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Scoping document - Justification and guidelines for a European register of old growth forests

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1 Objectives and structure

Task 1.7.5.A.IV.ii.b of ETC/BD 2016 Action Plan is: “based on the old growth forest scoping document prepared in 2015, to elaborate a document to justify the needs (including potential link with JRC Forest Information System for Europe FISE) and propose guidelines for the implementation of a European register on old growth forests with the support of EIONET”. The major objectives of this document are to expose the main reasons that would recommend the implementation of a European old growth forest register and propose a structure and the mechanisms to put it in place.

The scoping document is structured in the following chapters. Chapter 2 briefly introduces the definitions of old growth forest and, in order to justify the needs, enumerates the benefits that a European register would entail. Chapter 3 introduces the available information sources and datasets. Chapter 4 proposes the guidelines for the register implementation including some general principles and the structure and contents that it may contain. This chapter also provides two overviews focusing on the Scandinavian and the Central and Eastern European countries. Chapter 5 synthesizes the process to operationalize the register and the parties involved. Chapter 6 draws some conclusions. The annexes mainly show tables of available information and standardized factsheets related to the Scandinavian and Central-Eastern examples.

It must be highlighted that this scoping document is a follow-up of the ETC/BD Working paper N°B/2015 “Information related to European old growth forests” (García Feced *et al.*, 2015; http://bd.eionet.europa.eu/Reports/ETCBDTechnicalWorkingpapers/European_old_growth_forests, last accessed 27 March 2016) which reviews the concept of old growth forest (and other related terms) in Europe and presents 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 and maps related to old growth forests in Europe is provided. The presentation of the information is made both at Pan-European scale and structured by geographical regions: Scandinavia, Baltic, Central and Eastern, Mediterranean and Atlantic.

2 Justification of a European register of old growth forests

2.1 Definition of old growth forest

As shown in ETC/BD Working paper N°B/2015, it is very difficult to set a common definition of old growth forest due to the varied criteria that are used and the myriad of related terms that are erroneously employed as synonyms (Box 2.1). In the case of Europe, this problematic is even multiplied by the number of languages spoken in the continent.

Box 2.1 Criteria for the definition of old growth forest (extracted from García Feded et al., 2015)

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”.

Table 2.1 collects a number of concrete definitions of old growth forest provided by different sources at the European or global level. At the national scale, Annex 1 presents some of the definitions given to old growth forest and related terms in different European countries. Focusing in the Mediterranean countries, an interesting report that reviews the concept and identifies actual and potential ancient forests (a term commonly associated to old growth forests) 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.”.

Table 2.1 Some definitions of old growth forest and related terms at the European and global level

<p>European Forest Institute (“Research in old-growth forests and forest reserves: implications for integrated forest management”, Nagel et al. (2013))</p> <p>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.</p> <p>Definition based on structure: “forests in a late stage of stand development, characterised 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”.</p> <p>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.</p>
<p>Glossary of “Natura 2000 and Forests. Part I-II” (European Commission, 2015) http://ec.europa.eu/environment/nature/natura2000/management/docs/Final_Guide_N2000_Forests_Part_I-II-Annexes.pdf</p>
<p>Ancient forests/woodlands: see old growth forests.</p> <p>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”.</p>
<p>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)</p>
<p>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”.</p>

Regardless a concrete definition, old growth forests are complex systems that provide fundamental ecological functions. The EEA Technical report No 5/16 “European forest ecosystems. State and trends” (EEA, 2016; available at <http://www.eea.europa.eu/highlights/is-europe-doing-enough-to>, last accessed 31 March 2016) refers to old forests in Europe and states that “the importance of old trees for biodiversity is well recognised (Barbati *et al.*, 2012). Old forests are vital for forest biota, particularly many rare and threatened species. Ancient forests also have a higher volume of deadwood, which forms microhabitats for many species including fungi, lichens, ferns and invertebrates, as well as woodpeckers and beetles. In

the Białowieża Primeval Forest, half of the 12000 species found there are dependent on decaying logs (Bobiec *et al.*, 2000). Old forests are also important for their aesthetic, cultural and nature conservation values”.

Sadly, old growth forests have declined dramatically in Europe in the last centuries. According to EEA (2016), “only a few old forests exist in Europe and these cover a total area of approximately 3 million ha (i.e. less than 2 % of the total forest area)”. Given their valuable characteristics, efforts must be strengthened to ensure their conservation, maintenance and restoration.

2.2 Benefits of a potential register

The gaps in knowledge and recommendations that were reported for the Mediterranean countries in Mansourian *et al.* (2013) can be applied to the majority of European countries: “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 forests”.

The implementation of a European register of old growth forest would imply a number of advantages in the following aspects:

- **Agreement on a common terminology**

A primary justification of a European register is a reflection on what should be understood as old growth forest in a European context. Although it may be difficult to provide a unique definition, it is needed to establish common terminology and criteria that could be adapted to regional particularities or different forest types. The association of old growth forests to those “undisturbed by man” may be too restrictive since in Europe those forests are very scarce due to the long history of land use.

- **Compliance of EU policy requirements**

The availability of more systematized information on old growth forest across Europe could provide critical input to policy instruments and conservation programmes.

The Mid-Term review of Target 3B of the EU Biodiversity Strategy towards 2020 (i.e. increase the contribution of forestry to maintaining and enhancing biodiversity) has shown “no significant overall progress (much stronger efforts are needed to meet the target by its deadline)” (COM 2015 (478 final)). Particularly, Action 12 of this Strategy requires that “Member States will ensure that forest management plans or equivalent instruments include as many of the following measures as possible: maintain optimal levels of deadwood; taking into account regional variations such as fire risk or potential insect outbreaks; preserve wilderness areas; ecosystem-based measures to increase the resilience of forests against fires as part of forest fire prevention schemes, in line with activities carried out in the European Forest Fire Information System (EFFIS); specific measures developed for Natura 2000 forest sites; ensuring that afforestation is carried out in accordance with the Pan-European Operational Level Guidelines for Sustainable Forest Management, in particular as regards the diversity of species, and climate change adaptation needs”. Many of these measures are closely linked to old growth forests and will be benefited by an improved identification and register of these systems. The activities under the Mapping and

Assessment of Ecosystems and their Services (MAES, Target 2) can also profit of this information given the high rate of regulating ecosystem services that these forests provide.

An objective of the European Union Forest Strategy adopted by the European Commission (COM 2013 (659 final)) is to improve the knowledge about forest ecosystems and a register could be very helpful to understand better old growth forests.

Policy instruments such as the EU Habitats and Birds Directives and Natura 2000 network could strongly benefit from the inputs provided by a register. For instance, the information contained in a register could be useful for assessing the conservation status of habitat types and species, and reporting under Article 17 of the Habitats Directive and Article 12 of the Birds Directive every six years.

The LIFE programme finances conservation activities which are often located in old growth forests (European Commission, 2006). Thus, the register and mapping could be a tool to prioritize conservation and restoration activities.

In a global context, a register and mapping could provide useful inputs to the Convention on Biological Diversity assessments and the instruments for climate change mitigation (following 2015 Climate Convention in Paris), given that these forests are very efficient in the sequestration of carbon.

- **Potential links to FISE**

The Forest Information System for Europe (FISE) includes “not only European information on forests, but also all the relevant information on forests at the global scale that influences forests and forestry activities in Europe” (<http://forest.jrc.ec.europa.eu/>, last accessed 31 March 2016). This initiative is conducted by a group of scientist from research institutions such as the Joint Research Centre. The creation of such a system is an objective of the European Union Forest Strategy (COM 2013 (659 final)) by the European Commission.

The website of the system is accessible at <http://fise.jrc.ec.europa.eu> (last accessed 31 March 2016). The activities in FISE are organized in four modules dealing with: Forest Disturbances, Forest Ecosystem Services, Forest and the EU Bio-economy, Forests and climate change.

For the implementation of the register (see Chapter 5), it is proposed that FISE plays a role on the delivery of information of the register at the European level. A number of meetings between EIONET parties (EEA and ETCs) and the European Commission (in particular, the JRC and DG ENV) should be organized to set the guidelines and the mechanisms to include the register in FISE.

- **Improvement of classifications and mapping of land uses/covers and habitats**

One of the conclusions of the review made by García Feced *et al.* (2015) is that “in general, there is a lack of appropriate 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 work on old growth forests may refine some land use classifications, especially those related to forest management practices. Forest Europe, in its Congress in Madrid (2015), has reclassified forests in three categories: “plantations”, “semi-natural” and “undisturbed by man”. A better discrimination of the old

growth forests may help refine these categories, given that the boundaries between “semi-natural” and “undisturbed by man” are not well delimited.

Another classification that could benefit from the better knowledge of old growth forests is the EUNIS, which is a habitat classification but considers as well some aspects related to management.

The distribution maps of the forest habitat types (European Commission, 2013) included in the Habitats Directive could also be enhanced by an improved identification and understanding of old growth forests. Given the high biodiversity rates usually existing in these forests, distribution maps of flora and fauna species could be refined, helping as well to identify and assess the status of red list species. The particular conditions of the soil in old growth forests can also provide interesting information about soil biodiversity.

Moreover, the assessment and mapping of the likelihood of High Nature Value (HNV) forest areas (EEA, 2014) depends on the delimitation of old growth forests. The EEA Technical report shows an example for beech forests collected by the Italian Academy of Forest Sciences.

Copernicus program images and processed outputs could be instrumental for the identification and mapping of old growth forests. In more detail and providing 3D data, LIDAR can also be a very useful tool for the inventoring and measurement of old-growth attributes.

- **Delimitation of protected lands and Natura 2000 areas**

Many old growth forests are included within Natura 2000 areas and protected lands. A register and mapping of these forests can enhance the selection of new priority areas for protection and the design of adequate conservation measures.

- **Update of indicators**

The updated list of Sustainable Forest Indicators of Forest Europe (2015) includes in their Criterion 4 (Maintenance, Conservation and Appropriate Enhancement of Biological Diversity in Forest Ecosystems) these five indicators: “Diversity of tree species”, “Naturalness”, “Deadwood”, “Threatened forest species” and “Protected forests”. The calculation of these indicators could be greatly benefited by a better knowledge of old growth forests throughout Europe.

Some SEBI indicators may also benefit of the inputs of such register, since they take into consideration typical old growth forest characteristics such as biodiversity, naturalness and deadwood. These indicators are: SEBI 001 Abundance and distribution of selected species, SEBI 002 Red List Index for European species, SEBI 003 Species of European interest, SEBI 005 Habitats of European interest, SEBI 007 Nationally designated protected areas, SEBI 008 Sites designated under the EU Habitats and Birds Directives, SEBI 017 Forest: growing stock, increment and fellings (forest cuts), and SEBI 018 Forest: deadwood (accessible at <http://biodiversity.europa.eu/topics/sebi-indicators>, last accessed 31 March 2016). Some of these indicators are derived from Forest Europe’s SFM indicators. The CMEF (Common Monitoring and Evaluation Framework; DG AGRI, 2014) Context Indicator “Protected Forests” is also derived from Forest Europe’s statistics.

- **Encouragement of national initiatives and enhancement of forest planning**

The creation of a Pan-European register can have a positive effect on countries to study better their old growth forests and put in place the tools and measures to protect them.

Forest management plans must be design accordingly. For instance, the recreational use must be planned taking into account the protection of these valuable forests. People are increasingly interested in visiting and enjoying their beauty, but the flows of visitors must be organised adequately. An enhanced mapping of old growth forests could help organize land uses and establish zones of different protection or restrictive roads or tracks.

- **Improvement of the European research network and knowledge transfer**

Understanding the processes and functions occurring in these forests has always drawn the attention of the researchers. Yet, there is still much to understand of these complex systems. The proper mapping of these forests could help identifying pilot areas that could be investigated in deep. The design and implementation of a register could also strength collaborative efforts between research institutes, consortia and universities across Europe. The European Union could fund research projects with this aim.

For instance, 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). In 2014, the database contained approximately 150 old growth forests described in more than 80 scientific publications (EEA Technical report No 13/2014). 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.

- **Participation of environmental NGOs and associations**

Throughout Europe there is an increasing interest in protecting these forests. Environmental NGOs have already promoted networks to study, maintain and conserve these precious forests. For instance, WWF has carried out several activities on the Northern Mediterranean countries (Mansourian *et al.*, 2013) or the Danube-Carpathian area, and Wild Europe has an initiative called the “Wild Europe’s old growth forest protection strategy”. These efforts must be incorporated in a more harmonized European framework.

3 Available information sources and datasets

As mentioned above, the ETC/BD Working paper N°B/2015 “Information related to European old growth forests” (García Feced *et al.*, 2015) reviews the data, datasets, projects, initiatives and maps related to old growth forests that are currently available in Europe. The report provides a catalogue of datasets and maps presented in standardized factsheets that collect the following information: Coverage (continental, national or regional), Dataset title, Original title (in original language if different than English), Source (main provider of information), Classes (types of forests or legend of map), Shape/Spatial resolution (if the map has a point or polygon shape, and resolution), Year (of dataset creation), Availability (GIS files, map viewer, only tables or images), Definition/Criteria/Indicators (used to distinguish the old growth forest or related term), Main references, Main webpages, Observations and Map image.

The review of the available data/datasets revealed that the amount of information is very uneven across Europe. In some countries, the identification, inventory and protection of old growth forests are well advanced whereas in others it has not been implemented yet.

The catalogue of datasets and maps is useful for determining the availability of sources and databases from which the register could be populated. Examples of factsheets with datasets related to old growth forests in Sweden and Czech Republic are shown in Annex 2. The catalogue, which could be updated regularly, is organized in the report by European geographical regions and alphabetically by country. It can be explored at

http://bd.eionet.europa.eu/Reports/ETCBDTechnicalWorkingpapers/European_old_growth_forests (last accessed 27 March 2016).

4 Guidelines for a register of old growth forests

4.1 General principles and structure

The first step for the harmonisation of information and the creation of a register of old growth forests at a European scale is to agree on working definitions of what can be considered an old growth forest. Given the existence of varied criteria and related terms, there is a need to set flexible but operative working definitions and common criteria. Considering the variability of forest types in Europe, a single definition of old growth forest for the continent might not be possible but could be more feasible at biogeographical level. At least, each country should define precisely what they consider old growth forest and the criteria they use to identify them. Clear translations in all languages should be established as well.

As an example, the Carpathian Convention (The Framework Convention on the Protection and Sustainable Development of the Carpathians, signed in 2003 by seven countries: Czech Republic, Hungary, Poland, Romania, Serbia, Slovak Republic, Ukraine; <http://www.carpathianconvention.org/the-convention-17.html>, last accessed 3 October 2015) has elaborated a set of guidelines for the definition of virgin forests, defined as “natural forests which have not been influenced directly by human activities in their development”. The Strategic Action Plan for the implementation of the Convention’s Protocol on Sustainable Forest Management (Carpathian Convention, 2011) required the “harmonization of criteria and indicators for identifying natural and virgin forests”, “the compilation, analysis and update of the scientific data, national inventories and maps of natural and especially virgin forests” and “the inclusion of inventory data of virgin forests based of the format approved by the Parties in Carpathian Convention joint information system”. As a result, the criteria and indicators for identification of virgin forests in the Carpathians have been harmonized (see details in Annex 3). 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).

These guidelines may not be common to all the regions or forest types of Europe but could be used as a reference to set criteria and indicators in a more systematic manner across Europe.

A register of old growth forests at European scale must contain the basic information to identify them and the main characteristics usually utilized to define old growth forests. As García Feced *et al.* (2015) showed, the availability of information is very uneven across countries and therefore the register must also contemplate certain flexibility subjected to availability.

Thus, the fields that are proposed for the creation of a register of old growth forests are organized in three components: basic information of the old growth forest, main characteristics (related to old growth forests) and other interesting information.

The basic information to identify the forest includes: Region/Country, Old growth forest name, Geo-location, GIS availability, Source(s), Reference(s)/Webpage(s) and Register date (and identification number). In most cases, these fields would be associated to the information collected in the dataset factsheets that have been previously mentioned.

It is also needed to register the main characteristics of these forests. The following fields are proposed, based on common criteria used to define old growth forests: Old growth forest area, Surrounding forest area, Dominant tree species, Other tree species, Forest type, Protected area, Forest age, Forest structure, Presence of old trees, Deadwood volume and Human activities.

The area of old growth forest and the surrounding forest (if it exists) are relevant due to the ecological importance of the scale and the presence of buffer forest zones to protect this kind of forests. This can provide some insight of the fragmentation degree.

The dominant tree species and other tree species are also relevant fields to determine the type of old growth forest, which could be used to frame them into forest classifications and for the calculation of more detailed indicators.

It is also useful to point out if the forest is a protected area and/or which instruments are employed to manage it (e.g. Forest Management Plans, as specified in Target 3B of Biodiversity Strategy).

The age and structure of the forest are basic elements to understand how it has evolved and the balance between the different successional stages of the forest. As shown, they are commonly used criteria in definitions of the term. It is convenient to record both vertical forest structure and horizontal. An appropriate abundance of trees and a proper balance between age groups are keys to preserve their status. These fields are also linked to the presence of old or very old trees, which have an instrumental role in the system functioning. Some of them are nature jewels that have acquired strong relevance for the community through the centuries and have been protected.

The volume of deadwood existing in a forest is a biodiversity indicator. Old growth forests usually have a high amount of deadwood, which volume could be indicated in the register.

The human activities within the forest (if they exist) are also worth recording, given their influence in the development and status of the system. In fact, many definitions given to old growth forests employ the criteria “absence or very low activity by man”. For instance, this field could inform about the infrastructures and the forest uses such as felling, grazing or recreation.

A third component of the register could be more open and generically referred as “Other interesting information”. Depending on availability of information, some fields could be added to the factsheets, such as biodiversity indicators, representative and/or threatened flora and fauna species, a map or pictures of the forest.

Given the uneven availability of information between countries and forest types, the proposed fields may be considered insufficient in some cases and excessive in others. Therefore flexibility is recommended.

In order to show examples of the availability of all this information in the datasets collected in García Feced *et al.* (2015), two geographical regions (Scandinavian countries and Central and Eastern European countries) were further investigated. The next two sections provide some insights on the outputs.

4.2 Overview in the Scandinavian countries

This section and related annexes have been provided by Håkan Berglund (SLU).

Annex 4 shows the availability of information related to the proposed fields in the Scandinavian countries’ datasets. The following comments have been extracted:

- To fill-in the field “Old growth forest area”, it must be known how "old growth forests" are defined. Should it be limited to "old late-successional forests" or broaden to include also other types of natural forests or biodiversity hotspot areas? In this review it has been assumed a definition of "old late-successional forests" which involves criteria for natural regeneration, high forest stand age (old trees), high amount of coarse dead wood, multi-layered canopy structure, etc. The definition does not include natural early successional stages or biodiversity hotspot areas that may not fulfil some of the old growth criteria.
- For the field “Forest area”, it must be noted that various forest definitions may be applied: 1) The FAO definition (FAO, 1998); 2) Swedish definitions of a) productive forest land; i.e. land that can produce an average of one cubic meter of timber per hectare per year, and b) unproductive forest land (not productive forest land).
- Regarding the "technical feasibility" and the "transfer of data to a potential European register", several comments apply:
 - It should be possible to link to and transfer/download the listed public spatial datasets (GIS datasets) from the different Nordic countries to a common register (datasets are usually available via WMS);
 - A personal login and password are required to access some public spatial datasets, but there should be technical solutions to overcome such problems when building a register;
 - National Forest Inventory (NFI) datasets cannot be transferred to the register;
 - The datasets owned by forestry companies (or private landowners) as well as NGO’s are probably difficult (impossible) to access; data access probably requires negotiations and written agreements.
- Some challenges for the creation of a European register have been found:
 - To define what type of forests that should be included in the register (i.e., to define "old growth forest"); without a clear definition, it will be difficult (impossible?) to assess if a particular dataset contains useful data;
 - Even with a clear definition, it will still be difficult to identify old growth forests among the forest areas listed in the datasets. The datasets contain different attribute data and the majority lack attribute data on key “old growth variables” such as tree or stand age and dead wood amount. Satellite-image data on these variables are usually imprecise but might be used in combination with them in the different spatial datasets to identify likely old growth areas.

One example of old growth forest from each Scandinavian country has been selected and information has been collected and displayed in factsheets (see Annex 5).

4.3 Overview in the Central and Eastern European countries

This section and related annexes have been provided by Martin Strnad (AOPK).

Focusing on the Central and Eastern European countries, Annex 6 shows the availability of information for a register in some of the datasets.

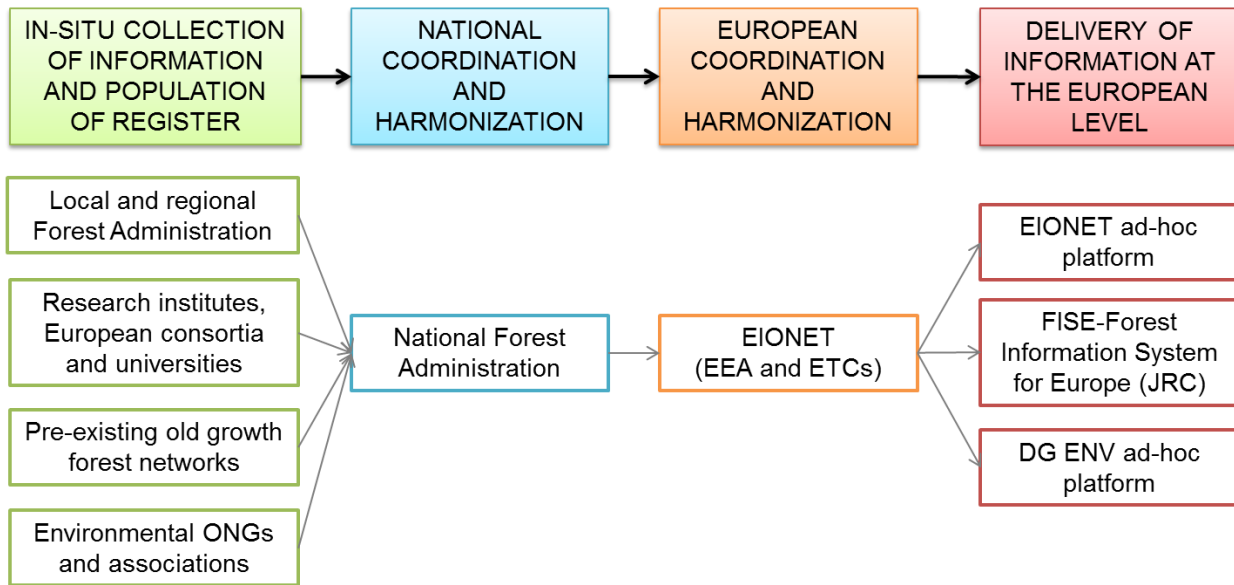
- From the table it can be noted that none of the selected aspects/variables were present simultaneously in all databases, but there are some which were present in several of them (at least six).
 - Those variables are geo-location, old growth forest area, dominant tree species, other tree species, presence of protected area and human activities. On the other hand, there are aspects/variables mentioned only in a few or no databases: forest area, forest age, forest structure, presence of old trees and deadwood volume.
- Two databases from Slovakia and the Czech Republic were inspected into more detail (information was obtained from the database webpages as well as from their authors). The following variables are present in the forest databases of both countries: geo-location, GIS availability, old growth forest area, dominant tree species, other tree species, protected area, presence of old trees, deadwood volume and human activities.
- All of those variables are considered important for the description of old growth forest in general. Therefore they are recommended to be used within the proposed common European old growth forest register in the following structure: Geo-location, old growth forest area, dominant tree species, other tree species, presence of protected area, presence of old trees (and their volume, if possible), presence of deadwood (and its volume, if possible) and human activities (in the present and in the past).

In Annex 7, factsheets with one example of old growth forest from some of the Central and Eastern European countries are displayed.

5 Implementation of the register

The register must be implemented systematically. The proposed flow of information is shown in Figure 5.1.

Figure 5.1 Basic process for the implementation of the register



Among the alternative and complementary sources of information can be highlighted the local or regional forest administrations that collect first-hand data, the academia and research institutions carrying out projects that investigate the processes and functions of specific forests, the pre-existing old growth forest networks (such as the old-growth forest database of the Italian Academy of Forest Sciences) and the environmental NGOs and associations (e.g. WWF, Wild Europe). These institutions and stakeholders should gather the information in as homogeneously as possible, using factsheets similar to the one proposed. At least a number of fields must necessarily be filled-in. All the information already existing must be also transformed into these templates in order to be later used. National Forest Administrations must centralize and collect all the information and generate national databases and maps about these forests. It must be noted that some countries such as France (Gilg, 2005) and Italy (Blasi *et al.*, 2010) have already created old growth forest networks.

The European environment information and observation network (EIONET) has an instrumental role on the collection and harmonisation of the datasets provided by the countries and other parties. EIONET is a partnership network of the European Environment Agency (EEA) and its member and cooperating countries. It consists of the EEA itself, six European Topic Centres (ETCs) and a network of around 1000 experts from 39 countries in over 350 national environment agencies and other bodies dealing with environmental information. These are the National Focal Points (NFPs) and the National Reference Centres (NRCs). EIONET must benefit of this large knowledge network to coordinate and harmonize the European register. In the case of trans-national projects developed by consortia or initiatives such as the Carpathian Convention, EIONET may also be instrumental for the collection and harmonisation of the data.

The information contained in the register may be delivered at the European level using an ad-hoc platform included in EIONET. It could also be incorporated to the Forest Information System of Europe (FISE-JRC), mentioned above, which is an objective of the EU Forest Strategy. Another alternative is that the information could also be allocated in an ad-hoc platform administrated by DG ENV services. In all cases, an appropriate infrastructure and powerful servers to store and display a large amount of data and maps (maybe interactively) are needed.

6 Conclusions

- The creation of a European register of old growth forests can be justified by the benefits that it would entail in the compliance of EU policy requirements (including potential links to FISE-JRC), the improvement of mapping and classifications, the delimitation of protected land, the update of indicators, the enhancement of forest planning and prioritization of uses, the knowledge transfer and the satisfaction of societal demands.
- The review and catalogue of datasets and maps related to old growth forests provided in ETC/BD Working Paper N°B/2015 (García Feced *et al.*, 2015) are useful to explore the information sources from which the register could be populated.
- The first step for the creation of a register would be to agree on a common working terminology, setting flexible but operative criteria to identify old growth forests across Europe.
- In order to create an harmonised register, factsheets with needed fields are proposed. These fields contain basic information to identify the old growth forest, data of the main characteristics related to old-growth attributes and other interesting information.
- Provided examples for the Scandinavian countries and the Central and Eastern European countries show how uneven is the availability of information across countries and the challenges that the creation of the register would face.
- The implementation of the register must be a collaborative effort with the involvement of institutions and stakeholder at all levels. An organized framework of information sources, national administrations, EIONET and FISE-JRC is recommended.

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Annex 1 Definitions of old growth forest in some European countries

<p>SCANDINAVIAN COUNTRIES: Lloyd (ed.), 1999. The last of the last: The Old-growth Forests of Boreal Europe. Taiga Rescue Network.</p>
<p>“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”.</p>
<p>ROMANIA: 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</p>
<p>The paper uses the term “old-growth forests”, following Wirth <i>et al.</i> (2009) 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).</p>
<p>SLOVAKIA: Jasík, M., Polák, P., (eds.), 2011. Pralesy Slovenska. FSC Slovensko, Banská Bystrica, 228 stran. (in Slovak)</p>
<p>“An old-growth forest is a 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”.</p>
<p>ITALY: Old-growth forest database of the Italian Academy of Forest Sciences (AISF). Extracted from EEA Technical report No 13/2014.</p>
<p>“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”.</p>
<p>ITALY: 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)</p>
<p>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 characterized 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”.</p>
<p>FRANCE: Gilg, O., 2005. Old-growth forests: characteristics, conservation and monitoring. Habitat and species management. Atelier technique des espaces naturels. Technical Report, 74.</p>

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 layers, specific composition and ecological functions; forests without signs of recent logging and comprised of native species”.

SPAIN: EUROPARC-España, 2015. El papel de los bosques maduros en la conservación de la biodiversidad. Grupo de Conservación de EUROPARC-España. Versión mayo 2015.

The report reviews the concept of old-growth forests (“bosques maduros” in Spanish) and 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”.

IRELAND: 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.

“Ancient woodlands are 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 woodlands are those that have been continuously wooded since 1830”.

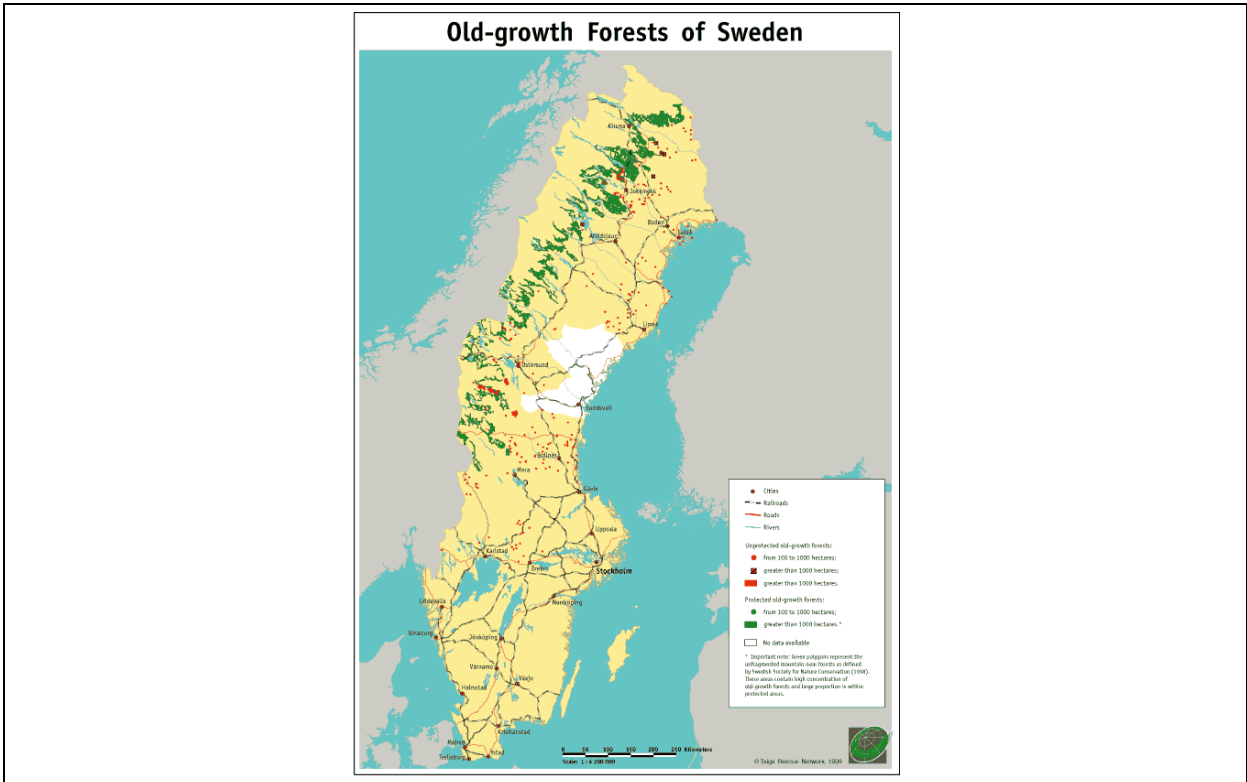
UNITED KINGDOM: Ancient woodland inventories

“Ancient woodland is a land continuously wooded since at least 1600”.

Annex 2 Examples of old growth forest dataset factsheet

Extracted from ETC/BD Working paper N°B/2015 “Information related to European old growth forests” (García Feced *et al.*, 2015; http://bd.eionet.europa.eu/Reports/ETCBDTechnicalWorkingpapers/European_old_growth_forests, last accessed 27 March 2016).

DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
Coverage	SWEDEN
Dataset 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 forests 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

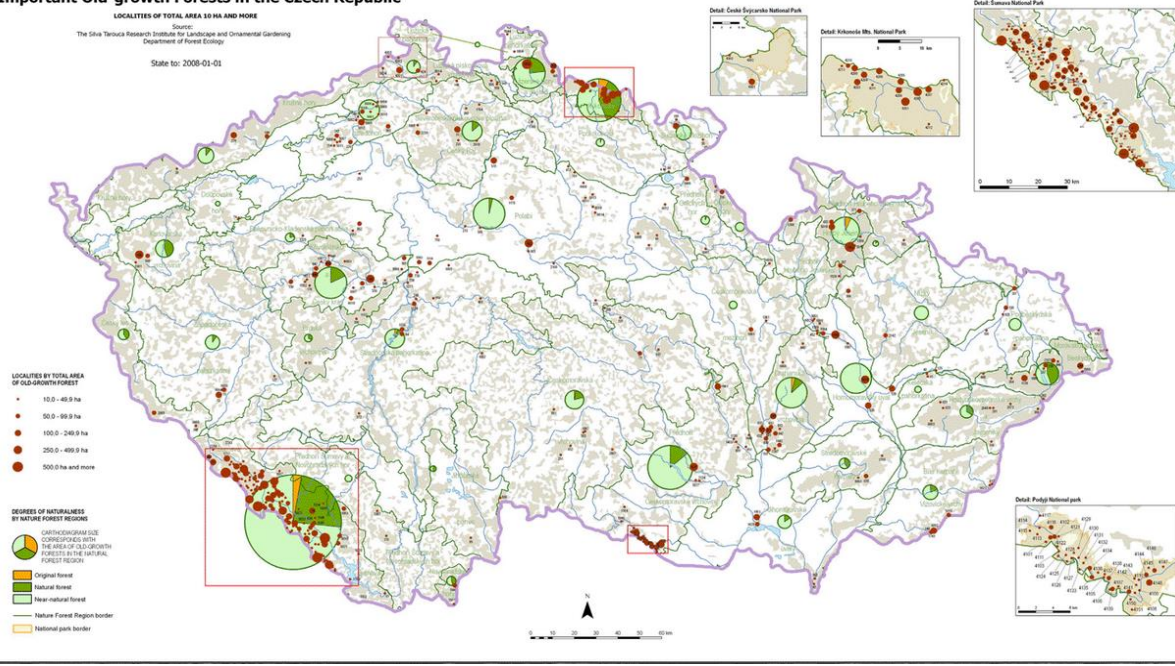


DATASETS WITH INFORMATION RELATED TO OLD GROWTH FORESTS IN EUROPE	
Coverage	CZECH REPUBLIC
Dataset title	Old-growth forests national databank (status in 2008)
Original title	Project: Czech natural forests database
Source	http://www.pralesy.cz/?id=6767 (in English) Authors: The Silva Tarouca Research 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	<p>Three categories are determined:</p> <ol style="list-style-type: none"> 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) <p>Size limit: at least 5 ha</p> <p>Parameters used for naturalness assessment of old-growth forests:</p> <ol style="list-style-type: none"> 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 <p>For details (definition and criteria) see this poster: http://www.pralesy.cz/publik_syst2/files/POSTER_Tasmania_08.gif</p>
Main references	<p>Nature Conservation Agency of the Czech Republic (NCA), Institute of Forest Ecosystem Research (IFER), The Forest Management Institute (FMI), Protected Landscape Areas (2004): <i>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)</i>, 202 pp. (in Czech)</p> <p>Hort L., Tesař V., Vrška T. (1999): <i>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</i>. Biotechnical Faculty, Ljubljana, Slovenia, pp. 25-44. (in Czech)</p>
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

Important Old-growth Forests in the Czech Republic

LOCALITIES OF TOTAL AREA 10 HA AND MORE
Source:
The Siles Tereza Research Institute for Landscape and Ornamental Gardening
Department of Forest Ecology
State to: 2008-01-01



Annex 3 Criteria and indicators for the selection of virgin forests in the Carpathians

<p>Criteria and Indicators for selection of virgin forests in the Carpathians. Mikulov (Czech Republic), 2014. http://www.carpathianconvention.org/documents-thematic-areas.html</p>		
<p>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.</p>		
<p>Objective: The purpose of this definition is to detail criteria and indicators for virgin forests identification, mapping and strict protection.</p>		
<p>CRITERIA & INDICATORS FOR SELECTION OF VIRGIN FORESTS IN THE CARPATHIANS</p>		
<p>A1. Criterion: Naturalness</p>		
A.1.1.	Species composition	Forests formed of native/autochthonous 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	<p>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).</p> <p>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.</p> <p>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.</p> <p>Forest litter removal: No visible traces and no documentary evidence (by forest inventory and planning documents, archives, etc.).</p> <p>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.</p> <p>Recreation /education infrastructure: No recreation infrastructure.</p>
<p>A2. Criterion: Area & Delimitation</p>		
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.
<p>Guidelines: The evaluation for 1.2 and 1.3 will take into consideration the structure valuation – not on a surface unit but on the over all considered polygon. This description should be considered mainly for the minimum area (20 ha) in order to be sure that such a small patch does not occur due to anthropic 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.</p>		

Annex 4 Available information in the Scandinavian countries' datasets

Information collected by Håkan Berglund (SLU).

DENMARK

Country	Denmark	Denmark	Denmark	Denmark
Dataset name	National Forest Inventory	Protected areas	Natura 2000 habitat types	Biodiversity map/HNV forests
Source	Copenhagen University	Danish Nature Agency	Danish Nature Agency	Danish Nature Agency
Geo-location	No	Yes (polygon)	Yes (polygon)	Yes (raster)
GIS availability	No (no web services for viewing or downloading data from sample plots)	Yes (map services WMS, WFS; image and attribute data; http://www.miljoportal.dk/soeg/miljoedata/soeg_areal/Sider/download%20data.aspx)	Yes (map services WMS, WFS; image and attribute data; http://www.miljoportal.dk/soeg/miljoedata/soeg_areal/Sider/download%20data.aspx)	Yes (map services WMS, WFS; image and attribute data; http://www.miljoportal.dk/soeg/miljoedata/soeg_areal/Sider/download%20data.aspx)
Old-growth forest area	Yes (average estimates at large spatial scale, e.g. county level; an old-growth forest definition based on local stand data may be applied)	No	No (areas classified as forest habitat types of the EU Habitats Directive)	No
Forest area	Yes (average estimates at large spatial scale, e.g. county level; any forest land definition may be applied)	No (only total land area; square meters)	Yes	No
Protected area	Yes (average estimates at large spatial scale, e.g. county level)	Yes	Yes (square meters)	No
Dominant tree species	Yes (average estimates at large spatial scale, e.g. county level)	No	No (some habitats are by definition dominated by certain tree species)	No
Other tree species	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No
Forest age	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No
Forest structure	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No
Presence of old trees	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No
Deadwood volume	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No
Human activities	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No
Other information	Yes (average estimates at large spatial scale, e.g. county level)	Yes (type of protection according to national definitions, etc.)	Yes (descriptive, administrative text)	No

http://kartkatalog.miljodirektoratet.no/Map_catalog_dataset_download_overview.asp

<http://kart.naturbase.no/>

FINLAND

Country	Finland	Finland	Finland	Finland	Finland
Dataset name	National Forest Inventory	Nationally designated protected areas	Forest areas within Natura 2000 sites	National conservation programmes	Old-growth forests
Source	Finnish Forest Research Institute	Finnish Environmental Administration	Finnish Environmental Administration	Finnish Environmental Administration	Taiga Rescue Network
Geo-location	No	Yes (polygon)	Yes (polygon)	Yes (polygon)	Yes (polygon)
GIS availability	No (no web services for viewing or downloading data from sample plots)	Yes (map services WMS, WFS; image and attribute data; http://www.syke.fi/fi-FI/Avoim_tieto/Paikkatietoaaineistot ; https://syke.maps.arcgis.com/home/)	Yes (map services WMS, WFS; image and attribute data; http://www.syke.fi/fi-FI/Avoim_tieto/Paikkatietoaaineistot ; https://syke.maps.arcgis.com/home/)	Yes (map services WMS, WFS; image and attribute data; http://www.syke.fi/fi-FI/Avoim_tieto/Paikkatietoaaineistot ; https://syke.maps.arcgis.com/home/)	No (no map services; permission required for GIS access)
Old-growth forest area	Yes (average estimates at large spatial scale, e.g. county level; an old-growth forest definition based on local stand data may be applied)	No (but some areas have by definition a high forest stand age)	No (but some areas have by definition a high forest stand age)	No (but some areas have by definition a high forest stand age)	No
Forest area	Yes (average estimates at large spatial scale, e.g. county level; any forest land definition may be applied)	Yes	Yes	Yes	No
Protected area	Yes (average estimates at large spatial scale, e.g. county level)	Yes	Yes	Yes	?
Dominant tree species	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No	?
Other tree species	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No	?
Forest age	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No	?
Forest structure	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No	?
Presence of old trees	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No	?
Deadwood volume	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No	?
Human activities	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No	?
Other information	Yes (average estimates at large spatial scale, e.g. county level)	Yes (type of protection according to national definitions, etc.)	Yes (type of Natura 2000 area; SCI, SAC and SPA)	Yes (type of protection according to national definitions, etc.)	?

NORWAY

Country	Norway	Norway	Norway	Norway	Norway
Dataset name	National Forest Inventory	Protected areas	Important and selected habitat types	Complementary hotspot inventory	Old-growth forests
Source	Norwegian Institute of Bioeconomy Research	Norwegian Environment Agency	Norwegian Environment Agency	Norwegian Institute of Bioeconomy Research	Taiga Rescue Network
Geo-location	No	Yes (polygon)	Yes (polygon)	Yes (polygon/point)	Yes (polygon)
GIS availability	No (no web services for viewing or downloading data from sample plots)	Yes (map services WMS, WFS; image and attribute data; http://karteksport.miljodirektoratet.no/)	Yes (map services WMS, WFS; image and attribute data; http://karteksport.miljodirektoratet.no/)	No (no map services; permission required for GIS access)	No (no map services; permission required for GIS access)
Old-growth forest area	Yes (average estimates at large spatial scale, e.g. county level; an old-growth forest definition based on local stand data may be applied)	No	? (but some habitats have by definition a high forest stand age)	? (but some habitats have by definition a high forest stand age)	? (but some habitats have by definition a high forest stand age)
Forest area	Yes (average estimates at large spatial scale, e.g. county level; any forest land definition may be applied)	No (not available as attribute data)	No (not available as attribute data)	?	?
Protected area	Yes (average estimates at large spatial scale, e.g. county level)	Yes	No	?	?
Dominant tree species	Yes (average estimates at large spatial scale, e.g. county level)	No	No (but some habitats are by definition dominated by certain tree species)	?	?
Other tree species	Yes (average estimates at large spatial scale, e.g. county level)	No	No	?	?
Forest age	Yes (average estimates at large spatial scale, e.g. county level)	No	No	?	?
Forest structure	Yes (average estimates at large spatial scale, e.g. county level)	No	No	?	?
Presence of old trees	Yes (average estimates at large spatial scale, e.g. county level)	No	No	?	?
Deadwood volume	Yes (average estimates at large spatial scale, e.g. county level)	No	No	?	?
Human activities	Yes (average estimates at large spatial scale, e.g. county level)	No	No	?	?
Other information	Yes (average estimates at large spatial scale, e.g. county level)	Yes (type of protection according to national definitions, IUCN Protected Areas Category, etc.)	Yes (descriptive, administrative text)	?	?

SWEDEN

Country	Sweden	Sweden	Sweden	Sweden	Sweden
Dataset name	National Forest Inventory	National terrestrial habitat monitoring	Protected areas	Forests in Natura 2000 sites	Natura 2000 habitat types
Source	Swedish University of Agricultural Sciences	Swedish University of Agricultural Sciences	Swedish Environmental Protection Agency	Swedish Environmental Protection Agency	Swedish Environmental Protection Agency
Geo-location	No	No	Yes (polygon)	Yes (polygon)	Yes (polygon)
GIS availability	No (no web services for viewing or downloading data from sample plots)	No (no web services for viewing or downloading data from sample plots)	Yes (map services WMS, WFS; image and attribute data; http://mdp.vic-metria.nu/miljodataportalen/)	Yes (map services WMS, WFS; image and attribute data; http://mdp.vic-metria.nu/miljodataportalen/)	Yes (map services WMS, WFS; image and attribute data; http://mdp.vic-metria.nu/miljodataportalen/)
Old-growth forest area	Yes (average estimates at large spatial scale, e.g. county level; an old-growth forest definition based on local stand data may be applied)	Yes (average estimates at large spatial scale, e.g. county level; an old-growth forest definition based on local stand data may be applied)	No	No	No (but most habitats have by the Swedish definition a high forest stand age)
Forest area	Yes (average estimates at large spatial scale, e.g. county level; any forest land definition may be applied)	Yes (average estimates at large spatial scale, e.g. county level; any forest land definition may be applied)	Yes (productive forest and total land area; hectares)	No (only total land area not forest land area; hectares)	Yes
Protected area	Yes (average estimates at large spatial scale, e.g. county level)	Yes (average estimates at large spatial scale, e.g. county level)	Yes	Yes	Yes (square meters)
Dominant tree species	Yes (average estimates at large spatial scale, e.g. county level)	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No (but some habitats are by definition dominated by certain tree species)
Other tree species	Yes (average estimates at large spatial scale, e.g. county level)	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No
Forest age	Yes (average estimates at large spatial scale, e.g. county level)	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No (most habitats have by the Swedish definition a high the stand age)
Forest structure	Yes (average estimates at large spatial scale, e.g. county level)	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No
Presence of old trees	Yes (average estimates at large spatial scale, e.g. county level)	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No
Deadwood volume	Yes (average estimates at large spatial scale, e.g. county level)	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No
Human activities	Yes (average estimates at large spatial scale, e.g. county level)	Yes (average estimates at large spatial scale, e.g. county level)	No	No	No
Other information	Yes (average estimates at large spatial scale, e.g. county level)	Yes (average estimates at large spatial scale, e.g. county level)	Yes (type of protection according to national definitions, IUCN Protected Areas Category, etc.)	Yes (type of Natura 2000 area; SCI, SAC and SPA)	Yes (descriptive, administrative text)

Country	Sweden	Sweden	Sweden	Sweden	Sweden
Dataset name	Forests for protection and primeval	Woodland key habitats	Old-growth forests	Forest areas	Voluntarily set-aside forest areas
Source	Swedish Environmental Protection Agency	Swedish Forest Agency	Taiga Rescue Network	Swedish Society of Nature conservation	Swedish Forest Industries Federation
Geo-location	Yes (polygon)	Yes (polygon)	Yes (polygon)	No (only viewable with coarse spatial resolution)	No (only viewable with coarse spatial resolution)
GIS availability	Yes (map services WMS, WFS; image and attribute data; http://mdp.vic-metria.nu/miljodataportalen/)	Yes (map services WMS, WFS; image and attribute data; http://skogsdataportalen.skogsstyrelsen.se/Skogsdataportalen/)	No (no map services; permission required for GIS access)	No (no map services; permission required for GIS access)	No (no map services; permission required for GIS access)
Old-growth forest area	No (but most areas have by definition a high forest stand age)	No (but most areas have by definition a high forest stand age)	? (but some habitats have by definition a high forest stand age)	? (but some habitats have by definition a high forest stand age)	? (but some habitats have by definition a high forest stand age)
Forest area	Yes (productive forest and total land area; hectares)	Yes (productive forest land; hectares)	?	?	?
Protected area	No	No	?	?	?
Dominant tree species	No	No (the GIS attribute data do not contain info about tree species, but it is given on the home page of each habitat)	?	?	?
Other tree species	No	No (the GIS attribute data do not contain info about other species, but it is given on the home page of the habitat)	?	?	?
Forest age	No	No (only in qualitative descriptive text)	?	?	?
Forest structure	No	No (only in qualitative descriptive text)	?	?	?
Presence of old trees	No	No (only in qualitative descriptive text)	?	?	?
Deadwood volume	No	No (only in qualitative descriptive text)	?	?	?
Human activities	No	No (only in qualitative descriptive text)	?	?	?
Other information	No	Yes (descriptive, administrative text)	?	?	?

Annex 5 Examples of factsheet based on the proposed model for a register of old growth forests in the Scandinavian countries

Information collected by Håkan Berglund (SLU).

REGISTER OF OLD GROWTH FORESTS IN THE SCANDINAVIAN COUNTRIES	
Country	DENMARK
Old growth forest name	Ledreborg Gods (national registration number 00827) within the Natura 2000 area Hejede Overdrev, Valborup Skov og Valsølille Sø (SITECODE DK004X216), Sjaelland, Denmark
Geo-location	681,660.230 6,161,098.182 Meters (European Terrestrial Reference System 1989 Universal Transverse Mercator Zone 32N)
GIS availability	Yes (map services WMS, WFS; shape files; image and attribute data)
Source/s	Danish Nature Agency
References/Webpages	Miljøportal
Register date	2009
Old growth forest area	No (most of the area is composed of forests classified as habitats of the EU Habitats Directive, forest with long history or low degree of homogenized structure; see section in Fig. 1)
Surrounding forest area	No (data on this aspect may be compiled from other sources)
Dominant tree species	No
Other species	No (data on this aspect may be compiled from other sources)
Protected area	Yes (the total protected area is 1623 hectares)
Forest age	No
Forest structure	No
Presence of old trees	No
Deadwood volume	No
Human activities	No
Other information	Yes (type of protection according to national definitions, etc.)

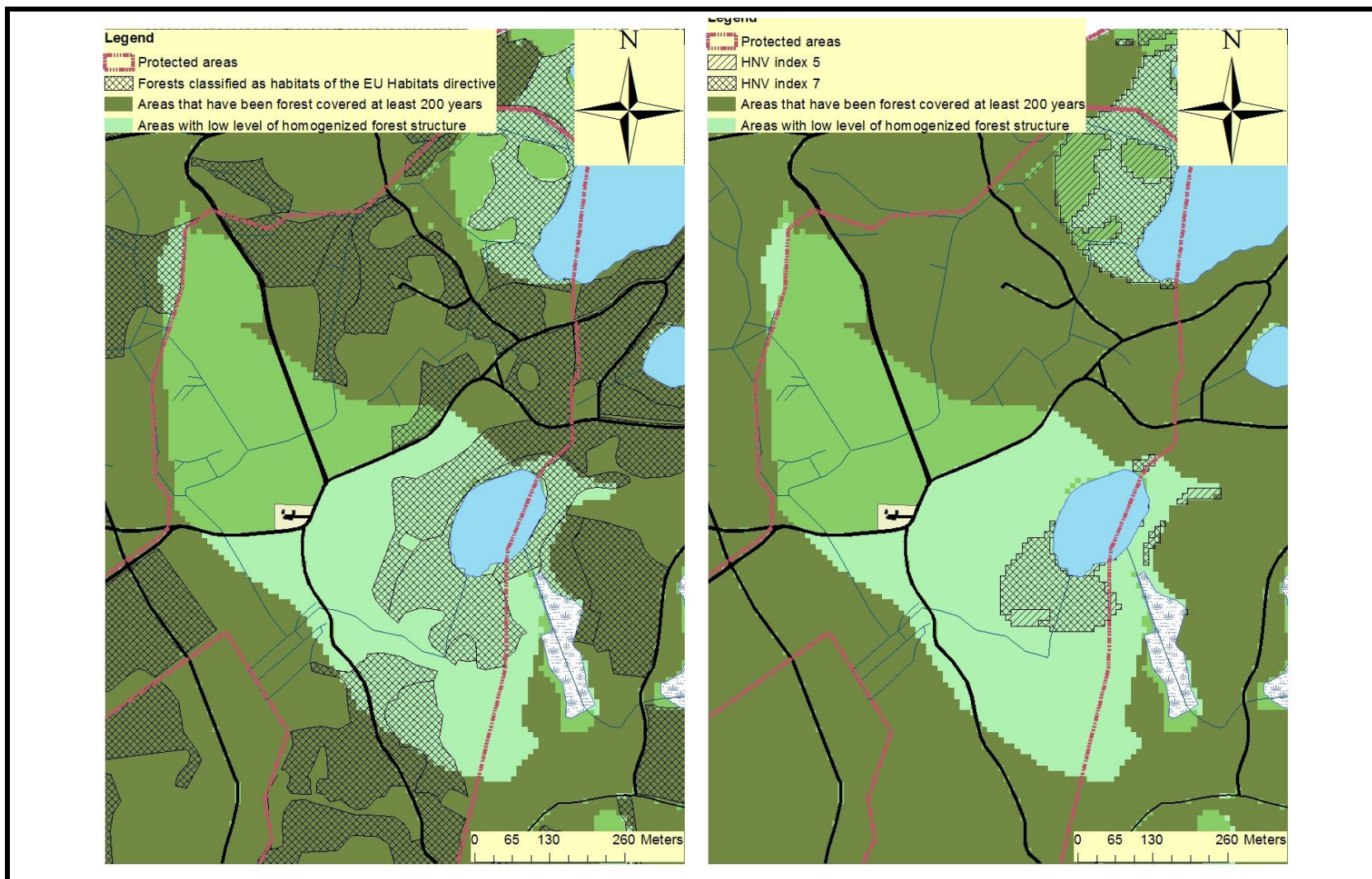


Fig. 1. The left map shows forest data for the protected area “[Ledreborg Gods](#)” (national registration number 00827) within the Natura 2000 area Hejede Overdrev, Valborup Skov og Valsøllille Sø ([SITECODE DK004X216](#)), Sjælland, Denmark. The polygon border of the protected area is from the dataset on protected areas (“Fredede områder”) while the polygons of habitat types are from the dataset on habitat types of the EU Habitats Directive (“Habitatområder”), all datasets are available from [Miljøportal](#). A raster data of forest history and structure (“[DIGITALE NATURKORT - til Et grønt Danmarks kort](#)”) has been added to illustrate the possibility to combine the previous datasets with addition forest data. The right map shows data on a biodiversity index (high nature value, HNV; ranging from 0 to 14) based on data on the distribution of biodiversity (endangered species observations) in combination with information on landscape parameters and agricultural activity.

REGISTER OF OLD GROWTH FORESTS IN THE SCANDINAVIAN COUNTRIES	
Country	FINLAND
Old growth forest name	Nuuksio national park (national registration number FI0100040)
Geo-location	362,224.942 6,688,237.057 Meters (EUREF FIN TM35FIN)
GIS availability	Yes (polygon)
Source/s	Finnish Environmental Administration
References/Webpages	Webportal Latauspalvelu LAPIO
Register date	2006-08-31
Old growth forest area	No (but some areas have by definition a high forest stand age)
Surrounding forest area	No (data on this aspect may be compiled from other sources)
Dominant tree species	No (data on this aspect may be compiled from other sources)
Other species	No (data on this aspect may be compiled from other sources)
Protected area	Yes (as a Natura 2000 area; total area is 5,600 hectares)
Forest age	No (data on this aspect may be compiled from other sources)
Forest structure	No (data on this aspect may be compiled from other sources)
Presence of old trees	No
Deadwood volume	No
Human activities	No
Other information	Yes (type of Natura 2000 area; SCI, SAC and SPA)

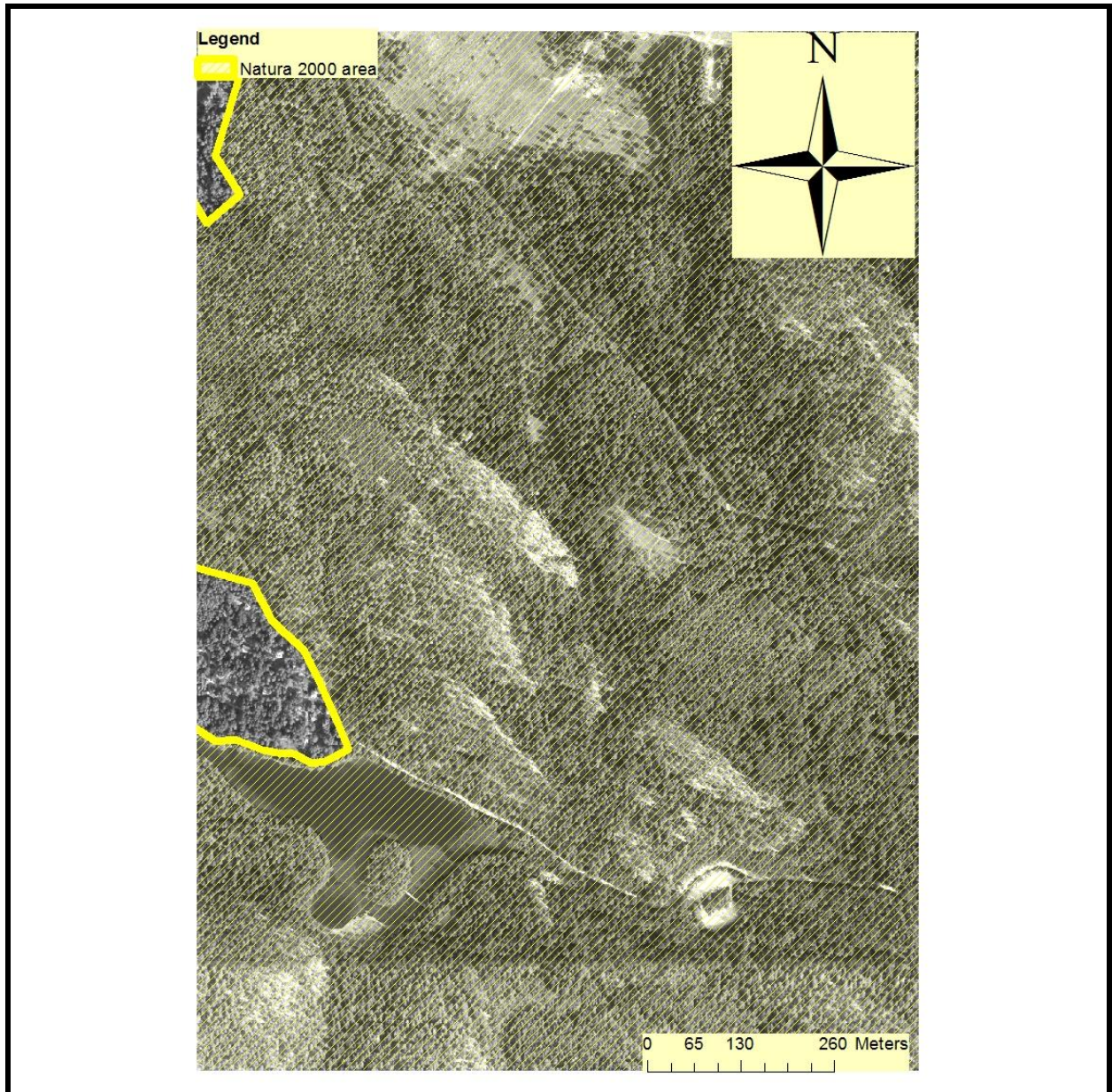


Fig. 2. Map showing a section of the protected Natura 2000 area “Nuuksio National Park” (national registration number [FI0100040](#)), Vihti, Espoo, Kirkkonummi, Southern Finland. Orthophoto as background picture.

REGISTER OF OLD GROWTH FORESTS IN THE SCANDINAVIAN COUNTRIES	
Country	NORWAY
Old growth forest name	“Larvik bøkeskog” (ID VV00001589)
Geo-location	214,770 6,557,129 Meters (European Terrestrial Reference System 1989 Universal Transverse Mercator Zone 32N)
GIS availability	Yes (map services WMS, WFS; shape files; image and attribute data)
Source/s	The Norwegian Environment Agency
References/Webpages	Karteksport
Register date	1980-06-13 (date of protection)
Old growth forest area	No (the total protected area is 29.7 hectares; most of the area is composed of forests classified as important broad-leaved deciduous forest habitat; Fig. 3)
Surrounding forest area	No (data on this aspect may be compiled from other sources)
Dominant tree species	No (data on this aspect may be compiled from other sources)
Other species	No (data on this aspect may be compiled from other sources)
Protected area	Yes (the area are not given by the GIS data, but it is 29.7 hectares)
Forest age	No (data on this aspect may be compiled from other sources; see Fig. 3)
Forest structure	No (data on this aspect may be compiled from other sources; see Fig. 3)
Presence of old trees	No
Deadwood volume	No
Human activities	No
Other information	Yes (type of protection according to national definitions, IUCN Protected Areas Category, etc.)

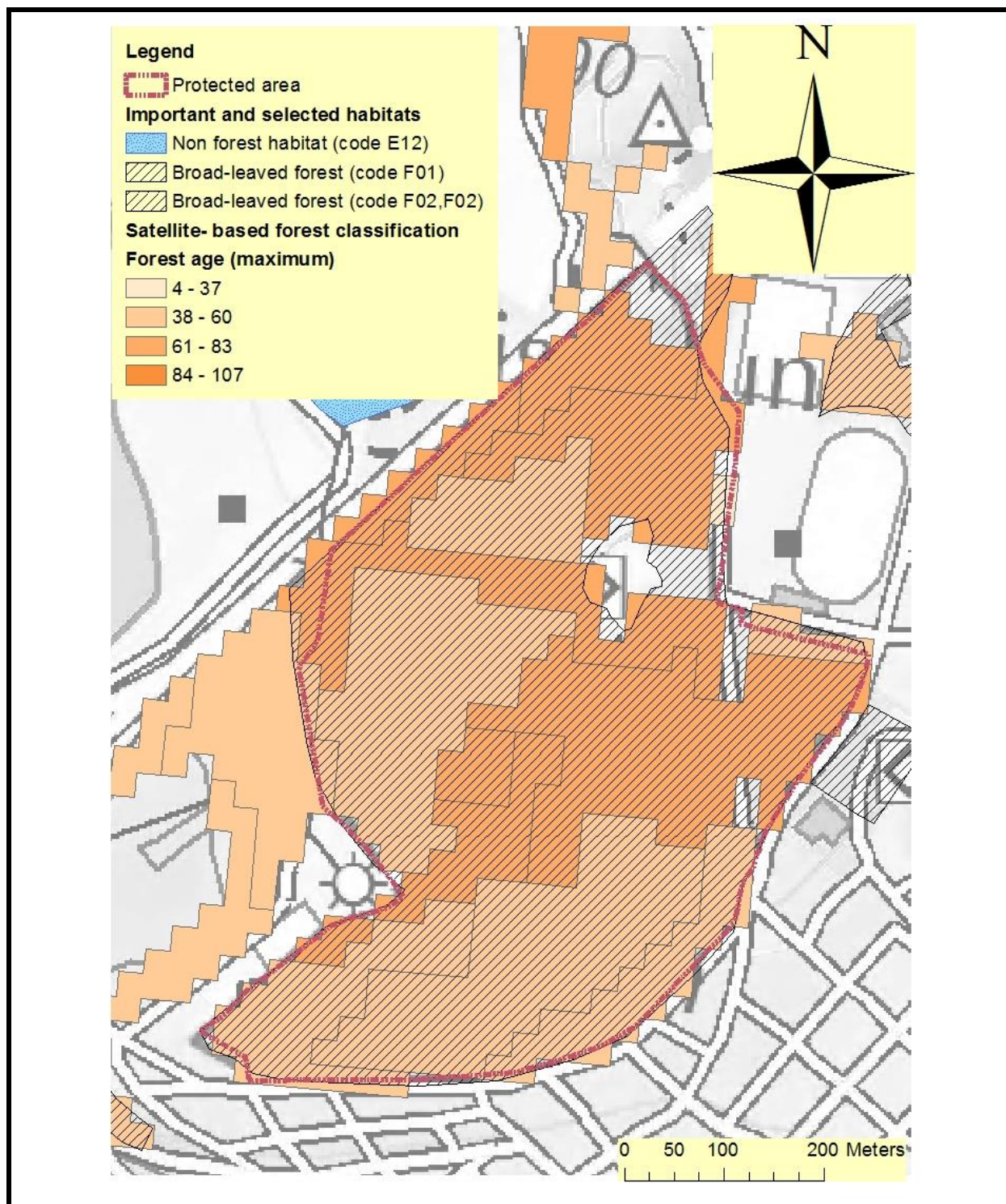


Fig. 3. Forest data compiled for the protected area “Larvik bøkeskog” ([ID VV00001589](#)), Larvik, Vestfold, Norway. The polygon border of the protected area is from the dataset on protected areas (“Naturvernområder”) while the polygons of habitat types are from the dataset on important and selected habitat types (“Viktige naturtyper”), all datasets are available from the web portal [Karteksport](#). A raster data from satellite-based classification of forests ([SAT-SKOG](#)) has been added to illustrate the possibility to combine the previous datasets with addition forest data (e.g. maximum age of forest).

REGISTER OF OLD GROWTH FORESTS IN THE SCANDINAVIAN COUNTRIES	
Country	SWEDEN
Old growth forest name	Bäcklösa Natura 2000 area (SITECODE SE0210291)
Geo-location	648,027.836 6,633,740.697 Meters (SWEdish REference Frame 1999, Transverse Mercator)
GIS availability	Yes (map services WMS, WFS; shape files; image and attribute data)
Source/s	Swedish Environmental Protection Agency
References/Webpages	Miljöportalen
Register date	2012-08-01
Old growth forest area	No (ca 5.9 hectares is classified as 9010 Western Taiga, which usually involves old natural forests; Fig 4)
Surrounding forest area	No (data on this aspect may be compiled from other sources)
Dominant tree species	No (data on this aspect may be compiled from other sources; see Fig. 4)
Other species	No (data on this aspect may be compiled from other sources)
Protected area	Yes (it is a Natura 2000 area; total land area is 44.3 hectares)
Forest age	No (data on this aspect may be compiled from other sources; areas classified as habitats have by definition a high forest stand age)
Forest structure	No (data on this aspect may be compiled from other sources)
Presence of old trees	No
Deadwood volume	No
Human activities	No
Other information	Yes (type of Natura 2000 area; SCI, SAC and SPA)

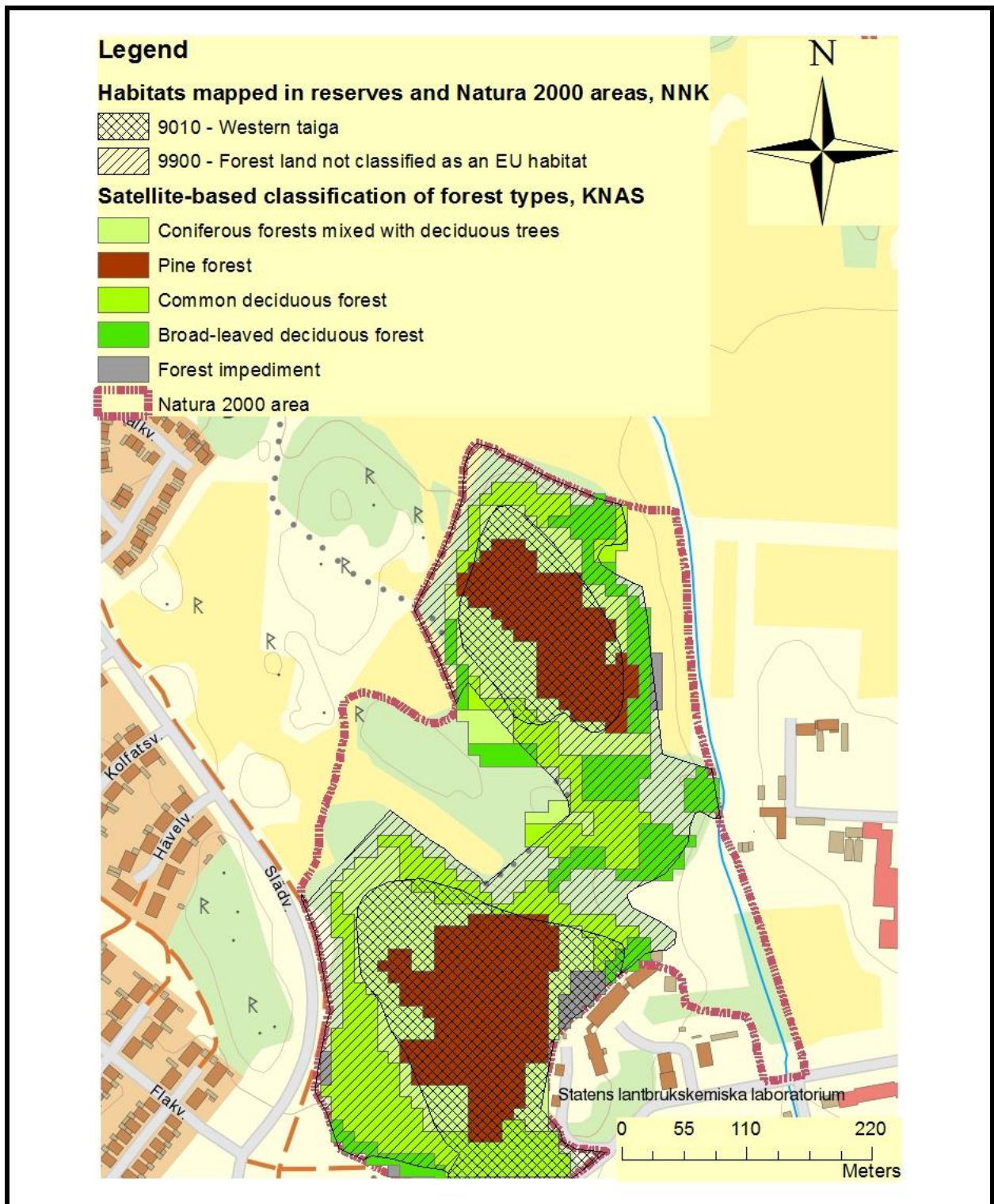


Fig. 4. Forest data compiled for the Natura 2000 area “Bäcklösa” ([SITECODE SE0210291](#)), Uppsala, Sweden. The polygon border of the Natura 2000 area is from the dataset on Natura 2000 areas (“Skyddade områden, Art- och habitatdirektivet Natura2000, SCI, SAC”) while the polygons of habitat types of the EU Habitats Directive are from the dataset on Natura 2000 habitat types (“Natura naturtypskartan, NNK”), both datasets are available from [Miljöportalen](#). A raster data from satellite-based habitat classification of forests within protected areas (“[Kontinuerlig Naturtypskartering av Skyddade områden, KNAS](#)”) has been added to illustrate the possibility to combine the previous datasets with addition forest data.

Annex 6 Available information in the Central and Eastern European countries' datasets

Information collected by Martin Strnad (AOPK).

Information about required aspects was searched for each of prescribed databases. "Yes", means that this aspect/variable was found in the database. "No", means that there is no such aspect/variable in the database.

Country	Bulgaria	Carpathian countries	Carpathian countries	Czech Republic	Germany	Germany	Hungary	Poland	Romania	Slovakia and Ukraine	Slovakia and Ukraine
Dataset name	Old-growth forests	Old-growth forests	Virgin forests	Old-growth forests	Ancient Beech Forests	Strict forest reserves	Forest reserves	Białowieża Forest	Virgin and Natural forests in Romania	Old-growth forests	Primeval beech forests
Source	WWF DCP Bulgaria	CCIBIS	Zsolt, 2002	The Silva Tarouca Research Institute for Landscape and Ornamental Gardening (RILOG)	UNESCO	The Natural Forests project group and Federal Agency for Agriculture and Food	Hungarian Academy of Science	UNESCO	Borlea et al., 2006	FSC Slovensko and PRALES, o.z.	UNESCO
Geo-location	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes
GIS availability	Yes	No	No	Yes	No	No	No	No	No	Yes	No
Old-growth forest area	No	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Forest area											
Dominant tree species	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other tree species	No	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Protected area	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Forest age	Yes, for the fragments in the map.	No	No	No	No	No	No	No	No	No	No
Forest structure	No	No	No	No	No	Yes	No	No	No	No	No
Presence of old trees	No	No	No	Yes	Yes, but no information about volume.	No	No	No	No	Yes	Yes (for Slovakia)/ No (for Ukraine)
Deadwood volume	No	No	No	Yes	No	No	No	No	No	Yes	No
Human activities	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes	No
Other information	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes	Yes
Comments	Map application only in Bulgarian.	Only map application, without any other information about individual localities.	Only in Hungary.	No	No	No	No	No	This new paper has been recently found. It is not included in the previous scoping document.	Protected area information is not available in old-growth forest databases (information existing only for some localities), but there is special shapefile for protected areas.	No

Annex 7 Examples of factsheet based on the proposed model for the register of old growth forests in the Central and Eastern European countries

Information collected by Martin Strnad (AOPK).

One forest area was chosen and described within each database. Most of these forest areas are made up by beech forest, which is the typical forest habitat in Middle Europe.

REGISTER OF OLD GROWTH FORESTS IN CENTRAL AND EASTERN EUROPE	
Country	BULGARIA
Old growth forest name	Chuprene
Geo-location	Map application – searching for locality only in Bulgaria http://pdbase.government.bg/zpo/en/area.jsp?NEM_Partition=1&categoryID=1&areaID=27 http://gis.wwf.bg/forests/
GIS availability	Yes, shapefile data to download
Source/s	
References/Webpages	http://pdbase.government.bg/zpo/en/area.jsp?NEM_Partition=1&categoryID=1&areaID=27
Register date	Click here to enter text.
Old growth forest area	Click here to enter text.
Surrounding forest area	Click here to enter text.
Dominant tree species	<i>Picea abies</i>
Other species	Click here to enter text.
Protected area	Biosphere reserve, 1451.99 ha
Forest age	Click here to enter text.
Forest structure	On the map application the locality is divided into parts, to which information about age and main tree species is present, but you have to click on it in the map to get it
Presence of old trees	Click here to enter text.
Deadwood volume	Click here to enter text.
Human activities	All activities are prohibited in the forest reserve except: 1. its conservancy; 2. visits with a scientific purpose; 3. people walking on the designated paths, including when it's with an educational purpose; 4. collection of seeds, wild plants, and animals with a scientific purpose.
Other information	The only compact natural spruce relict forests in the Western Old mountain.

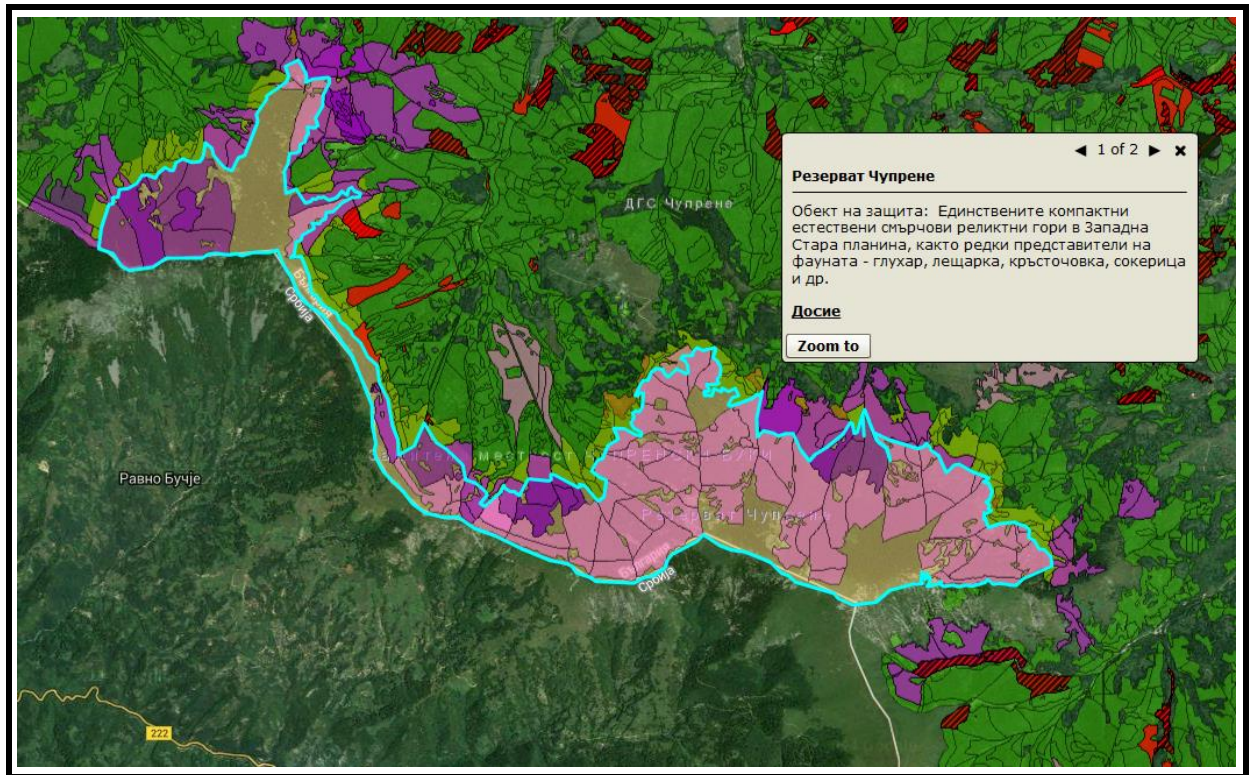


Fig. 5. Chuprene forest, Bulgaria

REGISTER OF OLD GROWTH FORESTS IN CENTRAL AND EASTERN EUROPE	
Country	CARPATHIAN COUNTRIES
Old growth forest name	Bargau
Geo-location	Click here to enter text.
GIS availability	Click here to enter text.
Source/s	Zsolt, B., 2002. List of virgin forest fragments in the Carpathians, their most relevant data and attributes. ER 2(1): 397-423.
References/Webpages	Click here to enter text.
Register date	Click here to enter text.
Old growth forest area	3600ha
Surrounding forest area	Click here to enter text.
Dominant tree species	<i>Fagus sylvaticus</i>
Other species	<i>Picea abies</i>
Protected area	No protected area
Forest age	Click here to enter text.
Forest structure	Click here to enter text.
Presence of old trees	Click here to enter text.
Deadwood volume	Click here to enter text.
Human activities	Click here to enter text.
Other information	Click here to enter text.

REGISTER OF OLD GROWTH FORESTS IN CENTRAL AND EASTERN EUROPE	
Country	CZECH REPUBLIC
Old growth forest name	Kohoutov
Geo-location	http://pralesy.cz/178-kohoutov under Map - Naturalness of assessment 49°55'20.303"N, 13°46'16.670"E
GIS availability	Yes, in shapefile format
Source/s	Yes - http://pralesy.cz/105-hodnoceni-plp-1-kohoutov , http://pralesy.cz/178-
References/Webpages	Yes - http://pralesy.cz/105-hodnoceni-plp-1-kohoutov , http://pralesy.cz/178-
Register date	1998 (2 nd census), 1978 (1 st census)
Old growth forest area	Original forest – 0 ha, natural forest - 29,14 ha, near-natural forest – 0 ha
Surrounding forest area	No
Dominant tree species	Yes
Other species	Yes
Protected area	Yes, 29,14ha, NPR Kohoutov
Forest age	No
Forest structure	No
Presence of old trees	Yes
Deadwood volume	Yes
Human activities	In the last ten years <i>Abies alba</i> was artificially planted, except that, spontaneous development since 1934
Other information	

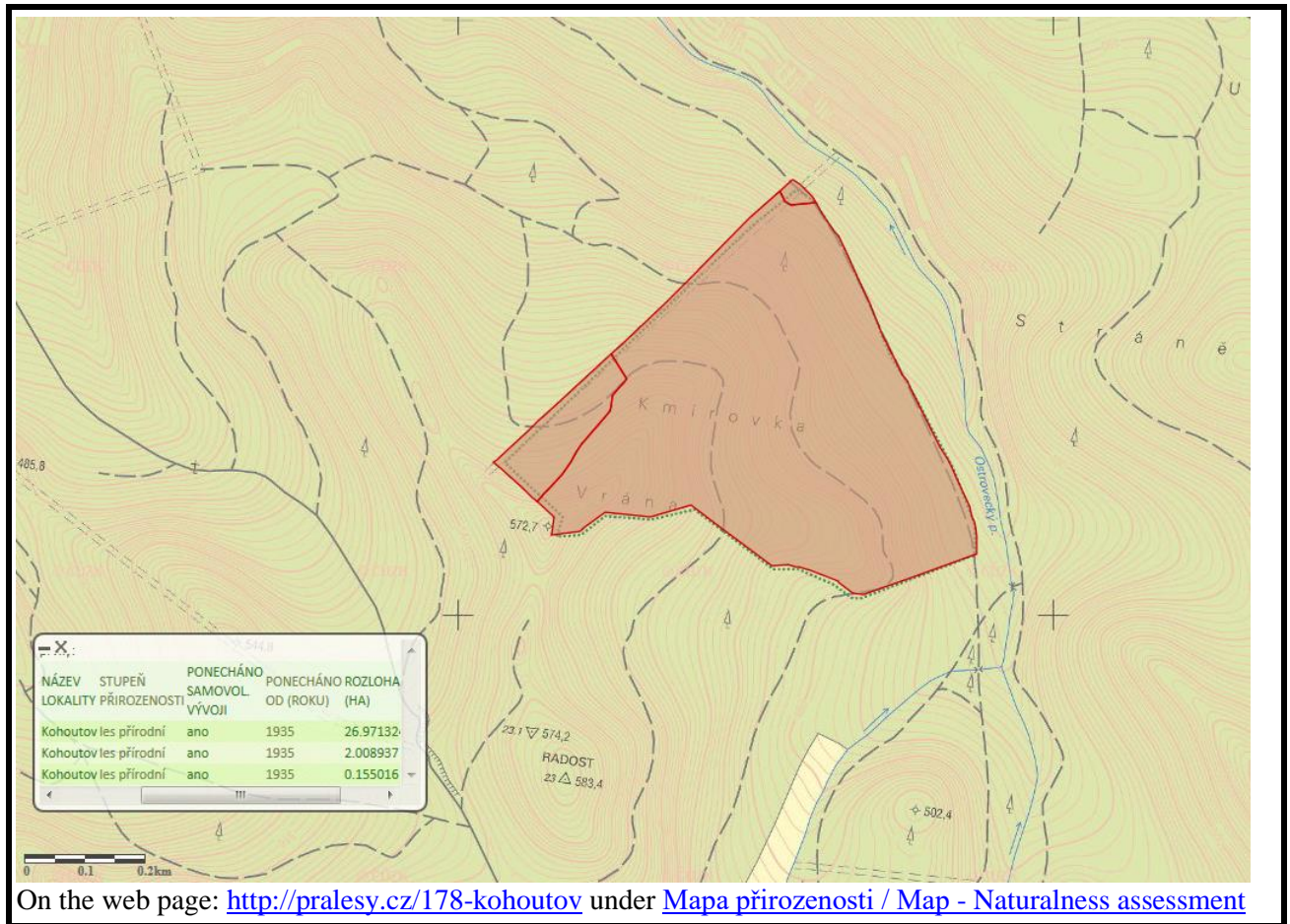


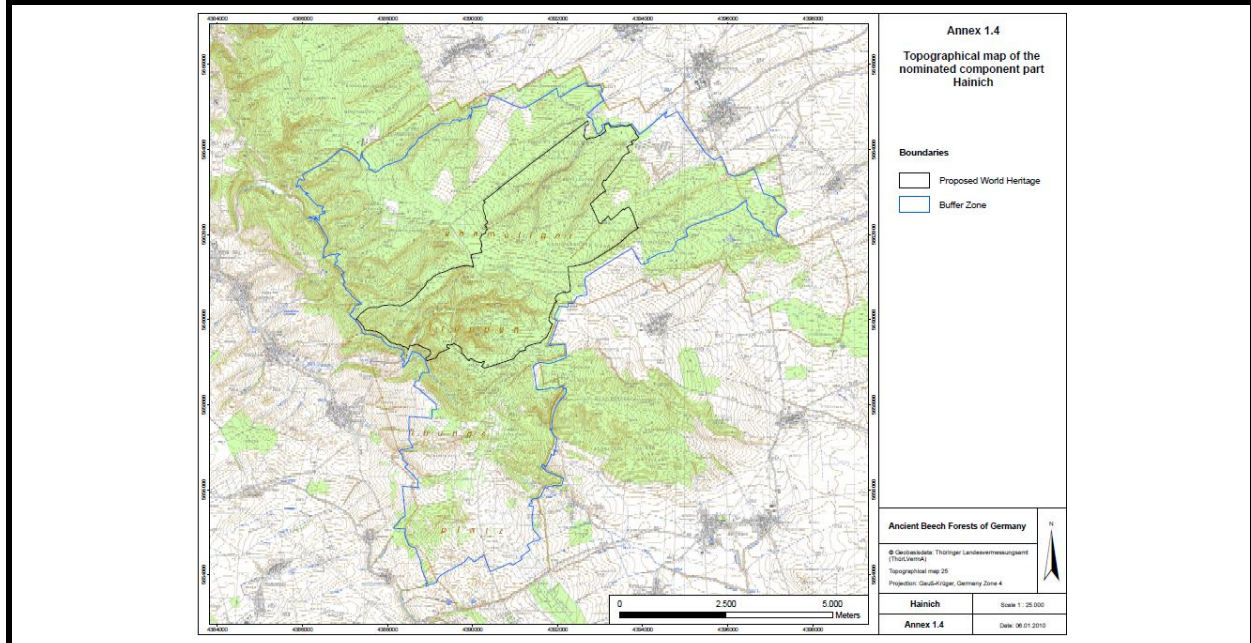
Fig. 6. This locality belongs among 20 well preserved study sites, which are monitored into detail. Many detailed measurements describing attributes of each trunk (laying x standing) within the whole site are repeatedly done in these “top 20” old-growth forest localities.

Attributes of the trunks are: species, location, vitality/shape (healthy without breakage, living breakage, stump, dead stump, windfall), degree of decomposition (solid, rotting, broken up), orientation, tree ID, trunk ID, thickness in the breast-height (1,3 m), top thickness (only for living breakages, stumps), height, length, balanced trunk height (calculated from graphical timetable), circular base of the trunk in the breast-height (1,3 m), trunk volume.

These trunk attributes are monitored only in core zones (and inventoring plots) within another set of localities which were chosen for non-intervention.

REGISTER OF OLD GROWTH FORESTS IN CENTRAL AND EASTERN EUROPE	
Country	GERMANY
Old growth forest name	Hohe Burg
Geo-location	WGS84: 53,853336; 11,829901
GIS availability	Click here to enter text.
Source/s	http://www.naturwaelder.de/index.php?tpl=detail&id_nwr=707
References/Webpages	Click here to enter text.
Register date	Click here to enter text.
Old growth forest area	Click here to enter text.
Surrounding forest area	Click here to enter text.
Dominant tree species	<i>Fagus sylvatica</i>
Other species	<i>Alnus glutinosa, Picea abies</i>
Protected area	30,2 ha
Forest age	Click here to enter text.
Forest structure	<i>Fagus sylvatica</i> : 0 – 40 years, 31-40% <i>Fagus sylvatica</i> : 121-160 years, 31-40% <i>Alnus glutinosa</i> : 0 – 40 years, 0-10% <i>Picea abies</i> : 0-10%
Presence of old trees	Click here to enter text.
Deadwood volume	Click here to enter text.
Human activities	Click here to enter text.
Other information	91-100% - limestone beech forest , 0-10% alder tree forest

REGISTER OF OLD GROWTH FORESTS IN CENTRAL AND EASTERN EUROPE	
Country	GERMANY
Old growth forest name	Hainich
Geo-location	N51 4 43.00; E10 26 8.00, http://whc.unesco.org/en/list/1133/multiple=1&unique_number=1777
GIS availability	
Source/s	http://weltnaturerbe-buchenwaelder.de/en/ancient-beech-forests-of-germany/hainich-national-park.html
References/Webpages	
Register date	2011
Old growth forest area	World Natural Heritage Property: 1573.4 ha (central area of NP), Buffer zone: 4085.4 ha
Surrounding forest area	
Dominant tree species	<i>Fagus sylvatica</i>
Other species	30 other species of deciduous trees
Protected area	Yes, National Park Hainich, 7 500 ha
Forest age	
Forest structure	
Presence of old trees	Yes (but no information about volume)
Deadwood volume	High proportion of dead wood (but not number)
Human activities	Area was a military no-go zone (partly undisturbed, partly afforested) for several decades, in 1997 national park was designated, central areas have remained untouched for some 50 years
Other information	Low-mountains beech forest on limestone



REGISTER OF OLD GROWTH FORESTS IN CENTRAL AND EASTERN EUROPE	
Country	HUNGARY
Old growth forest name	Pilis-oldal Forest Reserve
Geo-location	Click here to enter text.
GIS availability	Click here to enter text.
Source/s	http://www.erdorezervatum.hu/en/node/1211
References/Webpages	Click here to enter text.
Register date	
Old growth forest area	Click here to enter text.
Surrounding forest area	Click here to enter text.
Dominant tree species	<i>Fagus sylvaticus</i> , <i>Quercus pubescens</i>
Other species	Click here to enter text.
Protected area	Yes, 168,1 ha; <i>core area</i> : 44.9 ha; <i>buffer zone</i> : 123.2 ha
Forest age	Click here to enter text.
Forest structure	Click here to enter text.
Presence of old trees	Click here to enter text.
Deadwood volume	Click here to enter text.
Human activities	Core area has shown characteristics of managed high forest abandoned, outside that (buffer zone), more similar to natural forest structure, diverse (selection) stand structure of forest is evolving due to selection cutting.
Other information	Beech forest with homogeneous stand-structure and once overgrazed, overused, coppiced. No visible stand dynamics.

REGISTER OF OLD GROWTH FORESTS IN CENTRAL AND EASTERN EUROPE	
Country	POLAND
Old growth forest name	Białowieża Forest
Geo-location	N52 43 39; E23 58 52 and N52 43 39; E23 53 57 http://whc.unesco.org/en/list/33/multiple=1&unique_number=2005
GIS availability	Click here to enter text.
Source/s	http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?mode=all&code=POL+02 http://whc.unesco.org/en/list/33
References/Webpages	Click here to enter text.
Register date	1979, 1992, 2014
Old growth forest area	Click here to enter text.
Surrounding forest area	
Dominant tree species	<i>Picea abies, Pinus sylvestris, Quercus robur</i>
Other species	<i>Tilia cordata, Carpinus betulus, Salix cinerea, Betula humili</i>
Protected area	Yes, Białowieża National Park, Belovezhskaya Pushcha National Park Belarus: Property: 82308 Ha, Buffer zone: 130873 Ha Poland: Property: 59577 Ha, Buffer zone: 35835 Ha
Forest age	Click here to enter text.
Forest age structure	Click here to enter text.
Presence of old trees	Click here to enter text.
Deadwood volume	Richness in deadwood, standing and on the ground
Human activities	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
Other information	Click here to enter text.

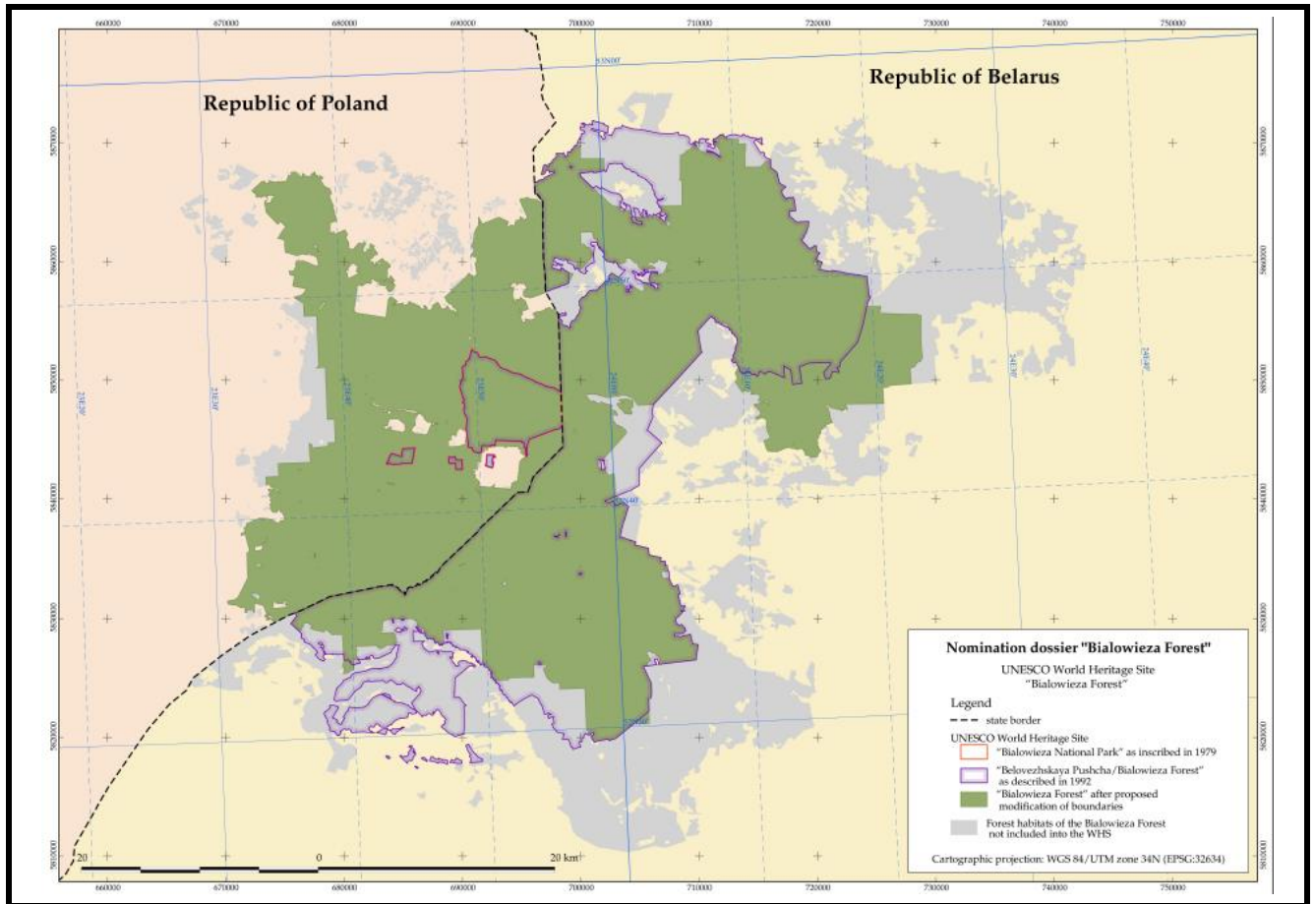


Fig. 7. Białowieża Forest, Poland.

REGISTER OF OLD GROWTH FORESTS IN CENTRAL AND EASTERN EUROPE	
Country	ROMANIA
Old growth forest name	National Park Cheile Bicazului-Hasmas
Geo-location	Click here to enter text.
GIS availability	Click here to enter text.
Source/s	Borlea G. F., S. Radu, Doina Stana: Forest biodiversity preservation in Romania. Not. Bot. Hort. Agrobot. Cluj, XXXIV/2006. https://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/7028/PB.pdf?sequence=1
References/Webpages	Click here to enter text.
Register date	Click here to enter text.
Old growth forest area	5 326 ha
Surrounding forest area	Click here to enter text.
Dominant tree species	<i>Fagus sylvaticus, Picea abies, Abies alba</i>
Other species	<i>Pinus sylvestris, Juniperus sabina</i> relicts
Protected area	Yes, National Park Cheile
Forest age	Click here to enter text.
Forest age structure	Click here to enter text.
Presence of old trees	Click here to enter text.
Deadwood volume	Click here to enter text.
Human activities	Click here to enter text.
Other information	Click here to enter text.

REGISTER OF OLD GROWTH FORESTS IN CENTRAL AND EASTERN EUROPE	
Country	SLOVAKIA
Old growth forest name	Baranovo (old-growth forest mapping segment)
Geo-location	http://www.pralesy.sk/lokality/pralesove-zvysky.html?id=37&task=view , 48°46'46.735"N, 19°8'9.323"E
GIS availability	Yes, shapefile available
Source/s	http://www.pralesy.sk/lokality/pralesove-zvysky.html?id=37&task=view and e-mail information from database author
References/Webpages	http://www.pralesy.sk/lokality/pralesove-zvysky.html?id=37&task=view
Register date	16.5.2011
Old growth forest area	7,15 ha
Surrounding forest area	Click here to enter text.
Dominant tree species	<i>Fraxinus exelsior</i> , <i>Acer pseudoplatanus</i> , <i>Fagus sylvaticus</i> , <i>Carpinus betulus</i>
Other species	<i>Acer platanoides</i> , <i>Acer campestre</i> , <i>Abies alba</i> , <i>Cerasus avium</i> , <i>Cerasus mahaleb</i> , <i>Cornus mas</i> , <i>Swida sanguinea</i> , <i>Taxus baccata</i> , <i>Tilia platyphyllos</i> , <i>Quercus petraea</i>
Protected area	Yes, PR Baranovo, protected zone of NP Nízke Tatry, Natura 2000 - SKUEV 0299 Baranovo
Forest age	Climax
Forest structure	Click here to enter text.
Presence of old trees	Yes, presence of trees near physical age - <i>Fagus sylvaticus</i> , <i>Fraxinus exelsior</i> , <i>Acer pseudoplatanus</i> , <i>Cerasus mahaleb</i> , <i>Tilia platyphyllos</i> , <i>Quercus petraea</i>
Deadwood volume	Yes Standing – level of decomposition 1. – 0,1-1 log / ha – level of decomposition 2. – 1,1-3 log / ha – level of decomposition 3. – 1,1-3 log / ha Laying – level of decomposition 1. – 0,1-1 log / ha – level of decomposition 2. – 1,1-3 log / ha – level of decomposition 3. – 3,1-10 log / ha both distributed unequally
Human activities	Yes, forest management (logging) 50-100 years ago, intensity of intervention – weak.
Other information	Ls4 – Ravine forest (lime-maple forest) 85%, Ls 5.1. – Herb rich beech forest (beech, beech-fir forest) 10%, not mapped natural biotopes 5%; Forest layer cover: E0 – 5%, E1 – 50%, E2 – 10% , E3 – 65% Standing trees: 5,1-15 trees / ha, unequally distributed, varied tree and shrub composition, presence of other natural biotopes - cliffs and boulder screens.

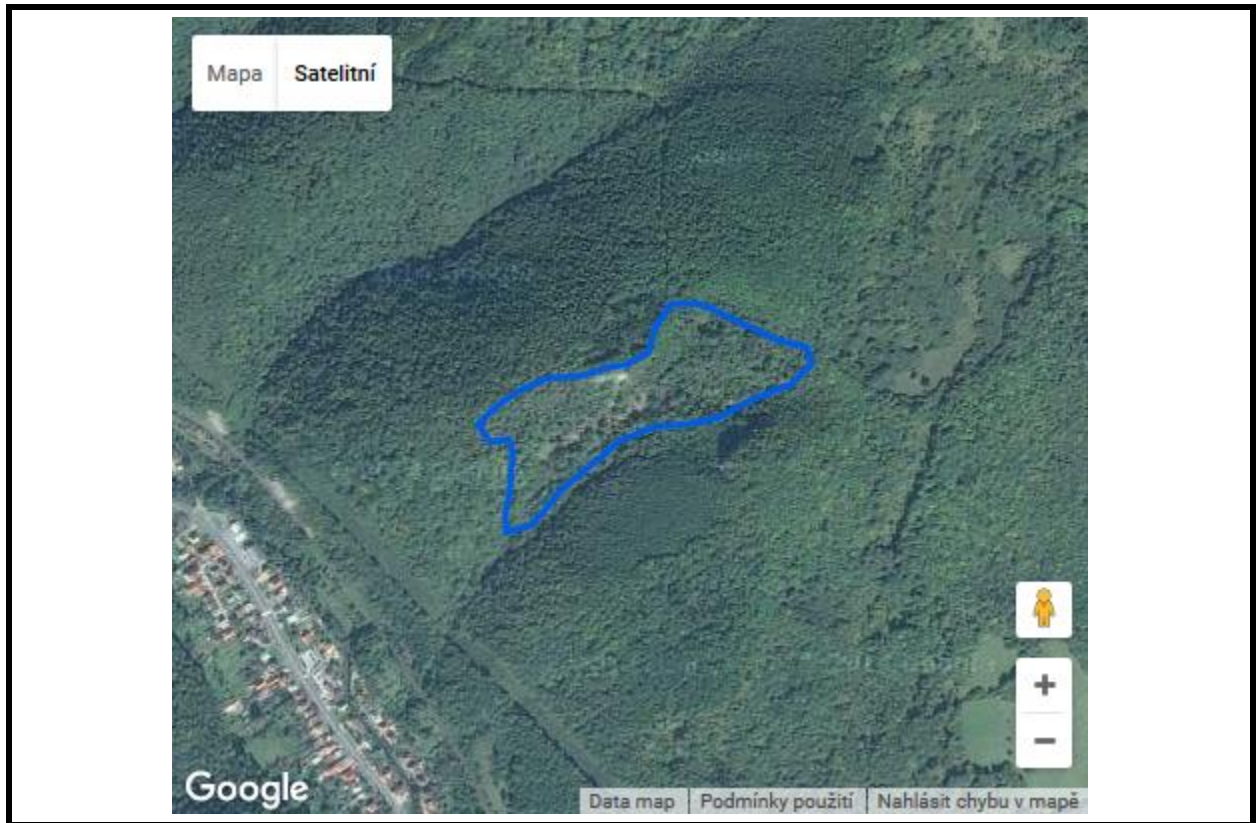
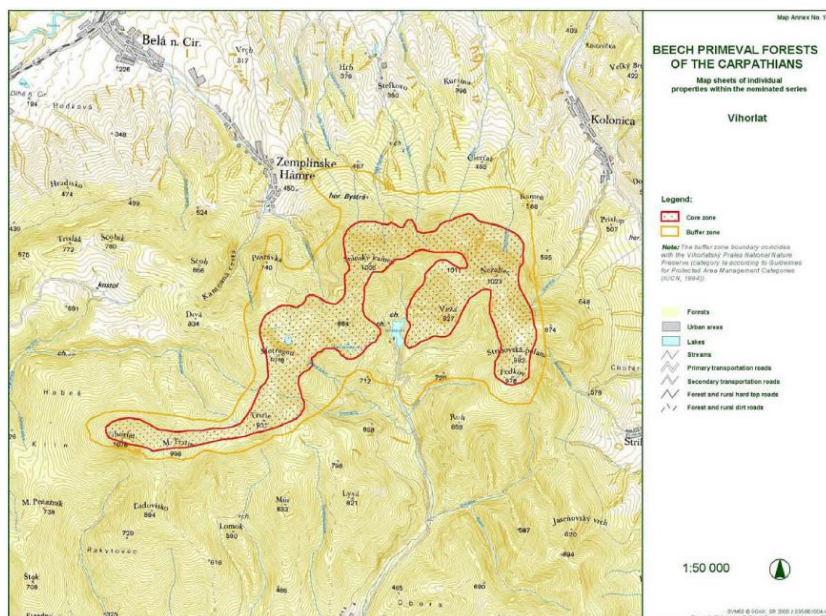


Fig. 8. Baranovo old-growth forest mapping segment, Slovakia.

REGISTER OF OLD GROWTH FORESTS IN CENTRAL AND EASTERN EUROPE	
Country	SLOVAKIA
Old growth forest name	Vihorlat
Geo-location	N48 55 45.00; E22 11 23.00 http://whc.unesco.org/en/list/1133/multiple=1&unique_number=1777
GIS availability	
Source/s	http://weltnaturerbe-buchenwaelder.de/en/world-natural-heritage-of-the-carpathians/primeval-beech-forest-of-the-slovak-republic.html http://www.sopsr.sk/web/?cl=1001 in Slovak
References/Webpages	
Register date	2007
Old growth forest area	World Natural Heritage Property: 2578 Ha, Buffer zone: 2413 ha
Surrounding forest area	
Dominant tree species	<i>Fagus sylvatica</i>
Other species	<i>Abies alba</i> , <i>Acer pseudoplatanus</i> , <i>Fraxinus excelsior</i>
Protected area	Part of the Vihorlat Protected Landscape, established 1973
Forest age	
Forest structure	
Presence of old trees	Yes, beech 240 years old or even older
Deadwood volume	
Human activities	
Other information	The beech forests in this area grow on soil of vulcanic origin with andesite bedrock and nutrient-rich soils.



REGISTER OF OLD GROWTH FORESTS IN CENTRAL AND EASTERN EUROPE

Country	UKRAINE
Old growth forest name	Maramorosh
Geo-location	N47 56 12.00; E24 19 35.00 http://whc.unesco.org/en/list/1133/multiple=1&unique_number=1777
GIS availability	
Source/s	http://weltnaturerbe-buchenwaelder.de/en/world-natural-heritage-of-the-carpathians/primeval-beech-forest-of-the-ukraine.html http://cbr.nature.org.ua/new_e.htm
References/Webpages	
Register date	2007
Old growth forest area	World Natural Heritage Property: 2243,6 Ha; Buffer zone: 6230,4 Ha
Surrounding forest area	
Dominant tree species	<i>Fagus sylvatica</i>
Other species	<i>Abies alba</i>
Protected area	Maramorosh Carpathian Biosphere Reserve, established in 1990
Forest age	
Forest structure	
Presence of old trees	
Deadwood volume	
Human activities	
Other information	Maramorosh is the only component part on metamorphic rocks, which has formed a very specific soil and vegetative cover. In this area, highly productive fir-beech primeval forests can be found (> 1.000 m ³ /ha).

