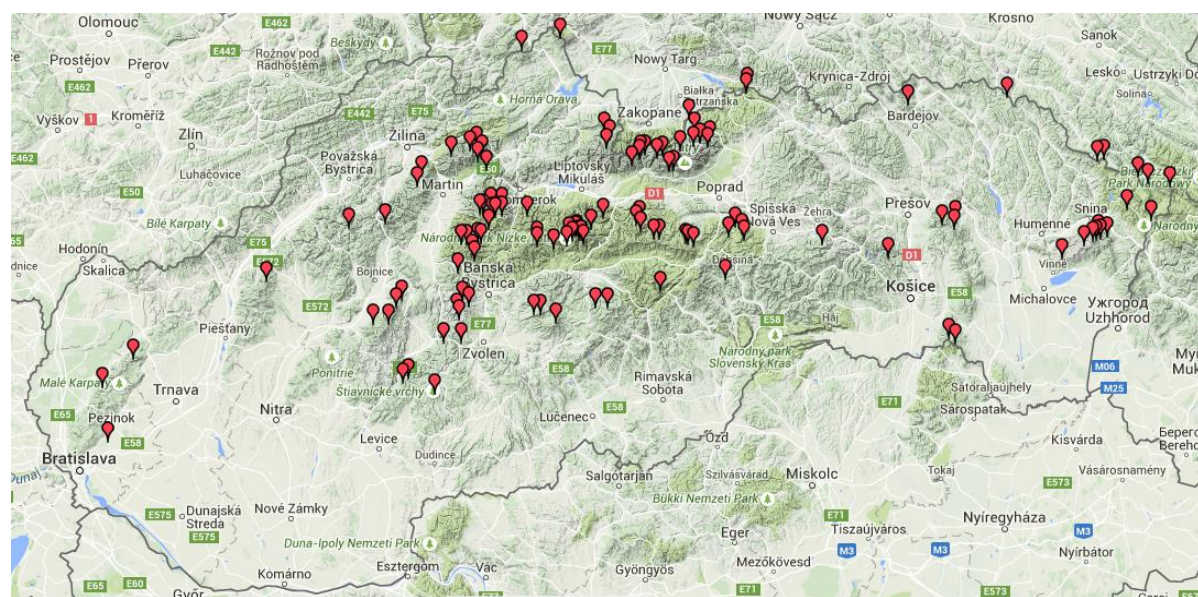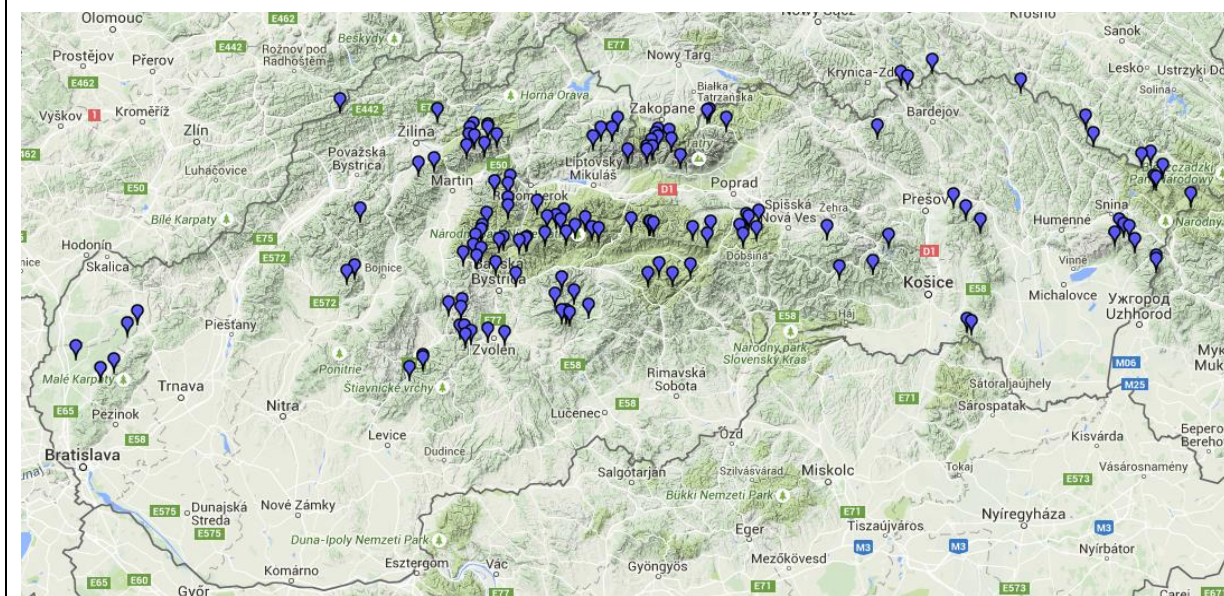| DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SLOVAKIA**
MAP TITLE	**Fig.1. Old-growth forests in SR (>20 ha)** **Fig.2. Old-growth forest fragments in SR (5-20 ha)**
ORIGINAL TITLE	Project: Protection of Old-growth forests in Slovakia *(„Ochrana pralesov Slovenska")*
SOURCE	http://www.pralesy.sk/ (in Slovak) **authors:** NGO - FSC Slovensko and **PRALES, o.z.**
CLASSES	old-growth forests (>20 ha), old-growth forest fragments (5-20 ha)
SHAPE/SPATIAL RESOLUTION	Point
YEAR	Project: 2009-2010
AVAILABILITY	Only image
DEFINITION/ CRITERIA/ INDICATORS	**Definition** (old-growth forest): relatively untouched nature forest with natural vegetation structure (trees species composition, age, horizontal and vertical structure) in climax stage, without or nearly without human impacts, with enough old trees and deadwood in different stage of decomposition. Also younger succession stages arisen by natural way are included. **Criteria**: biotope type, natural vegetation structure (tree species, age, vertical, horizontal), succession state, old trees, wood biomass, deadwood biomass, marks of human impacts, size limit: min. 5 ha for naturally small area biotopes, min. 25 ha for naturally broadly extended biotopes, accessibility of the locality, invasive species presence, influence of the game Three classes of old-growth forest localities were determined: 1) Old-growth forest (untouched): >50 ha 2) Influenced old-growth forest: >25 ha 3) Old-growth forest fragments: >5 - <25 ha
MAIN REFERENCES	Jasík, M., Polák, P., (eds.) (2011): Pralesy Slovenska. FSC Slovensko, Banská Bystrica, 228 stran. (in Slovak)
MAIN WEBPAGES	http://www.pralesy.sk/ http://www.fscslovakia.sk/images/Juraj/manual_mapovatela_27_8_def.pdf
OBSERVATIONS	122 localities old-growth forests (>20 ha), 8 849 ha 136 localities old-growth forest fragments (5-20 ha), 1 634 ha more details about individual localities are on the webpage: http://www.pralesy.sk/

Fig.1 Old-growth forests in SR (>20 ha)
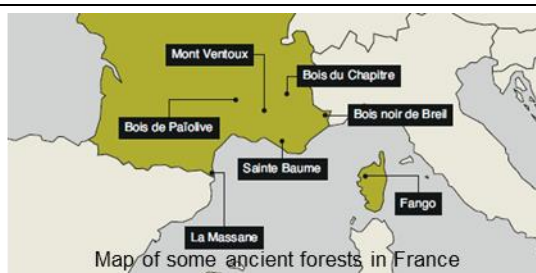

Fig.2. Old-growth forest fragments in SR (5-20 ha)

Scoping document: information related to European old growth forests

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SLOVAKIA AND UKRANIA**
MAP TITLE	**Primeval beech forests of the Carpathians**
ORIGINAL TITLE	
SOURCE	UNESCO World Heritage List
CLASSES	Click here to enter text.
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2006
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	The Primeval Beech Forests of the Carpathians and the Ancient Beech Forests of Germany are a serial property comprising fifteen components. They represent an outstanding example of undisturbed, complex temperate forests and exhibit the most complete and comprehensive ecological patterns and processes of pure stands of European beech across a variety of environmental conditions. They contain an invaluable genetic reservoir of beech and many species associated and dependent on these forest habitats.
MAIN REFERENCES	UNESCO World Heritage Centre
MAIN WEBPAGES	http://whc.unesco.org/en/list/1133/multiple=1&unique_number=1777

BEECH PRIMEVAL FORESTS OF THE CARPATHIANS
Map annex 2
The position of the serial nomination properties
on the Ukrainian and Slovak territories

Individual properties:
1. Chornohora
2. Havesova
3. Kuzyi - Trybushany
4. Maramorosh
5. Rozok
6. Stuzica - Bukovske vrchy
7. Stuzhytsia - Uzhok
8. Svydovets
9. Uholka - Shyrokyi Luh
10. Vihorlat

1:800 000

Thematic Elaboration © Slovak Environmental Agency 2005

Annex 5 Criteria and indicators for the selection of virgin forests in the Carpathians

Criteria and Indicators for selection of virgin forests in the Carpathians. Mikulov (Czech Republic), 2014. http://www.carpathianconvention.org/documents-thematic-areas.html

Definition:
According to Article 7 lit. (k) and (e) of the "Protocol on Sustainable Forest Management to the Framework Convention on the Protection and Sustainable Development of the Carpathians" (hereinafter Forest Protocol- FP), "virgin forests" means natural forests which have not been influenced directly by human activities in their development and "natural forest" means forests composed of tree species indigenous to the area with most of the principal characteristics and key elements of native ecosystems, such as complexity, structure and diversity.

Objective:
The purpose of this definition is to detail criteria and indicators for virgin forests identification, mapping and strict protection.

CRITERIA & INDICATORS FOR SELECTION OF VIRGIN FORESTS IN THE CARPATHIANS		
A1. Criterion: Naturalness		
A.1.1.	Species composition	Forests formed of native/autochtonous tree species according to potential natural forest types.
A1.2	Structure	Cyclic ecosystems with complex structures, which include all stages of small development circles (some phases may be present only in small areas) in a mosaic structure (horizontal) and vertically layered, according to the natural type of forest. Range of tree ages proved by biometric characteristic.
		Occurrence of trees with exceptional dimensions according to the site conditions and species, and signs of physiological decline.
A1.3	Deadwood	Presence of deadwood (lying and standing) at all stages of degradation and all over the forest surface.
A1.4	Human activities which influenced the development, structure and dynamic of the ecosystem	**Infrastructure:** No documented evidence and no visible traces of forest exploitation infrastructure (e.g. absence of remnants of facilities of wood water transport supporting walls, regulating facilities roads, trails, dams, cable systems, etc.) or other forestry machinery recent traffic. Limited traces of pedestrian activities are allowed (pathways not wider than 1 m).
		Felling: No felling occurred in the past, confirmed by documentary evidence (by forest inventory and planning documents, archives, etc.). No visible traces of harvesting which has influenced the development of forests.
		Non wood forest products: No visible traces of extensive gathering of such products (mushrooms, berries, fruits, medicinal herbs, etc.). The collection of such products is acceptable unless there are visible traces of extensive gathering of such products.
		Forest litter removal: No visible traces and no documentary evidence (by forest inventory and planning documents, archives, etc.).
		Grazing: No visible traces and no documentary evidence of grazing/soil erosion (by forest inventory and planning documents, archives, etc.). Acceptable: occasional passing of livestock to and from pastures without impact on the forest development.
		Recreation /education infrastructure: No recreation infrastructure.
A2. Criterion: Area & Delimitation		
A2.1	Area of forest plot stand	Minimum 20 ha.
A2.2	Shape of forest plot stand	Minimum distance between any two opposite boundary points does not decrease below 200 m. This rule does not apply to the remains of relic/rare forests ecosystems or relic tree stands, surrounded by natural stands.

Guidelines: The evaluation for 1.2 and 1.3 will take into consideration the structure valuation – not on a surface unit but on the overall considered poligon. This description should be considered mainly for the minimum area (20 ha) in order to be sure that such a small pattch does not ocure due to antropic intervention.

In declaring virgin forests, the Parties can include surfaces that do not meet the naturalness requirements or non-forest ecosystems up to 20% of the forest plot stands that permit self-maintenance of the forest ecosystems and/or for administrative purposes.

In declaring virgin forest the Parties should prefer natural margins (hill tops, ridges, valleys, streams, forest edges). Accepted artificial margins are: permanent roads, high-voltage corridors or other utilities, forest compartment's boundaries and railways, etc. Where possible, the Parties should conduct assessments at forest management entity level.

Annex 6 Datasets in the Mediterranean countries

NORTHERN MEDITERRANEAN

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**COUNTRIES IN THE NORTHERN MEDITERRANEAN**
MAP TITLE	**Location of ancient forests in Northern Mediterranean countries (here only shown in EEA33 countries)**
ORIGINAL TITLE	
SOURCE	Mansourian et al. (2013), WWF France
CLASSES	
SHAPE/SPATIAL RESOLUTION	
YEAR	2013
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Identification of ancient forests in the Northern Mediterranean countries. "Ancient forests" as a general, relatively loose term to signify those forests that exhibit a number of fundamental forest ecological qualities, including ancientness but also complex structures, presence of deadwood, diversity of species and habitats, evidence of disturbance. etc.
MAIN REFERENCES	Mansourian, S., Rossi, M. and Vallauri, D., 2013. Ancient Forests in the Northern Mediterranean: Neglected High Conservation Value Areas. Marseille: WWF France, 80 p.
MAIN WEBPAGES	http://www.foretsanciennes.fr/forets-anciennes-de-mediterranee/

Map of some ancient forests in France

Map of Mata do Solitario

Map of some ancient forests in Croatia

Map of some virgin forests in Slovenia

Map of some ancient forests in Italy

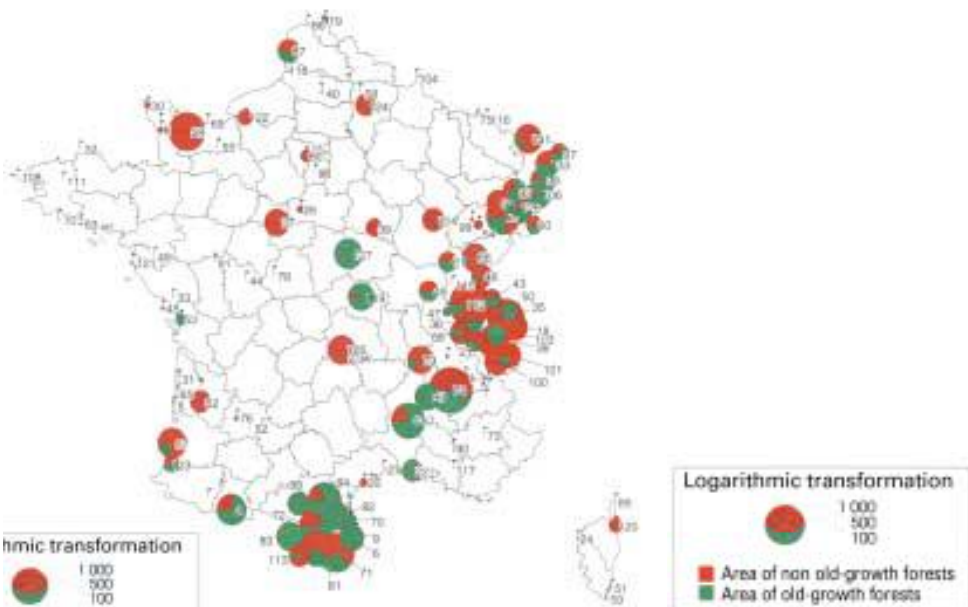Map of some potential ancient forests in continental Spain

Map of Fraktos and Olympus forests

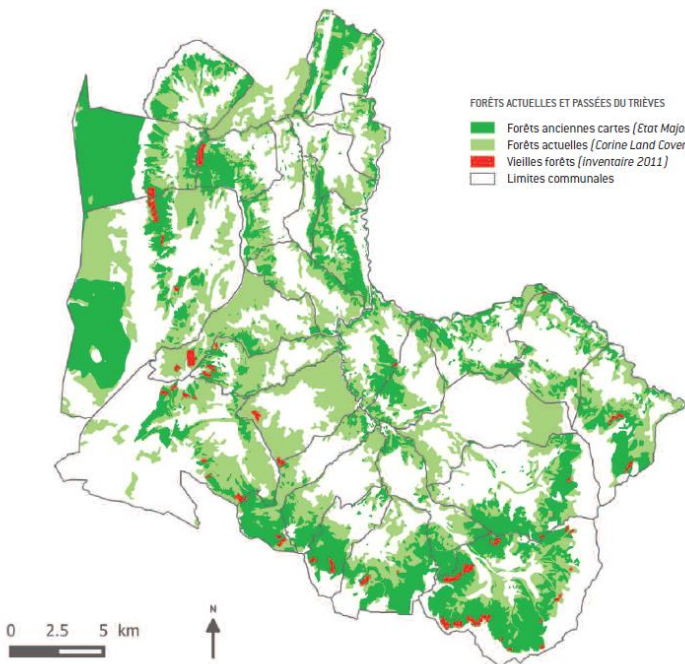Map of some potential ancient forests in Turkey

FRANCE

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**FRANCE**
MAP TITLE	**Location and size of forested nature reserves in Metropolitan France**
ORIGINAL TITLE	
SOURCE	Gilg and Schwoehrer, 1999
CLASSES	The symbols are proportional to the size of the reserves. Old-growth forests in green and managed parts in red; RNF codes according to the chronological establishment of the reserves.
SHAPE/SPATIAL RESOLUTION	
YEAR	1999
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	
MAIN REFERENCES	Gilg, O., Schwoehrer., C., 1999. Evaluation de l'importance du patrimoine naturel forestier (forêts subnaturelles et réserves forestières intégrales) dans le network des réserves naturelles. Ministère de l'Aménagement du Territoire et de l'Environnement - Réserves Naturelles de France, Quétigny
MAIN WEBPAGES	

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**FRANCE**
MAP TITLE	**The forests of Cassini. A quantitative analysis and comparison to current forests**
ORIGINAL TITLE	Les forêts de Cassini. Analyse quantitative et comparaison avec les forêts actuelles.
SOURCE	WWF/INRA
CLASSES	Ancient forest lands (in relation to Cassini's map), Current forest lands and Deforested lands.
SHAPE/SPATIAL RESOLUTION	
YEAR	2012
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Comparison between forest lands in the XVIIIth Century (Cassini's map) and CORINE 2006 land cover map.
MAIN REFERENCES	Vallauri D., Grel A., Granier E., Dupouey J.L. 2012. Les forêts de Cassini. Analyse quantitative et comparaison avec les forêts actuelles. Rapport WWF/INRA, Marseille, 64 pages + CD.
MAIN WEBPAGES	http://www.foretsanciennes.fr/protegermieux/france/

Forêts de Cassini
- Noyaux forestiers anciens
- Terrains déboisés à ce jour
- Non cartographié

Autres
- Autres boisements actuels
- Non boisés stables

0   75   150 kilomètres

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**MEDITERRANEAN REGION OF FRANCE**
MAP TITLE	**Ancient Forests in France's Mediterranean region and surrounding mountains**
ORIGINAL TITLE	Forêts anciennes de Méditerranée et montagnes limitrophes
SOURCE	WWF France
CLASSES	
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2013
AVAILABILITY	Image. Parcels of the inventory can be downloaded.
DEFINITION/ CRITERIA/ INDICATORS	Location of the 33 forests in which 52 stands were evaluated. The study aimed at characterizing naturalness of Mediterranean forests.
MAIN REFERENCES	Rossi M., Bardin, P., Cateau E., Vallauri D., 2013. Forêts anciennes de Méditerranée et montagnes limitrophes. Références pour la naturalité régionale. WWF France, Marseille, 144 pages.
MAIN WEBPAGES	http://www.foretsanciennes.fr/protegermieux/france/

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**PARC NATUREL REGIONAL DU LUBERON (France)**
MAP TITLE	**Map of ancient forests**
ORIGINAL TITLE	Les forêts anciennes du Luberon. Entre nature et histoire
SOURCE	PNRL/WWF
CLASSES	Ancient forests, Recent forests and Deforested lands
SHAPE/SPATIAL RESOLUTION	Scale 1:40.000
YEAR	
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Comparison between the "Carte de l'Etat-major" (circa 1860) and the National Forest Inventory (2003)
MAIN REFERENCES	Salvaudon A., Hamel A., Grel A., Rossi M., Vallauri D. (2013). Notice de la carte des forêts anciennes du Parc Naturel Régional du Luberon (1:40 000), avec référence aux autres usages du sol. PNRL/WWF, 22 pages.
MAIN WEBPAGES	http://www.foretsanciennes.fr/evaluer/methode/anciennete/
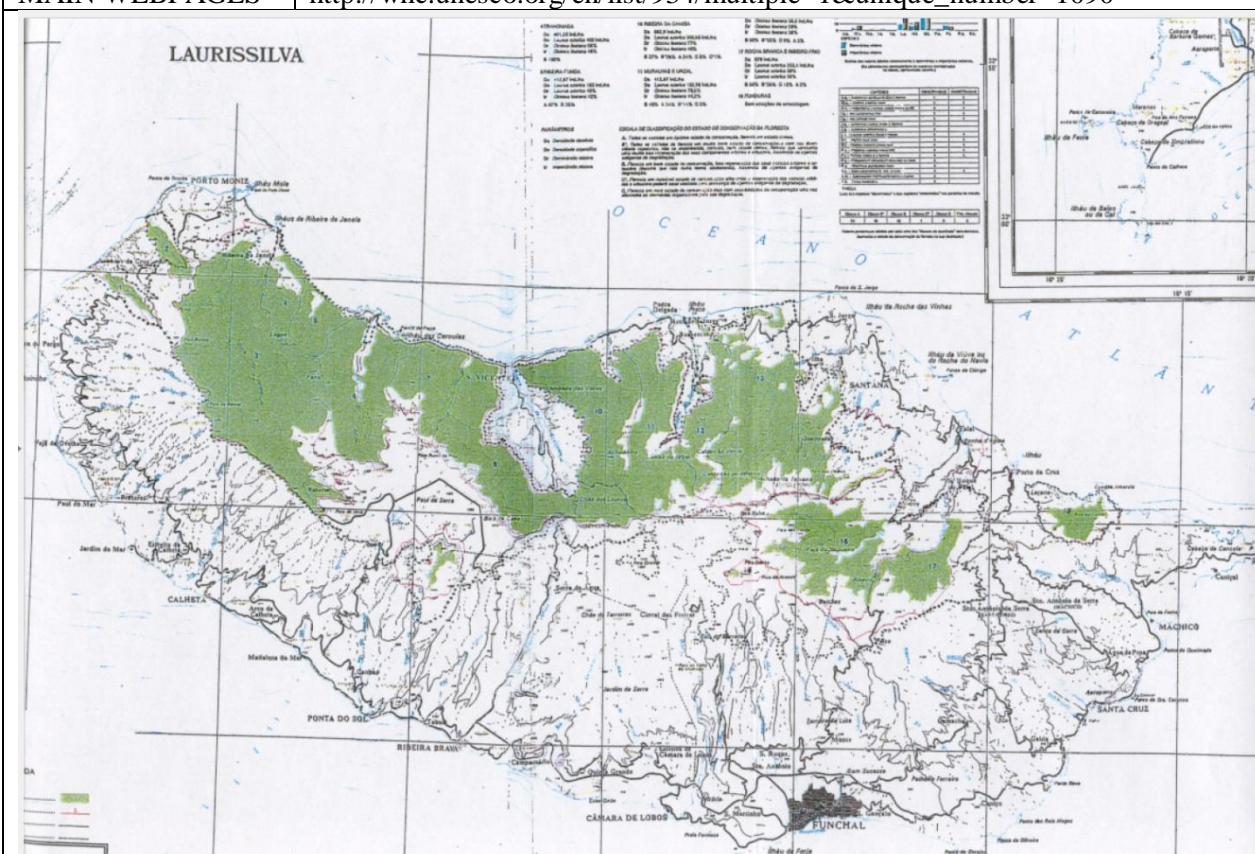
DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**LE TRIEVES (FRANCE)**
MAP TITLE	**Map of current forests, ancient forests and old forests in Le Trièves region**
ORIGINAL TITLE	Carte des forêts actuelles, des forêts anciennes et des vieilles forêts du Trièves.
SOURCE	FRAPNA
CLASSES	Ancient forests, current forests and Old forests
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2013
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	The map has been generated using the "Carte de l'Etat-major" (circa 1860), Corine Land Cover 2006 and the National Forest Inventory (2011).
MAIN REFERENCES	Forêts anciennes, vieilles forêts, vieux arbres. FRAPNA
MAIN WEBPAGES	http://www.fne.asso.fr/fr/forets-anciennes-vieilles-forets-vieux-arbres-les-forets-sont-bien-plus-qu-une-reserve-de-bois.html?cmp_id=167&news_id=13993

ITALY

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**ITALY**
MAP TITLE	**Old-growth Forests Network in Italian National Parks**
ORIGINAL TITLE	Foreste vetuste in Italia
SOURCE	Ministero dell'Ambiente e della Tutela del Territorio e del Mare. Direzione della Protezione della Natura e del Mare. Italia
CLASSES	Old-growthness level (High/Medium/Low). The "old-growthness level" is assigned to each stand based on three structural features: diamenter distribution of living trees, amount of deadwood (volume) and quality of deadwood (decomposition classes).
SHAPE/SPATIAL RESOLUTION	
YEAR	2010
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Italian definition of old-growth forest: forests in which human disturbance is absent or negligible, and in which natural dynamics create a mosaic of all the forest regeneration phases, including the senescing one. Such phase is characterised by large old trees, deadwood (snag logs and coarse woody debris) and a vascular plant species composition that is consistent with the biogeographical context and includes highly specialized taxa related to the small-scale disturbance and the microhabitats.
MAIN REFERENCES	Blasi, C., Burrascano, S., Maturani, A., Sabatini, F.M., 2010. Old-Growth Forests in Italy. Ministero dell'Ambiente e della Tutela del Territorio e del Mare. Direzione della Protezione della Natura e del Mare, Italia. (In English) Blasi, C., Burrascano, S., Maturani, A., Sabatini, F.M., 2010. Foreste Vetuste in Italia. Ministero dell'Ambiente e della Tutela del Territorio e del Mare. Direzione della Protezione della Natura e del Mare, Italia. (In Italian)
MAIN WEBPAGES	

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**ITALY**
MAP TITLE	**Location of the study sites of potential old-growth forests in the Apennines**
ORIGINAL TITLE	Foreste vetuste
SOURCE	Dipartimento di Economia, Ingegneria, Scienze e Tecnologie Agrarie e Forestali, Università degli Studi di Firenze
CLASSES	
SHAPE/SPATIAL RESOLUTION	
YEAR	2011
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	10 forest reserves across the Apennines in Italian peninsula were considered as potential old-growth forests. Attributes usually adopted to define old-growth forest such as large trees for the species and the site, wide variation in tree size, multiple canopy layer, J-reverse shape or rotated sigmoid diameter distribution were analyzed.
MAIN REFERENCES	Calamini G., Maltoni A., Travaglini D., Iovino F., Nicolaci A., Menguzzato G., Corona P., Ferrari B., Di Santo D., Chirici G., Lombardi F., 2011 – Stand structure attributes in potential Old-Growth Forests in the Apennines, Italy. L'Italia Forestale e Montana, 66 (5): 365-381.
MAIN WEBPAGES	http://dx.doi.org/10.4129/ifm.2011.5.01

PORTUGAL

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**MADEIRA (PORTUGAL)**
MAP TITLE	**Laurisilva of Madeira – Map of the inscribed property**
ORIGINAL TITLE	
SOURCE	UNESCO World Heritage List
CLASSES	Click here to enter text.
SHAPE/SPATIAL RESOLUTION	
YEAR	1999
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	The Laurisilva of Madeira, within the Parque Natural da Madeira (Madeira Natural Park) conserves the largest surviving area of primary laurel forest or "laurisilva", a vegetation type that is now confined to the Azores, Madeira and the Canary Islands. These forests display a wealth of ecological niches, intact ecosystem processes, and play a predominant role in maintaining the hydrological balance on the Island of Madeira.
MAIN REFERENCES	UNESCO World Heritage Centre
MAIN WEBPAGES	http://whc.unesco.org/en/list/934/multiple=1&unique_number=1090

SLOVENIA

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SLOVENIA**
MAP TITLE	**Locations of old-growth forests and forest reserves in Slovenia**
ORIGINAL TITLE	
SOURCE	Nagel et al. (2012)
CLASSES	Old-growth forests (stars) and forest reserves (black circles)
SHAPE/SPATIAL RESOLUTION	
YEAR	2012
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	In the paper, some of the basic characteristics of Slovenian old-growth forest remnants and the history of their protection are described. 14 old-growth forests (officially referred to as "virgin forests" in Slovenia) were identified.
MAIN REFERENCES	Nagel et al., 2012. Old-growth forest reserves in Slovenia: the past, present, and future. Schweiz Z Forstwes 163 (2012) 6: 240–246.
MAIN WEBPAGES	www.szf-jfs.org/doi/pdf/10.3188/szf.2012.0240
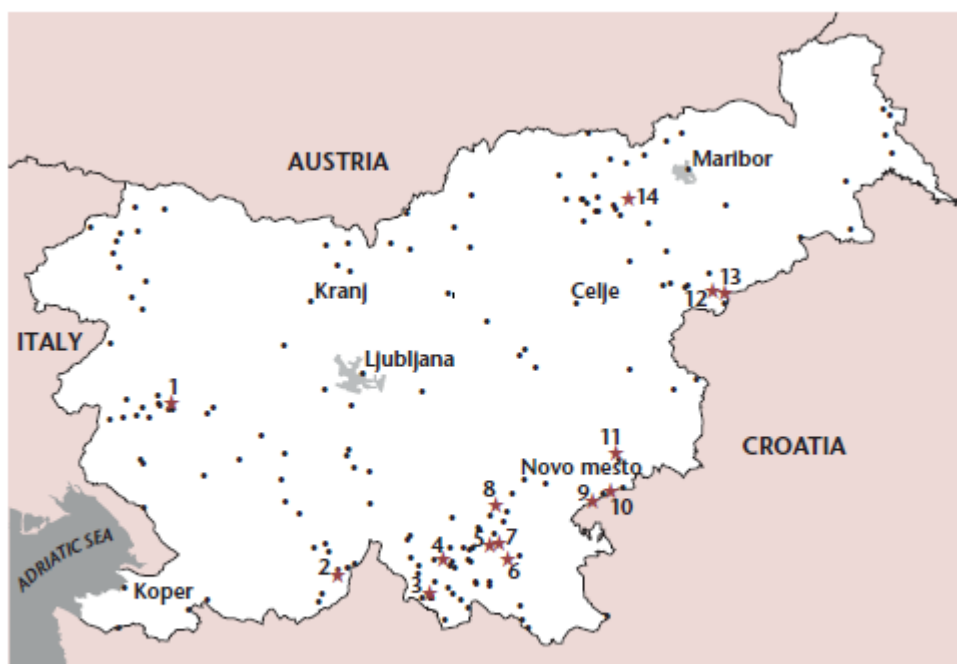
Fig 1 Locations of old-growth forests (stars) and forest reserves (black circles) in Slovenia. Numbered stars correspond to the list of reserves in Table 1.

SPAIN

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**CENTRAL PART OF SPAIN**
MAP TITLE	**Old growth forests in the central part of Spain**
ORIGINAL TITLE	Bosques maduros de la España interior
SOURCE	Fundación Félix Rodríguez de la Fuente
CLASSES	Click here to enter text.
SHAPE/SPATIAL RESOLUTION	
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	The main scope of the project LIFE+ BIGTREES4LIFE [LIFE11 INF/ES/000672] is to divulgate the presence of old growth and singular forests and singular trees in Spain.
MAIN REFERENCES	Fundación Félix Rodríguez de la Fuente, 2015. Árboles singulares de la España interior. enArbolar, Cuaderno de divulgación de la Fundación.
MAIN WEBPAGES	http://www.félixrodriguezdelafuente.com/ArbolesSingulares.aspx

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**ATLANTIC AND PYRENAIC PARTS OF SPAIN**
MAP TITLE	**Old growth forests in the Atlantic and Pyrenaic part of Spain**
ORIGINAL TITLE	Bosques maduros de la España atlántica y pirenaica
SOURCE	Fundación Félix Rodríguez de la Fuente
CLASSES	Click here to enter text.
SHAPE/SPATIAL RESOLUTION	
YEAR	2015
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	The main scope of the project LIFE+ BIGTREES4LIFE [LIFE11 INF/ES/000672] is to divulgate the presence of old growth and singular forests and singular trees in Spain.
MAIN REFERENCES	Fundación Félix Rodríguez de la Fuente, 2015. Árboles singulares de la España atlántica y pirenaica. enArbolar, Cuaderno de divulgación de la Fundación.
MAIN WEBPAGES	http://www.felixrodriguezdelafuente.com/ArbolesSingulares.aspx

bosques maduros

Paraísos de biodiversidad

Texto: Mariano Sánchez / Óscar Prada

Los bosques maduros son comunidades vegetales en las que predominan los árboles en todos sus estados de desarrollo. Además, los distintos estratos (herbáceo, arbustivo y arbóreo) están bien constituidos en ellos y aportan los microhábitats necesarios para una biodiversidad muy amplia. En el caso de la España atlántica y pirenaica, estos bosques mantienen la humedad durante todo el año, de manera que su frondosidad es muy superior a los de la zona mediterránea. Hayas, robles, castaños, tejos, abetos y diversas especies de pino son sus principales protagonistas arbóreos. Los árboles ancianos presentes en estas espesuras favorecen la nidificación de una gran variedad de animales y aportan madera muerta que constituye alimento y refugio para numerosas especies vegetales y de hongos.

Teixeda de Casaio

P. N. Redes

Reserva de Muniellos

Liébana

P. N. Urbasa y Andía

P. N. Aigüestortes i Estany de Sant Maurici

3. PARQUE NATURAL DE REDES, Caso y Sobrescobio *(Principado de Asturias).* Reserva de la Biosfera, Parque Natural. ZEPA y LIC: ES1200008 (37804.24 Ha).

Los excelentes hayedos crecen aquí sobre roca caliza, acompañados de abedulares, bosques de ribera y grandes manchas de castaño. La cuenca del río Nalón, que abastece de agua a la zona central y más habitada de Asturias, corre por este parque, donde viven lobos, nutrias, osos, águilas reales, pitos negros y algún urogallo. El tradicional queso Casín se obtiene de la ganadería extensiva con vacas de raza casina (de Caso). El aprovechamiento cinegético de venado, jabalí, corzo y rebeco se mantiene en estos bosques.
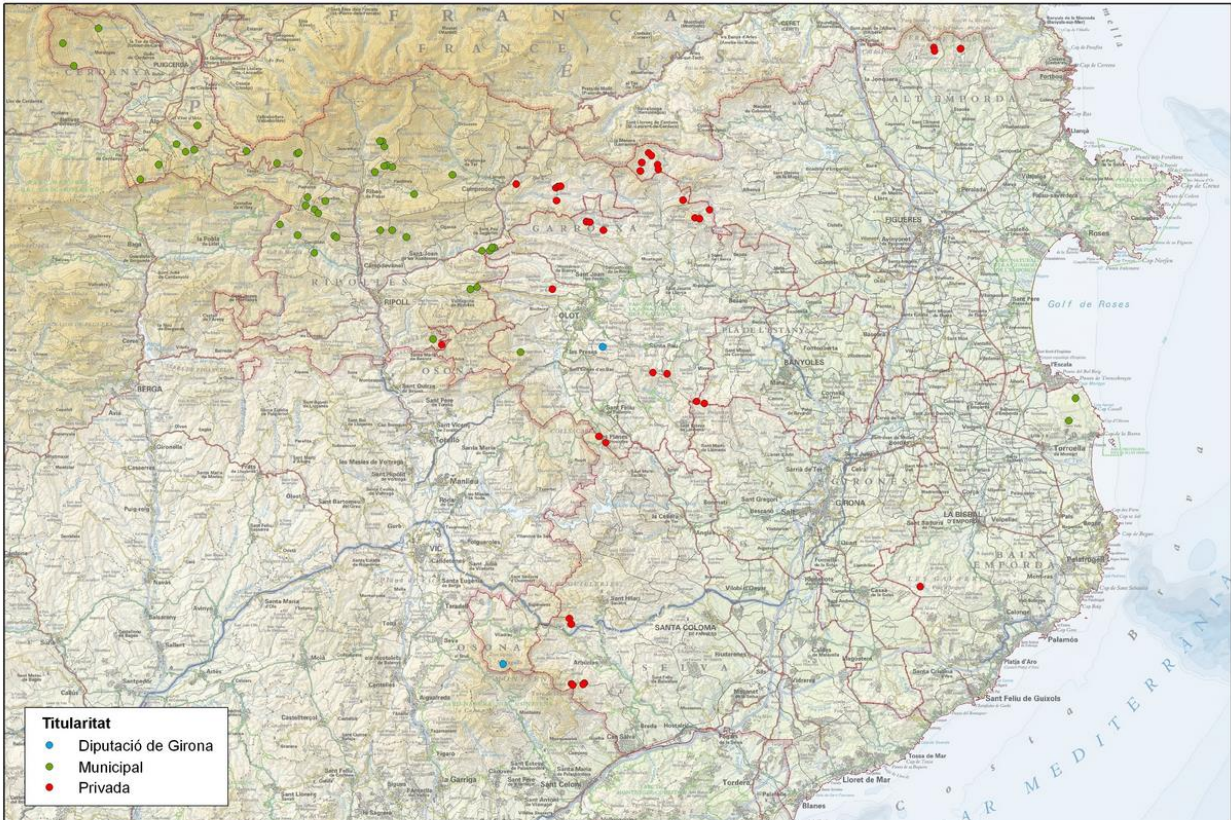
1.
TEIXEDA DE CASAIO, Carballeda de Valdeorras *(Ourense).* ZEPA Y LIC, Peña Trevinca: ES1130007 (24836.25 Ha).

Es considerado una reliquia botánica y uno de los escasos bosques puros de tejo de la Península, con una extensión de dos hectáreas. Alberga gran número de vertebrados, entre los que destacan diversas especies de águila, búho real, halcón peregrino, víbora de Seoane y, en menor medida, el gato montés y la nutria. A los tejos los acompañan brezos, retamas, acebos y robles.

2.
RESERVA DE MUNIELLOS, Cangas del Narcea e Ibias *(Principado de Asturias).* Reserva integral. ZEPA y LIC: ES1200002 (5559.21 Ha).

Considerado uno de los mayores robledales *(Quercus petraea)* de Europa, es el mejor conservado de la cordillera Cantábrica, con fragmentos de hayedo, un extenso abedular y un bosque de ribera de fresnos, alisos y arces. En él abundan los ejemplares monumentales, como el Roblón de Fonculebrera, osos, lobos, nutrias, urogallos y águilas reales. La visita, previa petición al 985 279 100, se restringe a 20 personas por día.

4.
LIÉBANA, municipios del Valle de Liébana *(Cantabria).* Parque Nacional de Picos de Europa. LIC: ES1300001 (42547.0 Ha).

El valle de Liébana tiene un microclima mediterráneo originado por las altas cimas que lo rodean, entre ellas los Picos de Europa. Bajo las cumbres de calizas, areniscas y pizarras se da una extraordinaria riqueza florística con bosques caducifolios, encinares e incluso alcornocales. Aquí viven el oso, el lobo, el pito negro, el pico mediano y el urogallo, casi extinto. Ganadería extensiva, caza, leña y actividades turísticas son los principales aprovechamientos.
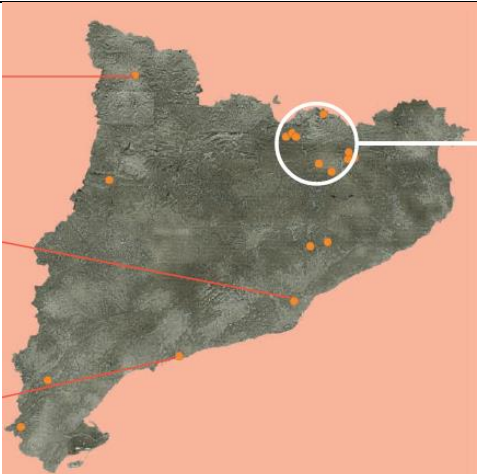
5.
PARQUE NATURAL DE URBASA Y ANDÍA, Estella *(Navarra).* Reserva integral. ZEPA y LIC: ES2200021 (27857.68 Ha).

El bosque principal es de hayas, acompañadas de arces, tilos, tejos, acebos y fresnos. Existen dos monumentos naturales: el tejo de Otsaportillo y el haya de Limitaciones. Entre las aves de presa destacan azores, ratoneros, cárabos y algún quebrantahuesos; entre los pequeños mamíferos, el tejón, el zorro, la garduña y el gato montés. Aquí tiene lugar el uso ganadero y forestal regulado.

6.
PARQUE NACIONAL DE AIGÜESTORTES I ESTANY DE SANT MAURICI *(Lleida).* Reserva de la Biosfera, Parque Nacional. ZEPA y LIC: ES1200008 (14.119 Ha).

Este parque constituye la zona lacustre más importante de los Pirineos, con unos 270 lagos. Cuenta con 1.471 especies vegetales, de las que el 7,8% son endemismos. Los bosques típicos son de haya pura o mixto de haya con abeto; en otras zonas se suma el abedul. Se encuentra igualmente bosque de pino negro. La fauna más habitual está formada por ardilla, corzo, gamo y jabalí. En los abetales y el pinar viven urogallos, mochuelos boreales y ciervos. También hay águilas reales y quebrantahuesos. Se mantienen las actividades agrarias y ganaderas.

12 | enArbolar

España atlántica y pirenaica | 13

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**GERONA (SPAIN)**
MAP TITLE	**Map of forest reserves**
ORIGINAL TITLE	
SOURCE	Provincial government of Gerona
CLASSES	Ownership of the forest reserve: Provincial government of Gerona (blue), Municipality (green), private (red)
SHAPE/SPATIAL RESOLUTION	
YEAR	2010
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	The main scope of the SELVANS programme is to promote sustainable forest management and the conservation of emblematic forests in the province of Gerona.
MAIN REFERENCES	
MAIN WEBPAGES	http://www.ddgi.cat/web/home.seam?nivellId=408&cid=7197&categoriaId=2

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**CATALONIA (SPAIN)**
MAP TITLE	**Singular Forests Inventory of Catalonia**
ORIGINAL TITLE	
SOURCE	CREAF, 2011
CLASSES	Click here to enter text.
SHAPE/SPATIAL RESOLUTION	
YEAR	2011
AVAILABILITY	Map viewer: SIPAN - Inventari de Boscos Singulars
DEFINITION/ CRITERIA/ INDICATORS	The main scope of the project is to develop "a reference catalogue of the best forests in relation to the matrix surrounding them. It provides a framework for determining their age-related singularities, taking into account the different values that society might attach to them; for example, a forest's biodiversity value, conservation value, prodcutive value, and/or social value".
MAIN REFERENCES	Comas, L., Gracia, M., Vayreda, J., 2013. Inventari de boscos singulars de Catalunya. Atzavara, L', (22), 29-36.
MAIN WEBPAGES	http://www.creaf.uab.es/BoscosSingulars/idesp/presenta.html http://www.creaf.cat/en/recerca/ecologia-forestal-i-incendis/bases-de-dades-forestals/singular-forest-inventory-catalonia

Annex 7 Datasets in the Atlantic countries

BELGIUM

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**FLANDERS (BELGIUM)**
MAP TITLE	**Forest age map (1771-2001) of Flanders**
ORIGINAL TITLE	Bosleeftijdskaart (1771-2001)
SOURCE	Instituut voor Natuur
CLASSES	Forest creation in four ranges: 1771-1775, 1775-1850, 1850-1930 and 1930-2001
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2014
AVAILABILITY	ArcGIS viewer, AGIV
DEFINITION/ CRITERIA/ INDICATORS	Vectorization of historical forest under the project VLINA C97/06 'Forest Ecosystem Vision of Flanders'. The forest age map (1771-2001) combines data from the following 4 maps: 1. The Ferraris Maps (1771-1778) 2. The Vandermaelen Maps (1846-1854) 3. The 3rd edition of the topographic maps at 1:20,000 (1910-1940) 4. The current afforestation according to the forest mapping, version 2001.
MAIN REFERENCES	
MAIN WEBPAGES	http://www.arcgis.com/home/webmap/ viewer.html?webmap=f67aca0a029f42e495f377efdadd60be

IRELAND
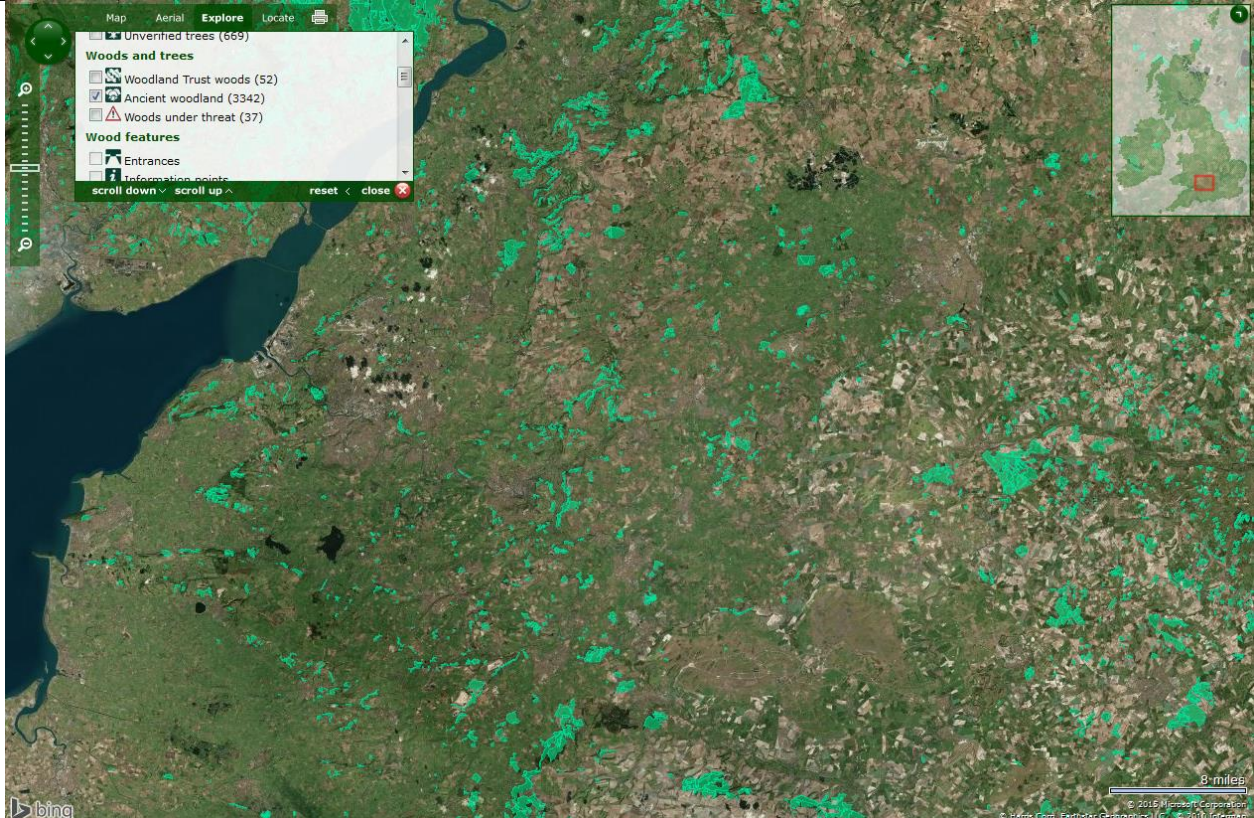
DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**IRELAND**
MAP TITLE	**A provisional inventory of ancient and long-established woodland in Ireland**
ORIGINAL TITLE	
SOURCE	National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland
CLASSES	Ancient woodland (AW)/Possible ancient woodland (PAW)/Long-established woodlands (LEW) with two sub-categories, LEW (I) and LEW (II)/ Recent woodland (RW).
SHAPE/SPATIAL RESOLUTION	
YEAR	2010
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Ancient woodland (AW) refers to those woods that have had a continuous history of cover since before the period when planting and afforestation became common practice (mid-1600s). Possible ancient woodland (PAW) stands have been continuously wooded since 1660. Long-established woodlands (LEW) have been continuously wooded since 1830 and there are two sub-categories, LEW (I) stands for which no evidence of antiquity could be found in older documentation, and LEW (II) stands for which there is evidence that the site is not ancient. Woodland that has originated since 1830 may be regarded as recent woodland (RW).
MAIN REFERENCES	Perrin, P.M., Daly, O.H., 2010. A provisional inventory of ancient and long-established woodland in Ireland. Irish Wildlife Manuals, No. 46. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
MAIN WEBPAGES	
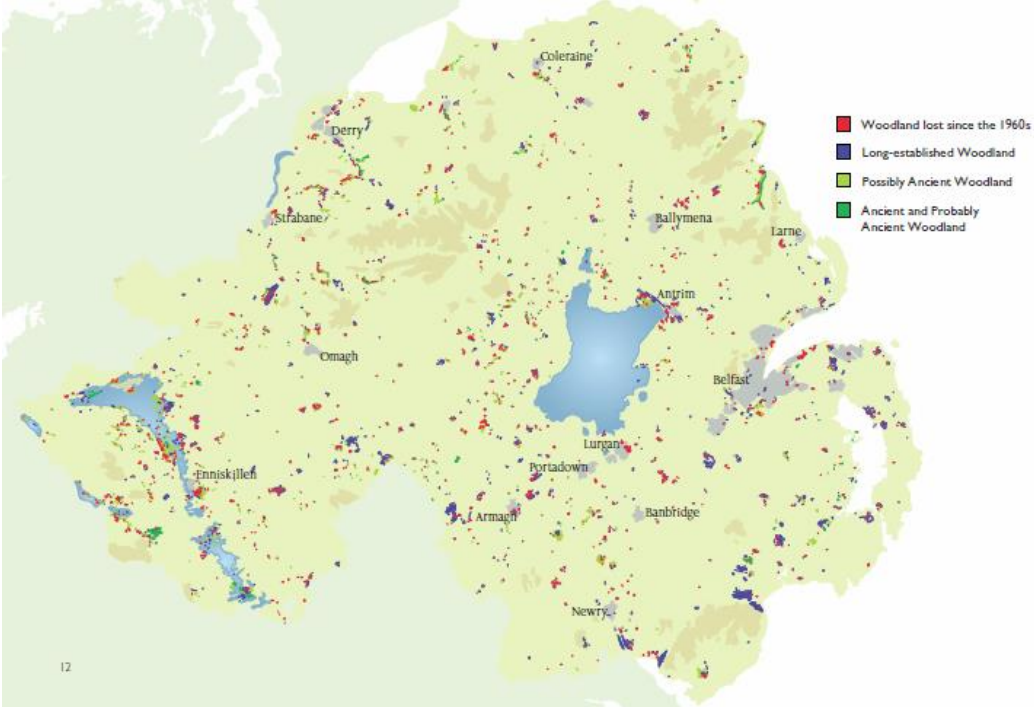
THE NETHERLANDS

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**THE NETHERLANDS**
MAP TITLE	**Old forests in 325 localities**
ORIGINAL TITLE	Click here to enter text.
SOURCE	Wageningen, Wettelijke Onderzoekstaken Natuur & Milieu
CLASSES	Old forests
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2008
AVAILABILITY	Image
DEFINITION/ CRITERIA/ INDICATORS	Forests which were planted before 1900 and forest areas which were already present before 1900.
MAIN REFERENCES	Daamen, W.P., 2008. Kaart van de oudste bossen in Nederland. Kansen op hot spots voor biodiversiteit. Wageningen, Wettelijke Onderzoekstaken Natuur & Milieu, WOt-werkdocument xx. 33 blz. 2 fig.; .3 tab.; .13. ref.; .5. bijl.
MAIN WEBPAGES	

Examples of old forests (blue colour) around Wageningen (left) and Bilthoven (right)

UNITED KINGDOM

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**UNITED KINGDOM**
MAP TITLE	**Viewer of UK's ancient woodlands**
ORIGINAL TITLE	Click here to enter text.
SOURCE	Woodland Trust
CLASSES	Ancient woodland and other forest related classes
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2015
AVAILABILITY	Map viewer
DEFINITION/ CRITERIA/ INDICATORS	Ancient woodland is defined as land continuously wooded since at least 1600.
MAIN REFERENCES	Ancient Tree Hunt. Mapping the UK's ancient and special trees
MAIN WEBPAGES	http://www.ancient-tree-hunt.org.uk/discoveries/interactivemap/

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**NORTHERN IRELAND (UNITED KINGDOM)**
MAP TITLE	**An inventory of ancient and long-established woodland for Northern Ireland**
ORIGINAL TITLE	Click here to enter text.
SOURCE	Woodland Trust
CLASSES	Woodland lost since the 1960's, Long-established Woodland, Possibly Ancient Woodland and Ancient and Probably Ancient Woodland
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	
AVAILABILITY	
DEFINITION/ CRITERIA/ INDICATORS	The project defined ancient woodland in Northern Ireland as land continuously wooded since at least 1600 to be consistent with the rest of the UK.
MAIN REFERENCES	Woodland Trust. Back on the Map. An inventory of ancient and long-established woodland for Northern Ireland. Preliminary report.
MAIN WEBPAGES	

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**SCOTLAND (UNITED KINGDOM)**
MAP TITLE	**Native Woodland Survey of Scotland (NWSS)**
ORIGINAL TITLE	Click here to enter text.
SOURCE	Forestry Commission
CLASSES	Native woodland, Nearly-native woodland, Open land habitat and Plantations on Ancient Woodland Sites (PAWS).
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2014
AVAILABILITY	Map viewer. Shapefiles can be downloaded.
DEFINITION/ CRITERIA/ INDICATORS	The aim of the Native Woodland Survey of Scotland (NWSS) was to undertake a baseline survey of all native woodlands, nearly native woodlands and Plantations on Ancient Woodland Sites (PAWS - as identified from the Ancient Woodland Inventory) in Scotland in order to create a woodland map linked to a dataset showing type, extent and condition of those woods.
MAIN REFERENCES	Native Woodland Survey of Scotland. Spatial Metadata
MAIN WEBPAGES	http://maps.forestry.gov.uk/imf/imf.jsp?site=fcscotland_ext&

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
COVERAGE	**WALES (UNITED KINGDOM)**
MAP TITLE	**Ancient Woodland Inventory 2011**
ORIGINAL TITLE	Click here to enter text.
SOURCE	Forestry Commission
CLASSES	Ancient Semi Natural Woodland (ASNW), Restored Ancient Woodland Site (RAWS), Plantation on Ancient Woodland Site (PAWS) or Ancient Woodland Site of Unknown Category (AWSU).
SHAPE/SPATIAL RESOLUTION	Polygon
YEAR	2012
AVAILABILITY	Map viewer. Shapefiles can be downloaded.
DEFINITION/ CRITERIA/ INDICATORS	The Ancient Woodland Inventory identifies woodlands that have had a continuous woodland cover for centuries. This dataset comprises the boundaries of Ancient Woodland sites in Wales. Each site is categorised as either Ancient Semi Natural Woodland (ASNW), Restored Ancient Woodland Site (RAWS), Plantation on Ancient Woodland Site (PAWS) or Ancient Woodland Site of Unknown Category (AWSU). Ancient woodland is defined as land continuously wooded since at least 1600.
MAIN REFERENCES	Ancient Woodland Inventory 2011. Spatial Metadata
MAIN WEBPAGES	http://maps.forestry.gov.uk/imf/imf.jsp?site=fcwales_ext&

Annex 8 Bibliographical review

FOCUS	AUTHORS	TITLE	YEAR
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WORLD	FAO	Global Forest Resources Assessment 2010. Terms and Definitions	2010
WORLD	Greenpeace	Map of The world's last intact forest landscapes	2010
WORLD	Rhett	Loss of old growth forest continues	2010
EUROPE	Alberdi et al.	A new method for the identification of old-growth trees in National Forest Inventories: application to *Pinus halepensis Mill.* stands in Spain	2012
EUROPE	Bauhus et al.	Silviculture for old-growth attributes	2009
EUROPE	Brown	Re-defining native woodland	1997
EUROPE	Brus et al.	Statistical mapping of tree species over Europe	2011
EUROPE	Brus et al.	Tree species European map	2011
EUROPE	Burrascano et al.	Commonality and variability in the structural attributes of moist temperate old-growth forests A global review	2013
EUROPE	Defries et al.	A new global 1-km dataset of percentage tree cover derived from remote sensing	2000
EUROPE	Diaci (ed.)	Virgin Forests and Forest Reserves in Central and East European Countries	1999
EUROPE	EEA	10 messages for 2010 Forest ecosystems	2010
EUROPE	EEA	Developing a forest naturalness indicator for Europe. Concept and methodology for a high nature value (HNV) forest indicator	2014
EUROPE	EEA	European forest types. Categories and types for sustainable forest management reporting and policy	2006
EUROPE	ETC/SIA	High Nature Value (HNV) Forest Area Indicator	2013
EUROPE	EUFORGEN	Fagus sylvatica distribution map	2009
EUROPE	European Commission	Disturbances of EU forests caused by biotic agents. Final report	2012
EUROPE	European Commission	Sustainable forestry and the European Union. Initiatives of the European Commission	2003
EUROPE	European Forest Institute	Compilation of Forestry Terms and Definitions	2002
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EUROPE	Fares et al.	Five steps for managing Europe's forests	2015
EUROPE	FOREST EUROPE/UNECE/FAO	Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand	2000
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EUROPE	Kraus and Krumm (eds.)	Integrative approaches as an opportunity for the conservation of forest biodiversity	2013
EUROPE	MCPFE	MCPFE Information Document on Data Collection and Compiling the Statistics On Protected and Protective Forest and Other Wooded Land in Europe	2006
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EUROPE	Nilsson et al.	Densities of large living and dead trees in old-growth temperate and boreal forests	2002
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EUROPE	Schuck et al.	A Review of Approaches to Forestry Research on Structure, Succession and Biodiversity of Undisturbed and Semi-Natural Forests and Woodlands in Europe	Unknown
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EUROPE	Abdul-Malak and Marín-Guerrero	High Nature Value (HNV) Forest Area Indicator	2013
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CARPATHIANS	Carpathian Convention	Strategic Action Plan for the implementation of the protocol on sustainable forest management	Unknown
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