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Tree restoration potential in the European Union

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*Preliminary assessment prepared by the FAO Climate, Biodiversity, Land and Water Department, produced under a contract with the **European Commission**,*
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Study contract
070202/2020/825508/ETU/ENV.D.I

Disclaimer
Due to the scale of the maps and for their better readability, some countries and territories have been excluded such as Guyane, Martinique, Guadeloupe, Canarias, Região Autónoma dos Açores, Região Autónoma da Madeira, Guernsey, Jersey, Andorra, San Marino, Liechtenstein, Monaco, Isle of Man, Sark, Åland Islands, Holy See.

KEY MESSAGES FOR POLICY MAKERS

The impacts of environmental degradation and climate change are a threat to the world and Europe. The European Green Deal is the roadmap for making the EU's economy sustainable by turning climate and environmental challenges into opportunities across all policy areas and making the transition just and inclusive for all. One of the actions in the roadmap is to restore biodiversity, a key nature-based solution to mitigate the negative impacts of environmental degradation and climate change.

One of the potential avenues to restore biodiversity in Europe is to assess the restoration potential of European ecosystems. Their natural (biophysical) potential. The question that this report therefore tackles is what Europe's capacity is to restore its ecosystems through tree restoration.

Applying the same approach used in the high-impact study on "The global tree restoration potential" published in Science (Bastin et al. 2019) but tailored to the European context by using EU specific data, this report constitutes a first preliminary assessment of the natural canopy restoration potential of European ecosystems. It constitutes a benchmark on which further work must be conducted before leading to concrete restoration actions. The numbers highlighted in this report, both in terms of canopy area or number of trees, only refer to the biophysical restoration potential of EU Member Countries. They do not include socio-economic aspects, which are important to consider when implementing the restoration potential.

The use of the term "ecosystem restoration" in this report refers to the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed. To estimate this the "tree cover of the ecosystem at maturity" is assessed, meaning the tree cover the most likely to happen under natural biophysical conditions, respecting local diversity and without human activities. From this, the "tree restoration potential" is calculated, which represents the difference between the tree cover of the ecosystem at maturity and the observed tree cover of the ecosystem.

To understand the specific context of ecosystem restoration within Europe, the present report accounts for current EU specific land management, land cover and land use distribution. In particular, the present document focuses on a key European land use feature, i.e. the characterization of a land as "in use" or as "unused/abandoned" (areas that were previously used as industrial, residential and agricultural areas but that are currently no longer used).

The first step to assess the restoration potential of Europe was to quantify the difference between the natural potential tree cover (Bastin et al. 2019) and the existing tree cover (Hansen et al. 2013). The positive values resulting from this difference, representing locations with a potential for a natural increase in tree cover, were kept to assess the tree restoration potential in Europe. A second level of subdivision was applied using Natura 2000 geographic data. A third level of subdivision was applied using the CORINE (coordination of information on the environment) Land Cover (CLC) inventory. Only the first level hierarchical land cover classes from the CORINE database were used for this division, namely "Artificial surfaces", "Agricultural areas", "Forest and semi natural areas" and "Wetlands". Areas belonging to the "Water bodies" class were excluded from the database. The EU Land Use and Cover Area frame Survey (LUCAS) 2018 data was used to characterise the distribution of abandoned land for every combination of factors in the database (in every country, for every land cover, inside or outside Natura 2000 protected area).

This report reveals that an additional total area of **77 million hectares** can be covered by trees through the restoration of natural ecosystems. An extra **59 million hectares** of land could be covered by trees within EU, when looking only at the natural (biophysical) potential of the **EU outside Natura 2000 sites**. This corresponds to an estimated 36 billion mature trees, trees with a diameter at breast height ≥ 10cm. In abandoned lands, which cover about 15% of European lands, we found that large areas are also available for tree restoration. Indeed, here, an extra **8 million hectares** of land outside Natura 2000 could be covered by trees, corresponding to an estimated 6 billion mature trees.

The report also reveals different patterns and therefore different potential strategies at the country level, both between and within countries. For example, there is a strong difference between the restoration potential in the forestry sector in northern countries compared to central European countries. Some countries have most of their potential in a single land use sector (e.g. forestry for Finland or agriculture for Germany) while others present restoration potential in many land use categories (e.g. Italy, Spain, France presenting important potential both in agriculture and forestry sectors). This shows that a multi-angle approach with a diversified strategy should be considered at the European level, that a basket of solutions exists for the different types of land-use and land-cover that each country can select / adopt depending on its national and regional circumstances.

Further work will be required to address the heterogeneity within EU Member Countries as data at the national level do not always reflect the reality best. The same data analysed at the regional level (NUTS2) could provide different perspectives on the restoration potential. With the support of EU Member Countries, such additional information could be combined with analyses on the socio-economic context to develop tailored national strategies to implement the socio-economic restoration potential.

The natural (biophysical) restoration potential of EU Member Countries reported here can theoretically be reached without "planting" a single tree, mostly through natural regeneration. However, in some cases, the lands will be too degraded or depleted and will require assisted natural regeneration. This involves the action of "planting". The distinction of areas suited for natural regeneration and natural assisted regeneration will be a key objective to tackle for further work.

The natural restoration of ecosystems is one of the many actions that should be undertaken to capture the excess of carbon from the atmosphere. Such action will not be sufficient if not complemented by relevant strategies to cut emissions. Indeed, cutting emissions and capturing excess of carbon are both required to reach the objectives defined by the European Green Deal.

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LIST OF ACRONYMS

CLC	CORINE Land Cover inventory
CORINE	Coordination of information on the environment
DG ENV	European Commission Directorate General for Environment
EEA	European Environment Agency
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
IUCN	International Union for Conservation of Nature
LUCAS	Land Use and Cover Area frame Survey
NATURA 2000	A network of nature protection areas in the territory of the European Union
NUTS	Nomenclature of territorial units for statistics
SAC	Special Areas of Conservation
SIC	Site of Community Importance
SPA	Special Protection Areas
WDPA	World Database on Protected Areas

1. INTRODUCTION

In July 2019 the Crowther Lab at ETH-Zurich and the Food and Agriculture Organization of the United Nations published a report on "the global tree restoration potential" which provided the first quantitative assessment of the Earth's current and future carrying capacity to host trees. The report was published in Science and since its publication it has been at the centre of the scientific and international debate on nature-based solutions to tackle climate change. Today it is considered as one of the scientific reports in environmental sciences with one of the largest impacts on society.

Inspired by the report and the European Union's new Green Deal, the European Commission Directorate General for Environment (DG ENV) requested the FAO Climate and Biodiversity Department to prepare a detailed report for the potential of land restoration in the European Union. The expected outputs include:

• Output 1: The preparation and publication of a report on "Tree restoration potential in the European Union" (this report);

• Output 2: Participation in the International Conference on Forests, Biodiversity and Climate Change and present the preliminary results of the report; and

•Output 3: Sharing preliminary data and results of the EU specific report on tree restoration potential through a pre-agreed platform and open-data policy for country evaluation and feedback.

DG ENV aims to share this report with EU Member Countries in order to support the development of specific national action plans for ecosystem restoration.

Responding to the need of a specific EU context, EU specific datasets on climate, soil, land-cover, forests, land-use and biodiversity are used as input data in the model developed by FAO. The project implementation strategy therefore relies on using EU specific datasets on climate (The Climate Data Store), soil (Soil Atlas of Europe), EU CORINE land-cover, forests (Forest Information System for Europe), land-use (LUCAS EUROSTAT) and biodiversity (Biodiversity Information System for Europe) as input data to the model developed by FAO.

This report was prepared by FAO in partnership with the Ghent University (supported by Fonds Wetenschappelijk Onderzoek) and with the support of the ENEL Foundation.

2.THE NATURAL POTENTIAL TREE COVER

This section summarizes the main principles and methodological steps originally followed in Bastin et al. (2019[1]) to produce the natural potential tree cover map at a global level and that provides the basis of this report.

The assessment of the natural potential tree cover of the planet corresponds to the estimation of the biophysical limits of the planet in terms of tree carrying capacity. It does not correspond to the maximal number of trees that the planet could carry, it corresponds to the number of trees the planet would carry naturally at ecosystem maturity, i.e. respecting the natural tree cover of each ecosystem (from 0% to 100%). The corresponding map produced in Bastin et al. (2019) is the result of a quantitative model that characterizes the relationship between natural tree cover - ranging from 0% to 100% - and a wide range of environmental conditions (climate, topography, soil) covering all the biomes of the planet (boreal, temperate, dry and tropical).

2.1 MODEL CONCEPTION

The prediction of the natural tree restoration potential was done through machine-learning approaches, known to yield good results under several conditions. Notably, the development of a statistically robust model through machine-learning approaches relies substantially on the number of observations that can be used to train, calibrate and test the model.

These observations should intercept the full range of environmental conditions and associated natural tree coverage. Therefore, to build such a database, a large amount of observations within natural conditions needed to be collected. This raised two fundamental questions: first, how to define "natural" conditions and second, how to cover the full range of tree cover in all the biomes?

Natural conditions were defined as any location in the world falling under "protected areas", as defined by the World Database on Protected Areas (WDPA[2]). Although these regions are not entirely exempt of human activity (Jones et al. 2018[3]), they represent areas where humans have had minimal impacts on the overall ecosystem type. Based on the assumption that any human effect may reduce tree cover, the modelled estimates are likely to be conservative estimates of potential tree cover.

The characterization of the full range of tree cover was ensured from a global effort of augmented visual interpretation conducted through Collect Earth (Bey et al. 2016[4]), partially previously collected for the characterization of the vegetation in drylands (Bastin et al. 2017[5]) and completed on other biomes for this study. In total, 78,774 plots of 0.5 hectare each were visually interpreted within protected areas (yellow dots in Figure 1).

1 - Bastin, J.-F., Finegold, Y., Garcia, C., Mollicone, D., Rezende, M., Routh, D., et al. (2019). The global tree restoration potential. Science, 365, 76–79.
2 - UNESCO. (2011). The World Database on Protected Areas. Available at: https://www.protectedplanet.net/c/world-database-on-protected-areas. Last accessed in February 2019.
3 - Jones, K.R., Venter, O., Fuller, R.A., Allan, J.R., Maxwell, S.L., Negret, P.J., et al. (2018). One-third of global protected land is under intense human pressure. Science, 360, 788–791.
4 - Bey, A., Sanchez-Paus Diaz, A., Maniatis, D., Marchi, G., Mollicone, D., Ricci, S., et al. (2016). Collect earth: Land use and land cover assessment through augmented visual interpretation. Remote Sens., 8, 1–24.
5 - Bastin, J.-F., Berrahmouni, N., Grainger, A., Maniatis, D., Mollicone, D., Moore, R., et al. (2017). The extent of forest in dryland biomes. Science, 356, 635–638.

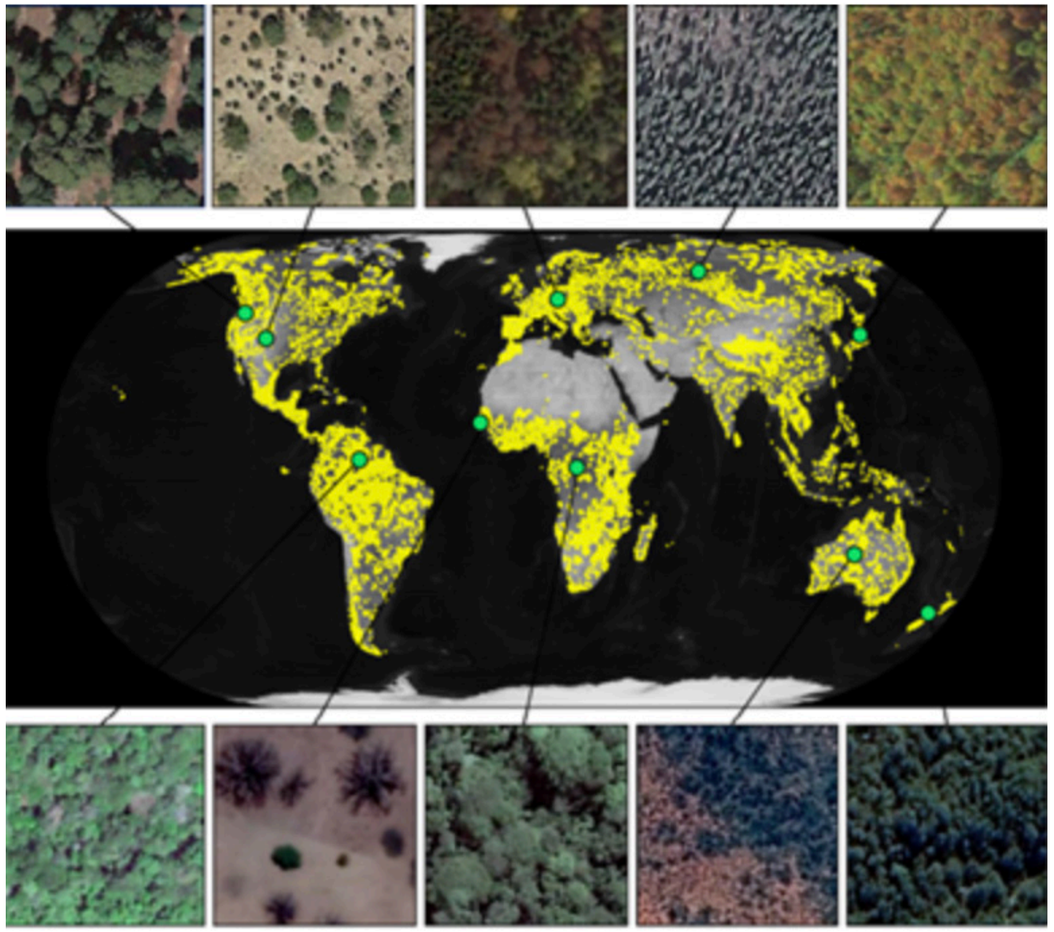

Figure 1 - Spatial distribution of the 78,774 plots photo-interpreted with Collect Earth within the protected regions of the world. The figure corresponds to the original figure S published in Bastin et al. (2019).

BOX 1 - PHOTO-INTERPRETATION USING COLLECT EARTH

The assessment of tree cover in each plot was performed through an "augmented visual interpretation" approach, using Collect Earth. Collect Earth is an open access software built on Google Earth Pro and Google Earth Engine (Figure 2) and was developed by the Open Foris initiative of the Food and Agriculture Organization of the United Nations (FAO). Collect Earth can facilitate the assessment of land use, land use cover and land dynamics for government agencies, non-for-profit organizations, academic institutions, field experts or other individuals. The main requisite for the correct adoption and application of the system is the local knowledge of the territory that is to be analysed.

Collect Earth allows the operator to visually interpret the land use and the tree cover of a plot (shown as a square of 70-by-70m in Figure 2) combining land cover information gathered from satellite images with very high spatial (pixel size ≤ 1metre) and temporal resolution (daily data acquisition). The operator photo-interprets very high spatial resolution satellite images, made freely accessible for visualization in Google Earth, and in parallel controls his/her assessment with spectral information which is automatically compiled for the last 20 years from medium-to-high resolution satellite images (particularly from MODIS and Landsat 7/8 in addition to the more recent Sentinel 2 from the Copernicus Programme). After a few days of training on Collect Earth, a user can access the huge availability of information from Google Earth Engine in a streamlined manner and without the need for coding. The user can match the expert knowledge of the territory with a summarized historical review of vegetation data through a simplified access to the power of Google Earth Engine cloud computing. This makes it possible to rapidly understand the dynamics of the territory and "collect" it through a customizable survey form in Google Earth.

Each plot presents a systematic grid of 7-by-7 points (49 points) allowing easy and direct measurements of tree canopy cover, with each point representing 2% of the plot.

Data are stored locally, either individually on the user machine or on a local server for a whole group of users. They can be analysed with the included open source business intelligence software Saiku or exported in open formats for additional spatial and statistical analysis.

Collect Earth was mainly developed for the assessment of Land Use, Land Use Change and Forestry (LULUCF) and is supported by the International Climate (IKI) of the German Ministry for Environment (BMUB). The system has been applied to different scenarios, country assessments, international initiatives and project evaluations in approximately 50 countries. The system has also been applied in projects of the US Geological Survey, US Forest Service, NASA SERVIR, World Resources Institute, World Bank and IFAD. Overall Collect Earth has been downloaded over 20,000 times.

In 2017 a global exercise was carried out with Collect Earth thanks to the collaboration among fifteen institutions worldwide to assess the status of the drylands. The analysis involved the visual interpretation of about 200,000 plots from more than 200 operators and the results were published in Science (Bastin et al. 2017). The methodology behind the software is detailed in the Remote Sensing paper "Collect Earth: Land Use and Land Cover Assessment through Augmented Visual Interpretation" (Bey et al. 2016).

While more than 100 variables have been collected, the fundamental variable measured in this study was the percentage of tree cover, ranging from 0 to 100%.

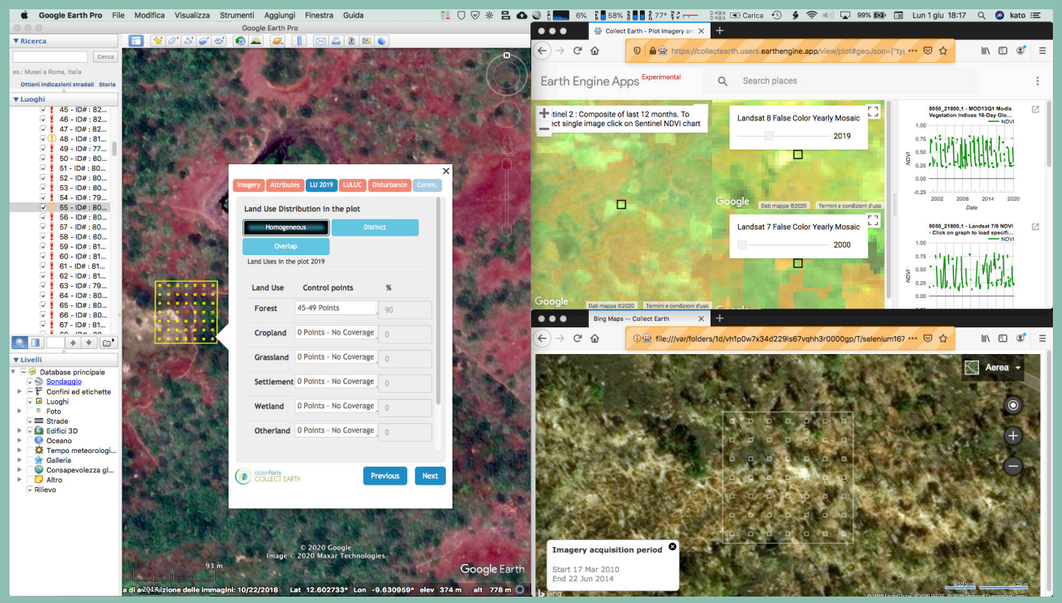

Figure 2 Collect Earth data collection form in Google Earth Pro with connected custom windows of Earth Engine and Bing Maps.

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http://www.fao.org/news/story/en/item/425931

Trees, forests and land use in drylands: The first global assessment
http://www.fao.org/documents/card/en/c/01382d82-6356-478e-9f42-d85ccdfd7a7d

2.2 ENVIRONMENTAL DATABASE

To predict the global potential natural tree cover, the most relevant environmental covariates from a set of 58 environmental variables, comprising soil, topographic and climate layers were selected (see Annex 8.2.1). All covariate layers were resampled and reapplied to a unified Eckert IV equal area projection, at 30 arc-seconds resolution (≈1km at the equator). Layers with a higher original pixel resolution were down-sampled using a mean aggregation method; layers with a lower original resolution were resampled using simple up-sampling, i.e. without interpolation, to align with the highest resolution grid. In total, this corresponds to 34 quantitative soil descriptors extracted from gridsoils (Hengl et al. 2017[6]), 5 topographic properties extracted from GMTED2010 and 19 bioclimatic variables extracted from Worldclim 2.0 (Fick and Hijmans, 2017[7]). The 10 most relevant variables were then identified based on a collinearity analysis (Table 1). This resulted in the selection of 5 climate, 3 soil and 2 topographic variables: annual mean temperature; annual precipitation; precipitation seasonality; mean temperature of the wettest quarter; precipitation of the driest quarter; organic carbon stock from 0 to 15cm, depth to bedrock; sand content from 0 to 15cm; elevation; and hill shade.

Table 1 - List of the 10 relevant variables selected for the prediction of the potential tree cover.

Data Name	Layer Group	Original Spatial Resolution
Annual Mean Temperature	Climatic	30 arcsec
Mean Temperature of Wettest Quarter	Climatic	30 arcsec
Annual Precipitation	Climatic	30 arcsec
Precipitation Seasonality (Coefficient of Variation)	Climatic	30 arcsec
Precipitation of Driest Quarter	Climatic	30 arcsec
Elevation	Topographic	30 arcsec
Hillshade	Topographic	30 arcsec
Soil Organic Carbon Stock from 0.00m-0.05m	Soil	250m
Sand content at 0.00m-0.05m	Soil	250m
Depth to Bedrock	Soil	1km
BDRICM_M_1km_ll = Depth to Bedrock	Soil	1km

6 - Hengl, T., Mendes de Jesus, J., Heuvelink, G.B.M., Ruiperez Gonzalez, M., Kilibarda, M., Blagotić, A., et al. (2017). SoilGrids250m: Global gridded soil information based on machine learning. PLoS One, 12, e0169748.
7 - Fick, S.E. & Hijmans, R.J. (2017). WorldClim 2: new 1-km spatial resolution climate surfaces for global land areas. Int. J. Climatol., 37, 4302–4315.

2.3 BUILDING THE GLOBAL NATURAL POTENTIAL TREE COVER MAP

The 10 selected variables were applied to a random forest machine-learning regression model (Breiman 2001[8]) to predict the natural tree cover among the 78,774 plots.
The model was built by finding the set of combinations of covariates that best predicts the training samples (Breiman 2001). The resulting model was subsequently evaluated and validated through cross-validation (further details can be found in the original scientific publication Bastin et al. (2019)).

The next step was to use the model to extrapolate the natural potential tree cover outside protected areas, for each pixel, using model coefficients combining the 10 selected environmental variables.
This resulted in the global natural potential tree cover map (Figure 3).

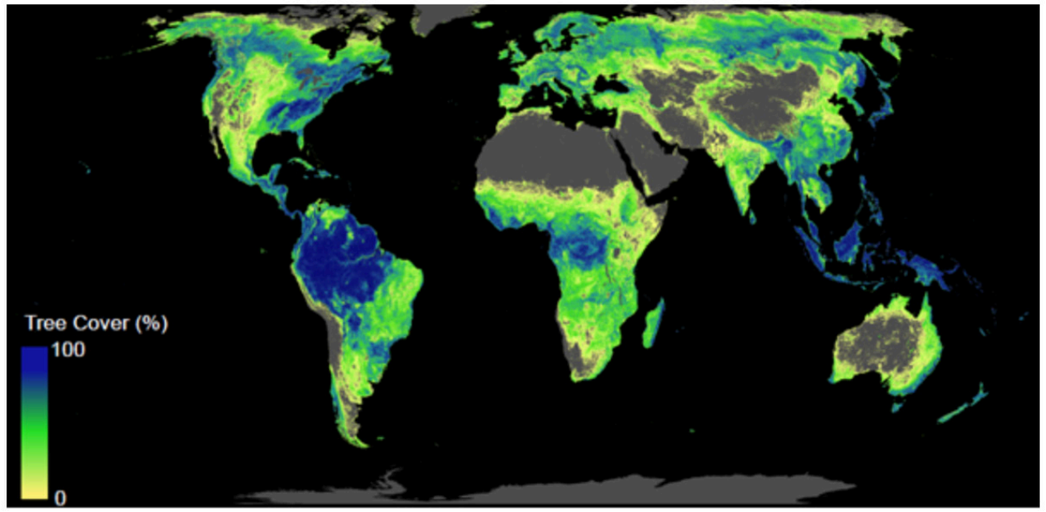

Figure 3 The natural tree cover potential of the planet Earth, based on bio-physical conditions only. The figure corresponds to the original Figure 2A published in Bastin et al. (2019).

2.4 ECOSYSTEM MATURITY

The term "ecosystem maturity" used in the present report refers to the average state of an ecosystem at maturity. In the present report, it specifically corresponds to the average natural tree cover of each ecosystem as observed in protected areas (see Box 2). At ecosystem maturity, the tree cover of the ecosystem is not the maximal tree cover that could be achieved (e.g. through reforestation or afforestation), it corresponds to the tree cover that is the most likely to happen under natural conditions, without human activity. For example, the tree cover at ecosystem maturity of a tundra or a savannah could average 0% of tree cover, the natural tree cover at ecosystem maturity of a temperate forest could average 80% of tree cover, etc. It is not about reaching 100% of tree cover.

8 - Breiman, L. (2001). Random Forests. Mach. Learn., 45, 5–32.

BOX 2 - PREDICTING THE AVERAGE TREE COVER AT ECOSYSTEM MATURITY

The natural tree cover of the planet Earth does not correspond to the maximal tree carrying capacity of the planet but to the **average tree cover carrying capacity** that is observed when human activity/pressure is close to zero.

To illustrate this principle, **three hypothetical cases** of three ecosystems (shrubland, woodland and forest) observed in three contrasted sets of environmental conditions are presented in Figure 4. Each case has multiple observations of natural tree cover, summarized as a density distribution curve. Each curve (orange, green and blue) represents the frequency of the distribution of tree cover observations for each set of environmental condition. In the hypothetical case presented here, the average tree cover of ecosystem maturity is close to 5% in shrubland, 50% in woodland and 100% in forest.

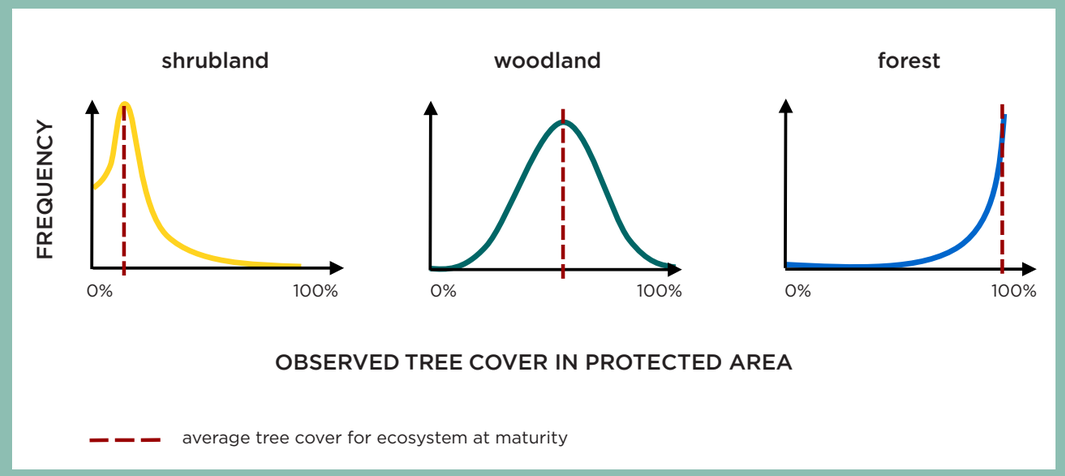

Figure 4 Example of observed tree cover distribution in protected areas for three ecosystems (shrubland in orange, woodland in green and forest in blue) in three different sets of environmental conditions. The average tree cover for ecosystem at maturity is represented for each case with a vertical red dotted line.

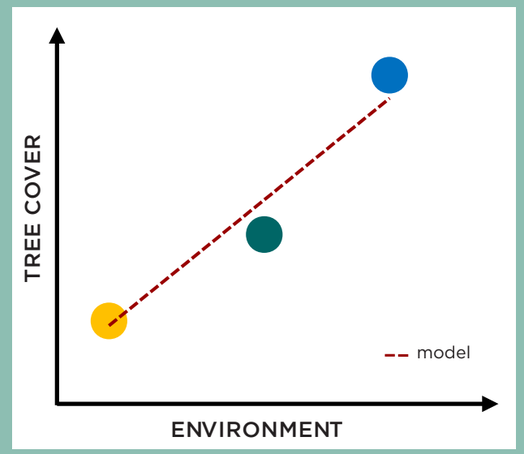

Figure 5 Illustration of the relationship between the average tree cover for three hypothetical ecosystems at maturity (orange for shrubland, green for woodland, blue for forest) and environmental conditions. The red dotted line illustrates the resulting prediction from a model using environmental dataset to predict the average tree cover of any ecosystem at maturity.

This average tree cover carrying capacity is the value that is used to build the model (Figure 5). Using the selected set of environmental variables, the machine learning model is trained from the observed average tree cover of natural ecosystems at maturity (orange, green and blue dots).
This model can then be used to extrapolate the "average tree cover of natural ecosystems at maturity", beyond observed points, only using environmental datasets, i.e. the red dotted line representing the model, and results in the estimation of the natural tree cover of the planet Earth (Figure 3).

2.5 CANOPY AREA

To express the tree cover restoration potential of a given area, e.g. by country or land use category, this report further refers to the **canopy area**, a metric originally defined in Bastin et al. (2019). Instead of calculating an area of forest or grassland from a definition based on a tree cover threshold, the canopy area refers to the area actually covered by trees. This presents the advantage to account for both low and high tree cover values while weighting their respective contribution to the calculated area. In practice, it can be applied to describe both the current and the potential areas that are or that could be covered by trees.

For instance, if the average tree cover of a given region of 1 hectare is 50%, its canopy area equals 0.5 hectares (Figure 6). If it is 100%, its canopy area equals 1 hectare and if it is 3% its canopy area equals 0.03 hectares. In the case of the restoration potential, an increase of tree cover of 10% would equal to an increase of 0.1 hectares.

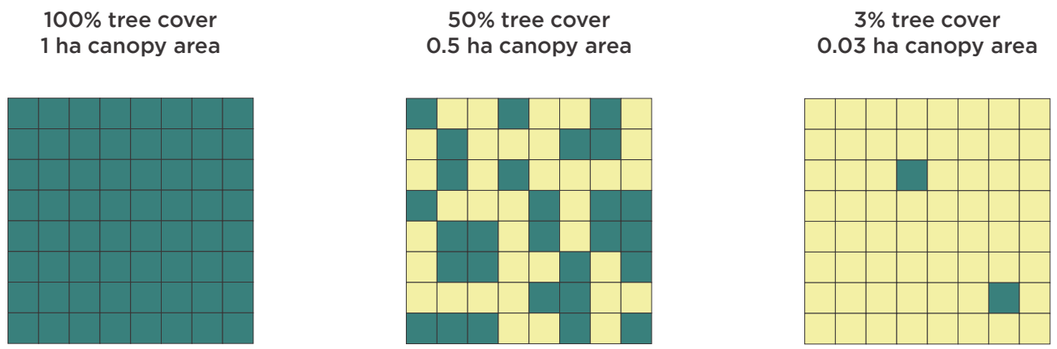

Figure 6 Example of canopy area calculation for three examples of 1 hectare. The three examples, from left to right, represent respectively the case of 100% of tree cover, 50% of tree cover and 3% of tree cover.

3. TREE RESTORATION POTENTIAL IN EU

The potential natural vegetation for most of Europe are forest ecosystems, however today the European territories are shaped by more than 5,000 years of human interventions. Many forest lands have been lost and converted to agriculture, grassland and residential-industrialized areas. The near constant land use conversion of forest areas stopped around 200 years ago when there was a turning point due to a large-scale rural exodus from many remote areas and to the first large scale reforestation programmes[9]. Forest expansion had a boost immediately after the Second World War with a stabilization effect starting from the 1990s. Currently there are countries which are still reporting fractional increase of their forest area and very few countries which are reporting locally concentrated deforestation processes[10].

Although forest area is now increasing slowly, large changes are occurring within forest ecosystems. These changes are due to the adoption of different forest management systems, including the conversion to more natural forest ecosystems to address biodiversity and soil conservation, but also due to natural adaptation processes to climate change.

In the last 30 years, the multiple functions and potential uses of forests have attracted the interest of policy makers, which have developed forest policies and measures at international, national and regional scales. Sustainable forest management, reforestation and afforestation have also been found to help increasing the terrestrial carbon sink and protecting unstable soils. The European Union and its Member Countries now have a large set of policies and measures, which refer to forests as multiple functions and ecosystems services that are vital to society and human well-being. The European Union has a large experience in developing and implementing policies and measures to protect and increase biodiversity within land use categories; here the concept of the "tree" as a crucial element of each land use category (including cropland and settlement) is already addressed.

3.1 THE NATURAL TREE COVER POTENTIAL IN EUROPE

In Europe, the natural tree cover potential map (Bastin et al. 2019) estimates that **193 million hectares** of land could be covered by trees at ecosystem maturity. The map (Figure 7) presents high natural tree cover potential in forested regions and low potential in the driest regions. However, it also presents a particularly low natural tree cover potential in agriculture and urban regions that are not particularly dry. It should be noted that it is likely to be an underestimation of the model that was statistically trained using observations in protected lands (e.g. several Natura 2000 sites) as a proxy of natural state of the ecosystems, and that are actually found in agriculture and urban regions. Therefore, despite being classified as protected areas, they present very low tree cover. In Europe this results in a very low tree cover potential for regions such as the Po valley in Italy, the Levante of the Iberian Peninsula or the Champagne district in France, while most likely, without human presence, these fertile regions would be covered by very dense forests.

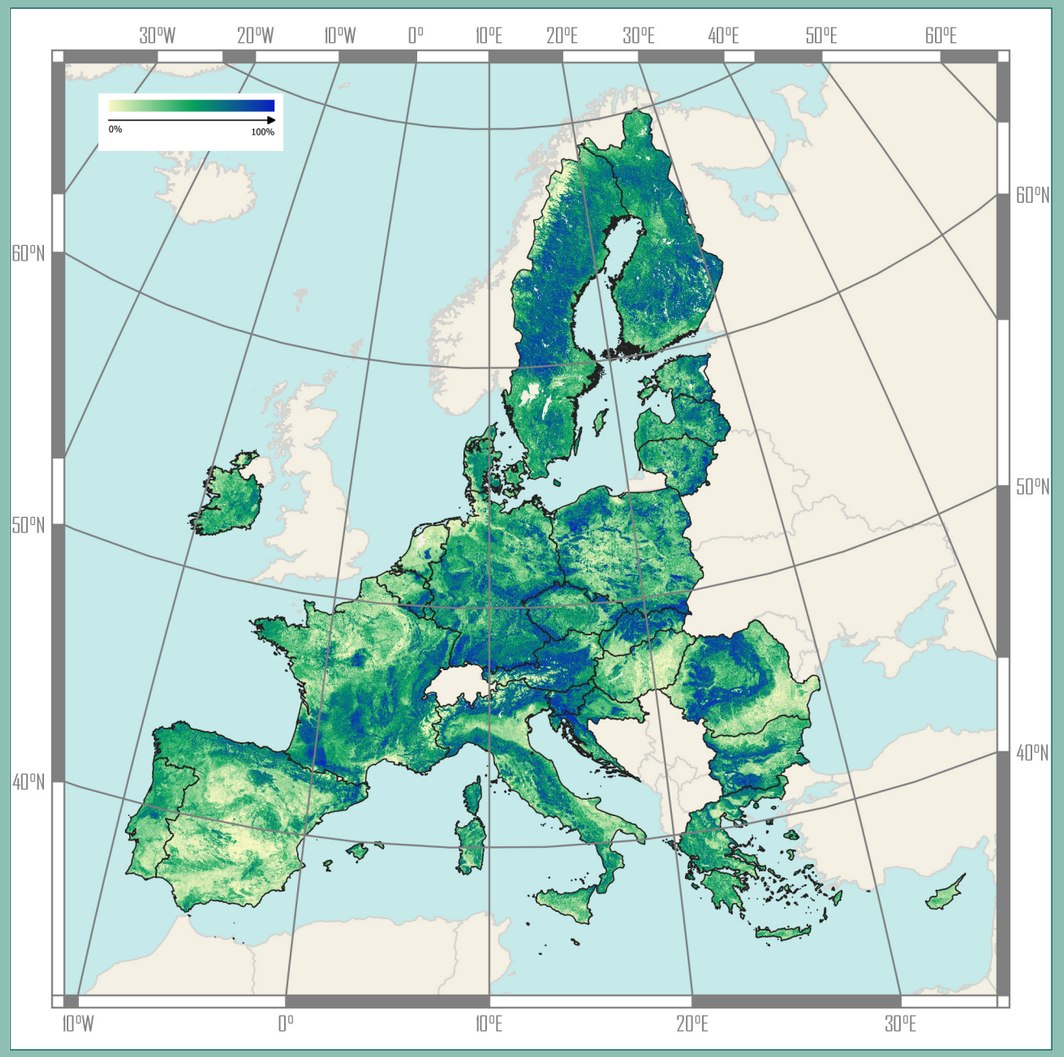

Figure 7 - The natural tree cover potential of Europe based on biophysical conditions only. The figure corresponds to the original figure 2A published in Bastin et al. (2019) and delineated for the 27 EU Member Countries.

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10 - State of Europe's forests 2015. Ministerial Conference on the Protection of Forests in Europe, Forest Europe Liaison Unit Madrid.

3.2 THE TREE RESTORATION POTENTIAL IN EUROPE

The first step to assess the restoration potential of Europe was to quantify the difference between the natural potential tree cover (Bastin et al. 2019) and the existing tree cover (Hansen et al. 2013). The positive values resulting from this difference, representing locations with a potential for a natural increase in tree cover, were kept to assess the tree restoration potential in Europe. The resulting map (Figure 8) reveals that an additional total area of **77 million hectares** can be covered by trees through the restoration of natural ecosystems. It should be noted that the present report provides a detailed description of this restoration potential by country and by land use categories. This is a substantial difference with the original scientific publication (Bastin et al. 2019), where agriculture and urban areas were excluded. To understand the tree restoration potential of Europe, it is essential to consider it in the specific context of EU land management (land use, abandoned land, etc.).

Indeed, one of the main land use changes in Europe over the last 200 years has been the expansion of the forest area, mainly driven by large-scale afforestation programmes in several European countries. At the same time, the rural exodus accelerated and changes in technology allowed the intensification of agricultural systems in smaller areas (Mather, 2001; Pile et al. 2012[11]).

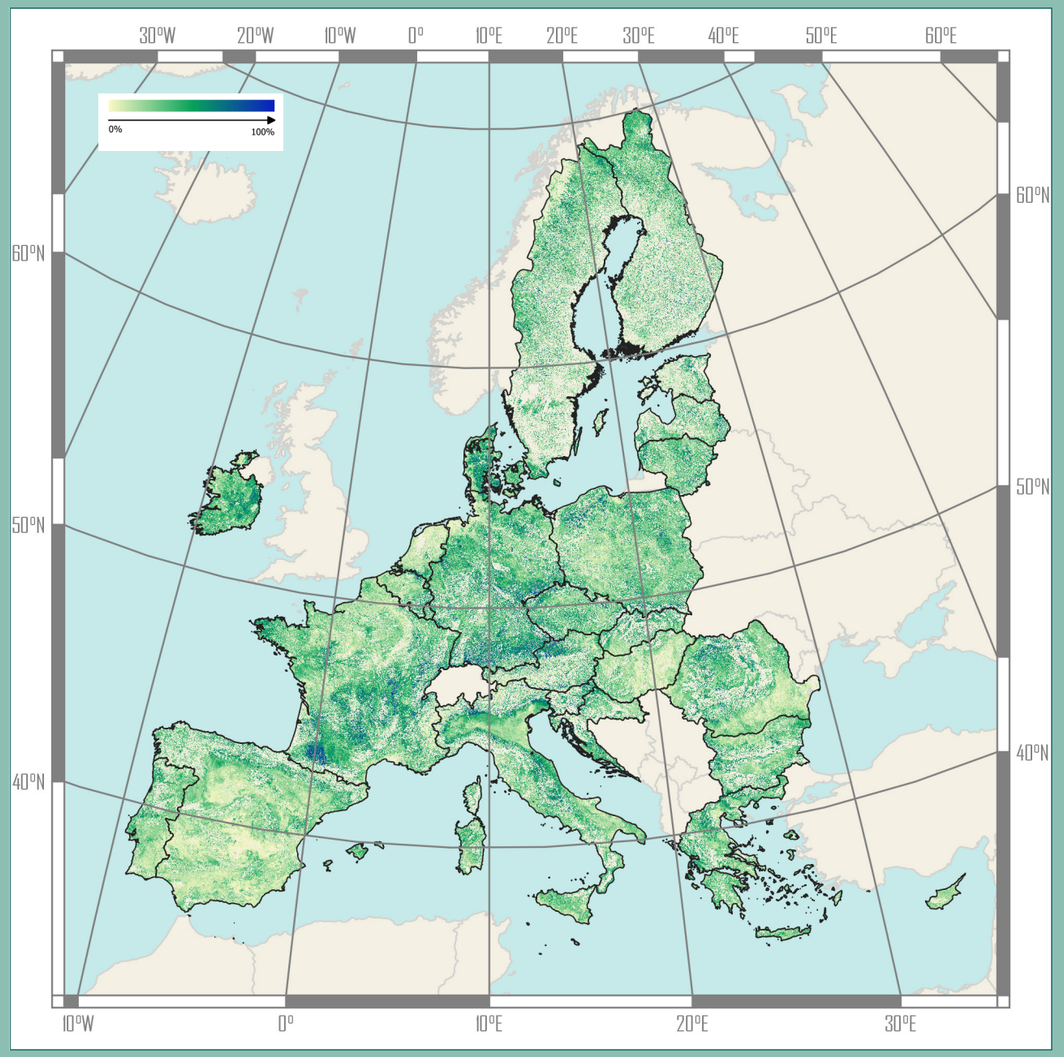


Figure 8 - The natural tree restoration potential of Europe based on biophysical conditions only. The map results from the difference between the natural tree cover potential of Europe (Figure 7) and the current tree cover of Europe (Hansen et al. 2013).

11 - Pile, L. S., et al., 2012, 'Forest resource management plans: a sustainability approach', Journal of Natural Resources and Life Sciences Education 41(1), pp. 79-86

4. METHODOLOGY

4.1 EU-LEVEL DATA

This section briefly presents the different databases used for the analysis that was undertaken and is summarized in this report: Natura 2000, the Eurostat - Land Use and Cover Area frame Survey (LUCAS) survey and the Copernicus CORINE (Coordination of information on the environment) Land Cover (CLC) inventory.

4.1.1 Natura 2000

Natura 2000 is a network of nature protection areas in the territory of the European Union. It is comprised of Special Areas of Conservation (SAC), Site of Community Importance (SIC) and Special Protection Areas (SPA), designated under the Birds and Habitats Directives. The network includes both terrestrial and marine protected areas. Natura 2000 is the largest ecological coordinated network of protected areas in the world. It offers a haven to Europe's most valuable and threatened species and habitats.

In this report, the Natura 2000 database is used to differentiate lands inside and outside its border. Indeed, any actions to be developed within Natura 2000 areas should take the specific conditions and objectives of the area into consideration, which may not necessarily consist of tree cover restoration.
Therefore, the areas outside Natura 2000 areas and inside Natura 2000 areas are treated separately in this report.

4.1.2 EUROSTAT – LUCAS

The aim of the LUCAS survey is to gather harmonised information on land use, land cover and their changes over time. The survey also provides territorial information facilitating the analysis of the interactions between agriculture, environment, and countryside, such as irrigation and land management.

This dataset is particularly interesting in the scope of this report because it includes data on the absence of land use, i.e. abandoned lands. In LUCAS documentation, abandoned land is defined as follows: areas that are abandoned or are in a natural or semi-natural state and showing no visible signs of any use. Areas belonging to the abandoned class are not in use and can therefore no longer be used for their original purpose / land use destination without major reparation/renovation work. This report will mainly use the LUCAS dataset to estimate the extent of abandoned land at different geographic levels.

4.1.3 Copernicus – CORINE

The CORINE Land Cover (CLC) inventory was initiated in 1985 to standardize data collection on land in Europe to support environmental policy development. The project is coordinated by the European Environment Agency (EEA) in the framework of the EU Copernicus programme and is implemented by national teams. The number of participating countries has increased over time currently including 33 (EEA) Member Countries and six cooperating countries (EEA39) with a total area of over 5.8 Mkm^2.

CLC provides information on the biophysical characteristics of the Earth's surface, identifying 44 land cover and land use classes, grouped in a three-level hierarchy. The five main categories are: **artificial surfaces, agricultural areas, forest and semi-natural areas, wetlands, water bodies**. This report will focus on these five main categories which are presented in Table 2.

Member Country	Areas in use				Abandoned areas			
	Artificial surfaces	Agricultural areas	Forest semi natural areas	Wetlands	Artificial surfaces	Agricultural areas	Forest semi natural areas	Wetlands
Austria	9	40	43	0	0	1	8	0
Belgium	25	56	16	0	1	1	0	0
Bulgaria	6	58	23	0	1	9	3	0
Croatia	5	35	30	0	1	11	18	0
Cyprus	8	39	8	0	2	16	26	0
Czechia	8	63	24	0	1	4	1	0
Denmark	10	73	12	0	0	3	1	0
Estonia	5	45	43	2	0	2	2	1
Finland	6	29	53	2	0	1	5	5
France	8	59	28	0	0	2	2	0
Germany	11	63	23	0	0	1	0	0
Greece	5	37	33	0	1	9	16	0
Hungary	10	61	23	0	1	4	1	0
Ireland	3	68	10	6	0	7	2	4
Italy	8	49	24	0	1	6	12	0
Latvia	4	51	36	1	0	5	3	0
Lithuania	6	65	23	0	1	4	1	0
Luxembourg	11	60	26	0	0	2	0	0
Malta	27	48	4	1	4	9	6	0
Netherlands	17	72	7	0	0	1	1	0
Poland	9	62	24	0	1	4	1	0
Portugal	6	45	41	0	0	3	4	0
Romania	9	69	17	0	0	4	1	0
Slovakia	11	50	30	0	1	6	1	0
Slovenia	7	49	41	0	0	1	1	0
Spain	4	45	27	0	1	7	17	0
Sweden	4	23	55	1	0	1	11	4
EU	**6**	**46**	**33**	**0**	**1**	**4**	**9**	**1**

Table 2 - Distribution of LUCAS EUROSTAT points within the CORINE land use database by Member Countries in percentage of occurrence. Based on CORINE (2018) and LUCAS (2018). This table excludes water bodies as there is no natural tree restoration possible in water bodies.

4.2 DATA COLLECTION

4.2.1 EU NATURAL TREE RESTORATION

A map of the global natural tree restoration potential was produced by subtracting the current global tree cover from Hansen et al. (2013) to the natural potential tree cover from Bastin et al. (2019). Only positive values, i.e. increases in natural tree restoration potential, were retained (Figure 9).

The global map of tree restoration potential was cropped to EU boundaries and the national subdivision (NUTS0) was applied using publicly available GISCO (the Geographic Information System of the Commission) national boundary geographic data from 2016, consulted in April 2020.

4.2.2 Natura 2000

A second level of subdivision was applied using Natura 2000 geographic data. Areas from both Birds and Habitats Directives were used to build the Natura 2000 layer, without distinction between the types of protected area. The Natura 2000 geographic data was obtained from the European Environment Agency public database and includes the reporting of 2019, consulted in April 2020.

4.2.3 CORINE

A third level of subdivision was applied using the CORINE (coordination of information on the environment) Land Cover (CLC) inventory of 2018 consulted in April 2020. Only the first level hierarchical land cover classes from the CORINE database were used for this division, namely “Artificial surfaces”, “Agricultural areas”, “Forest and semi natural areas” and “Wetlands” (Figure 10). Areas belonging to the “Water bodies” class were excluded from the database.

4.2.4 LUCAS abandoned area

The LUCAS 2018 survey data was used to characterise the distribution of abandoned land for every combination of factors in the database (in every country, for every land cover, inside or outside Natura 2000 protected area). The database was consulted on April 2020. Points outside the EU and/or inside water bodies were excluded from the database. In total 263,325 points were considered.

As LUCAS is a systematic sampling grid survey and not a comprehensive wall-to-wall land cover map, the distribution of abandoned land from LUCAS is estimated by calculating the proportion of points of abandoned land falling in each country and/or CORINE subdivision. Therefore, the total area of abandoned land (or land in use) within a geographic level, is given by the total area of the geographic level times the ratio of abandoned (or in use) LUCAS points. The associated standard error can be calculated as follows[12]:

$$\sigma = A\sqrt{\frac{p_i\,(1-p_i)}{n-1}}$$

Where pi is the proportion of abandoned points in the geographic level i; A the total area of the geographic level and n the total number of sample points in the geographic level.

These estimations and associated standard errors are directly dependent on the number of observations (n-1). Therefore, the error increases with the decrease of number of points considered for area calculation (from European level to the regional level and from major land use categories to small sub-divisions). To avoid a propagation of errors from small to large scale, this calculation is computed for each geographic level separately (EU, country, region, etc.) and not by aggregating for each level the values from the corresponding sublevel. Consequently, the sum of areas calculated at a sublevel does not exactly equal to the area of the corresponding level. To illustrate this point, a working example can be found in Box 3.

To further account for differences of tree cover restoration potential in abandoned lands between the different categories, the restoration potential is extracted on each LUCAS point from the natural tree restoration map of EU. This allows ultimately accounting for the differences of restoration potential between abandoned land and land in use (see Box 3 for calculation details).

12 - IPCC Guidelines for National Greenhouse Gas Inventories 2006 - Chapter 3: Consistent Representation of Lands.

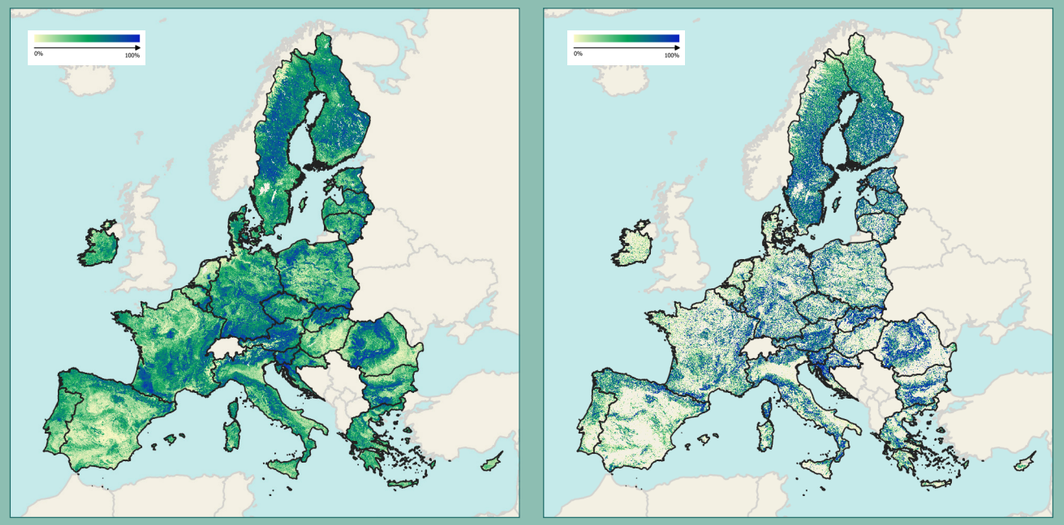


Figure 9 - Illustration of process applied to calculate the global natural tree restoration potential cropped to EU boundaries.

AUSTRIA
BELGIUM
BULGARIA
CROATIA
CYPRUS
CZECHIA
DENMARK
ESTONIA
FINLAND
FRANCE
GERMANY
GREECE
HUNGARY
IRELAND
ITALY
LATVIA
LITHUANIA
LUXEMBOURG
MALTA
NETHERLANDS
POLAND
PORTUGAL
ROMANIA
SLOVAKIA
SLOVENIA
SPAIN
SWEDEN

50°W 40°W 30°W 20°W 10°W 0° 10°E 20°E 30°E 40°E 50°E 60°E
60°N
50°N
40°N
30°N
20°W 10°W 0° 10°E 20°E 30°E

ARTIFICIAL SURFACES
AGRICULTURAL AREAS
FOREST SEMINATURAL
WETLANDS
WORLD MAP

Figure 10 - CORINE Land Cover map illustrating the retained land cover classes for the analysis: artificial surfaces, agricultural areas, forest and semi natural areas and wetlands.

BOX 3. ILLUSTRATION OF CALCULATIONS TO ESTIMATE THE SURFACES

To illustrate the discrepancies and errors that can arise when adding together the surface of abandoned (or in use) areas of a given geographic level to estimate the surface of the abandoned (or in use) areas of a higher geographic level, the following example is proposed (Figure 11).
An island of 277 hectares (1 pixel = 1 hectare) presenting 2 classes (class A and class B), is sampled by a LUCAS like point sampling every other pixel in a square grid.

Class A totals 90 hectares and 20 points, Class B totals 187 and totals 40 points. A lot of abandoned area is found in Class A: 15 of its 20 points (75%). Class B on the other hand has a lot of used area: only 3 of its 40 points (8%) are classified as abandoned. Using the equivalence of distribution between points and area assumption, it can be estimated that 75% of the area of class A is abandoned (67.5 hectares), and 8% of the area of class B is abandoned (14.03 hectares).

To estimate the surface of abandoned area at the country level, one could be tempted to simply sum the surface of abandoned area in class A and B. This would however underestimate the surface of abandoned area at the country level.

To estimate the surface of abandoned area at the country level, the same methodology using the equivalence of distribution must be used: the country area is 277 ha, and 18 of its 60 LUCAS points (30%) are classified as abandoned. Therefore, 30% of the total surface of the country is abandoned, which is 83.10 hectares. This is slightly higher than the sum of the abandoned area in class A and class B (81.53 hectares) (Table 3).

Moreover, the same approach must be used to calculate the total distribution of areas within the country: only the LUCAS point should be used to calculate the distribution of areas within the country, not the estimated areas (Table 4).

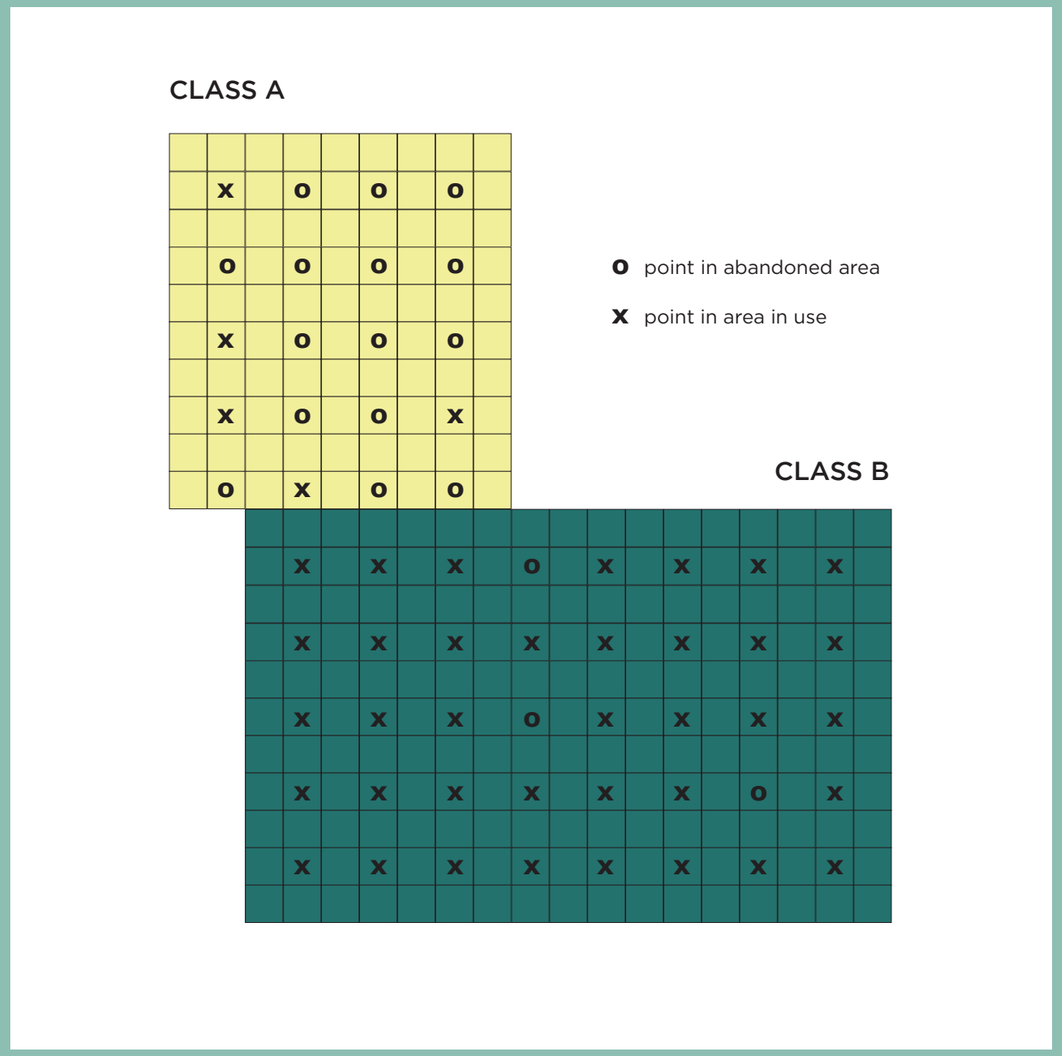


Figure 11 - Working example: Fictional island with 2 classes and a LUCAS grid sampling every other pixel. Class A in yellow class B in green. "X" is a LUCAS point classified as used. "O" is a LUCAS point classified as abandoned. Cell surface is 1 ha.

Table 3 - Calculations of abandoned areas, based on the the working example presented in Figure 11.

	Class A	Class B	Sum of class A and B	Country
Area (ha)	90	187	277	277
Total number of points	20	40	60	60
Number of points in abandoned area	15	3	18	18
Number of points in area in use	5	37	42	42
Proportion of abandoned points	75%	8%	/	30%
Estimated abandoned area (ha)	67.50	14.03	81.53	83.10

Table 4 - Calculations of the distribution of abandoned areas, based on the working example presented in Figure 11.

	Class A		Class B		Sums
	abandoned	in use	abandoned	in use	
Area (ha)	67.50	22.50	14.03	172.98	277
"Distribution" based on the estimated area (erroneous)	24 %	8%	5%	62%	100%
Total number of points	15	5	18	42	80
Distribution based on the LUCAS points	19%	6%	22%	52%	100%

4.3 COUNTING TREES - how hectares are converted to number of trees

The total number of trees associated to restoration in Europe is **approximated** from the combination of the estimation of the canopy area available for restoration within EU Member Countries (Bastin et al. 2019 and section 3 of this report) and tree densities estimated per biome (Crowther et al. 2015) (Table 5). Tree densities are provided by hectare and only include adult trees, i.e. trees with a diameter at breast height (130cm) superior or equal to 10cm.

As tree densities are highly variable (from 244.57 trees per hectare in deserts and xeric shrublands, to 1,042.03 trees per hectare in tundra), a region presenting a higher natural canopy restoration potential in terms of hectares can present a lower natural canopy restoration potential in term of number of trees, when compared to a region belonging to a more densely vegetated biome.

Table 5 - Tree density per biome per hectare, for trees with a diameter at breast height superior or equal to 10cm as defined in Crowther et al. 2015.

Biome	Mean tree density (trees per hectare)
Boreal forests/taiga	967.59
Deserts and xeric shrublands	244.57
Flooded grasslands and savannas	497.24
Mangroves	494.08
Mediterranean forests, woodlands and scrub	881.39
Montane grasslands and shrublands	799.31
Temperate broadleaf and mixed forests	486.41
Temperate conifer forests	426.19
Temperate grasslands, savannas and shrublands	285.47
Tropical and subtropical coniferous forests	426.19
Tropical and subtropical dry broadleaf forests	372.35
Tropical and subtropical grasslands, savannas and shrublands	292.88
Tropical and subtropical moist broadleaf forests	779.26
Tundra	1,042.03

5. RESULTS

This section presents the results of the natural tree restoration potential analysis customized for Europe. It summarizes essentially areas of land and number of trees that could naturally be restored for different geographic levels (e.g. country, land use category).

The objective was to predict the average tree cover at ecosystem maturity (see section 2.4 and glossary). The results correspond to what can be achieved in terms of restoration through **natural assisted regeneration and not through afforested plantations**. The model does not try to maximize the number of trees but it approximates the most probable natural tree cover for any ecosystem (ranging from 0% to 100% of tree cover). Furthermore, the communicated numbers fundamentally correspond to the potential increase in tree cover associated to the sole bio-physical conditions, therefore they do not consider any socio-economic aspect. The numbers provided should be used as a bio-physical informative benchmark that will help to build future strategies on ecosystem restoration. This work constitutes a preliminary assessment that will require several improvements, as mentioned in the Conclusions and Future Considerations sections.

As reported in section 2.1, the model used the existing tree cover within the International Union for Conservation of Nature (IUCN) World Database on Protected Areas as the main reference. In Europe, except for the artificial areas, all the land use categories are well represented within the large number of European protected areas. This results in the ability of the model to detect and predict the restoration tree potential within each land use category without the need to include a land use change process such as reforestation or afforestation. Trees can indeed be added in pasture or cropland to a certain extent without affecting crop yields (Erb et al. 2016[13], Erb et al. 2018[14]), and they can also serve as an indicator of transition towards sustainable agriculture (Pretty et al. 2018[15]).

The results are presented as follows:

- Section 5.1 presents the distribution of the natural canopy restoration in relation to the size of countries;
- Section 5.2 presents the canopy restoration potential inside and outside Natura 2000 areas;
- Section 5.3 presents the canopy restoration potential in abandoned areas;
- Section 5.4 presents the bio-physical potential for canopy cover restoration in the EU; ·
- Section 5.5 presents the bio-physical potential for canopy cover restoration among Member Countries.

5.1 NATURAL CANOPY RESTORATION POTENTIAL AND COUNTRY AREA

The natural canopy restoration potential is a function of each country area, i.e. larger countries have larger areas available for restoration. However, the average natural tree restoration potential (in % of tree cover) indicates that some countries have a higher relative potential than others (Table 6; Figure 12). For example, Italy has more than one-third of the natural tree restoration potential compared to Finland, even if their area is approximately the same. Germany has a higher natural tree restoration potential compared to Spain, although its area is significantly smaller.

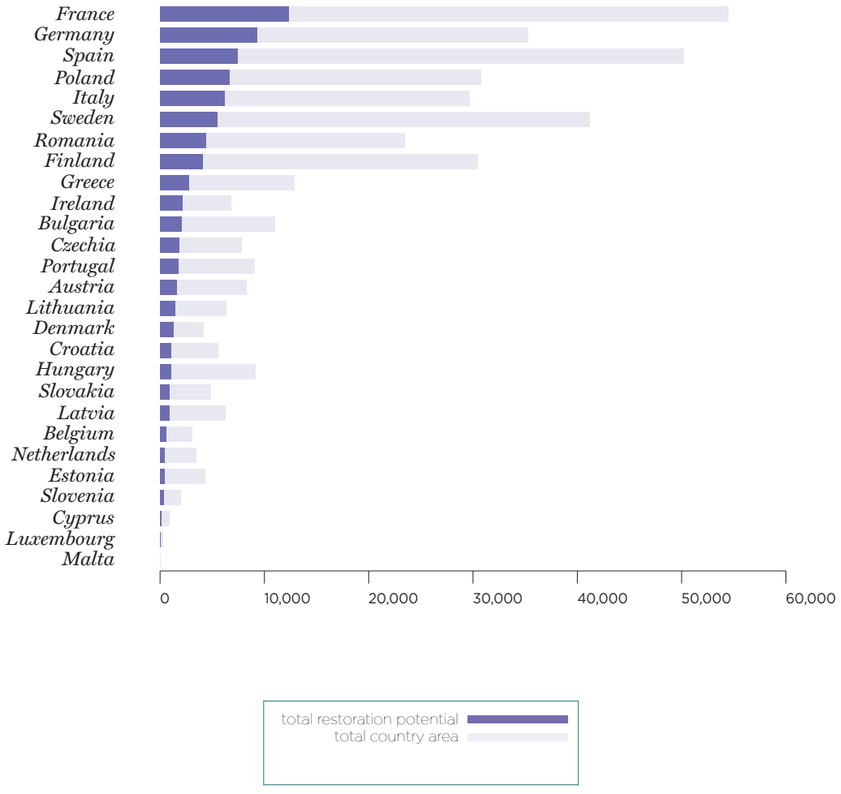
The natural canopy restoration potential in Europe is close to **77 million hectares**, which represent 19% of the total EU area (about 402 million hectares). The five countries presenting the largest restoration potential in the EU are France (12.4 million hectares), Germany (9.3 million hectares), Spain (7.4 million hectares), Poland (6.7 million hectares) and Italy (6.2 million hectares), representing together 55% of the total potential of the EU.

The natural canopy restoration potential represents on average 19% of the country area. There is some variation between country (standard deviation: ±5%), with a maximum in Ireland where the restoration potential reaches 31%, and a minimum in Estonia where it reaches 10%.

13 - K.-H. Erb, C. Lauk, T. Kastner, A. Mayer, M. C. Theurl, H. Haberl, Exploring the biophysical option space for feeding the world without deforestation. Nat. Commun. 7, 11382 (2016). doi:10.1038/ncomms11382
14 - K.-H. Erb, T. Kastner, C. Plutzar, A. L. S. Bais, N. Carvalhais, T. Fetzel, S. Gingrich, H. Haberl, C. Lauk, M. Niedertscheider, J. Pongratz, M. Thurner, S. Luyssaert, Unexpectedly large impact of forest management and grazing on global vegetation biomass. Nature 553, 73–76 (2018). doi:10.1038/nature25138
15 - J. Pretty et al., Global assessment of agricultural system redesign for sustainable intensification. Nat. Sustain. 1, 441–446 (2018).

Table 6 - Natural canopy restoration potential per Member Country.

	Area	Cumulative canopy restoration potential		
Member Country	**In kha**	**In kha**	**In % of total country area**	**In million trees**
France	54,460	12,367	23	6,507
Germany	35,328	9,272	26	4,498
Spain	50,184	7,394	15	6,086
Poland	30,749	6,655	22	3,207
Italy	29,707	6,180	21	4,441
Sweden	41,174	5,519	13	4,953
Romania	23,484	4,385	19	2,017
Finland	30,473	4,099	13	3,955
Greece	12,840	2,793	22	2,331
Ireland	6,822	2,147	31	1,040
Bulgaria	10,997	2,068	19	1,003
Czechia	7,836	1,845	24	896
Portugal	9,056	1,720	19	1,348
Austria	8,327	1,594	19	734
Lithuania	6,360	1,413	22	687
Denmark	4,182	1,312	31	621
Croatia	5,546	1,083	20	670
Hungary	9,142	1,078	12	524
Slovakia	4,872	899	18	418
Latvia	6,321	883	14	429
Belgium	3,047	599	20	291
Netherlands	3,414	456	13	221
Estonia	4,293	444	10	215
Slovenia	2,021	357	18	183
Cyprus	912	136	15	119
Luxembourg	259	58	22	28
Malta	29	7	23	5
EU	**401,834**	**76,764**	**19**	**47,426**



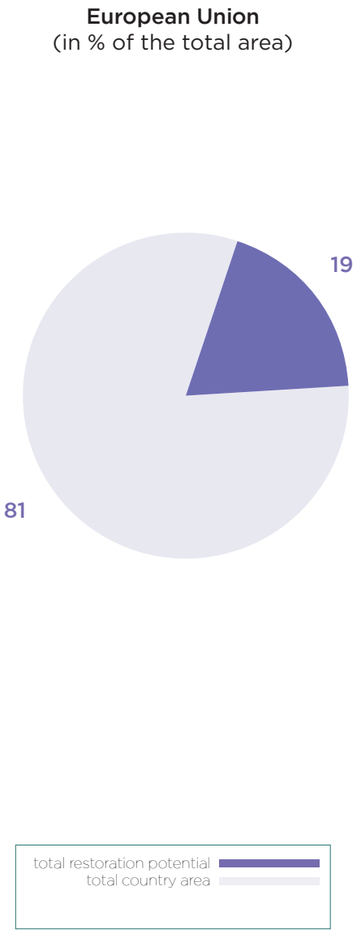


Figure 12 - Canopy restoration potential compared to total Member Country area (kha).

5.2 NATURAL CANOPY RESTORATION POTENTIAL AND NATURA 2000

This section assesses the natural canopy restoration potential inside and outside of Europe's network of Natura 2000 sites (see Table 7, Table 8 and Figure 13).

The natural canopy restoration potential within Natura 2000 sites equals **17.6 million hectares**. A large portion, about 38%, can be found in only three countries: Spain (2.5 million hectares), Germany (2.2 million hectares) and France (2 million hectares). Most of the natural canopy restoration potential of Europe is however located outside Natura 2000 sites, with a total of **59 million hectares** available for canopy restoration.

As could be expected, in most EU Member Countries the natural canopy restoration potential inside Natura 2000 protected areas is lower than that outside Natura 2000 protected areas (Table 8). This means that in most Member Countries, the ecosystems inside Natura 2000 protected areas are closer to ecosystem maturity than the rest of the ecosystems in the country.

There are however two exceptions, Sweden and Finland, where ecosystems outside Natura 2000 protected areas are closer to ecosystem maturity than those inside Natura 2000. The reason of these two nordic exceptions is not clear and should be investigated further.

On average, European Member Countries have 75% of their restoration potential outside Natura 2000 sites, and, consequently, 25% within Natura 2000 sites. There is however some variation between countries (standard deviation: 10%). For instance, the minimum percentage of natural canopy restoration potential outside Natura 2000 is in Luxembourg with 51% and the maximum is in Denmark with 92%.

As Natura 2000 sites are generally registered as "protected" areas by the World Database on Protected Areas of the IUCN, the model used considers them as mature ecosystems. The relative potential gain in tree cover through restoration is therefore lower than outside Natura 2000 sites. This is indeed observed in most of the countries (see difference inside/outside Natura 2000 sites in Table 7). However, it is important to consider that each Natura 2000 area has a protection status based on specific conditions and objectives, which may not necessarily aim to canopy cover restoration. Therefore, any canopy restoration action inside Natura 2000 area should be planned carefully in relation to the existing management plans on a case-by-case basis.

As the main part of the natural canopy restoration potential in Europe is located outside Natura 2000 sites, and as these areas are already under specific management policies, the rest of this report will focus on the natural canopy restoration potential outside Natura 2000 sites.

Table 7 - Natural canopy restoration potential at the Member Country level inside and outside Natura 2000 protected areas: absolute values are presented.

Member Country	Area		Natural canopy restoration potential					
	Outside Natura 2000	Inside Natura 2000	Outside Natura 2000			Inside Natura 2000		
	In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees
France	43,314	11,146	10,361	84	5,386	2,006	16	1,121
Germany	24,831	10,497	7,047	76	3,421	2,225	24	1,077
Spain	32,648	17,535	4,916	66	4,055	2,477	34	2,030
Poland	23,188	7,561	5,266	79	2,539	1,389	21	668
Italy	22,080	7,627	4,932	80	3,568	1,249	20	872
Sweden	34,233	6,941	4,222	76	3,696	1,298	24	1,256
Romania	16,826	6,657	3,401	78	1,577	984	22	440
Finland	25,609	4,864	2,994	73	2,880	1,105	27	1,075
Greece	8,745	4,094	1,924	69	1,632	869	31	700
Ireland	5,238	1,583	1,783	83	865	364	17	175
Bulgaria	6,211	4,786	1,284	62	622	784	38	381
Czechia	6,243	1,593	1,555	84	755	291	16	141
Portugal	6,849	2,207	1,350	79	1,061	369	21	287
Austria	6,520	1,807	1,301	82	600	293	18	134
Lithuania	5,186	1,174	1,214	86	590	199	14	97
Denmark	3,571	611	1,212	92	577	99	8	44
Croatia	3,111	2,435	626	58	376	457	42	293
Hungary	6,255	2,887	825	77	401	253	23	123
Slovakia	2,998	1,874	643	72	301	256	28	117
Latvia	5,394	927	770	87	374	113	13	55
Belgium	2,142	904	444	74	216	155	26	75
Netherlands	2,861	553	393	86	191	63	14	30
Estonia	3,224	1,069	355	80	172	90	20	43
Slovenia	964	1,057	202	57	100	155	43	83
Cyprus	675	236	111	82	97	25	18	22
Luxembourg	124	135	30	51	14	28	49	14
Malta	20	9	5	70	4	2	30	1
EU	**299,062**	**102,772**	**59,166**	**77**	**36,071**	**17,597**	**23**	**11,354**

Table 8 - Natural canopy restoration potential at country level inside and outside Natura 2000 protected areas: the values presented are in relation to Member Country area.

Member Country	Area		Natural canopy restoration potential				Difference between canopy restoration potential outside and inside Natura 2000 In % of area
	Outside Natura 2000	Inside Natura 2000	Outside Natura 2000		Inside Natura 2000		
	In kha	In kha	In kha	In % of country area outside Natura 2000	In kha	In % of country area inside Natura 2000	
France	43,314	11,146	10,361	24	2,006	18	6
Germany	24,831	10,497	7,047	28	2,225	21	7
Spain	32,648	17,535	4,916	15	2,477	14	1
Poland	23,188	7,561	5,266	23	1,389	18	4
Italy	22,080	7,627	4,932	22	1,249	16	6
Sweden	34,233	6,941	4,222	12	1,298	19	-6
Romania	16,826	6,657	3,401	20	984	15	5
Finland	25,609	4,864	2,994	12	1,105	23	-11
Greece	8,745	4,094	1,924	22	869	21	1
Ireland	5,238	1,583	1,783	34	364	23	11
Bulgaria	6,211	4,786	1,284	21	784	16	4
Czechia	6,243	1,593	1,555	25	291	18	7
Portugal	6,849	2,207	1,350	20	369	17	3
Austria	6,520	1,807	1,301	20	293	16	4
Lithuania	5,186	1,174	1,214	23	199	17	6
Denmark	3,571	611	1,212	34	99	16	18
Croatia	3,111	2,435	626	20	457	19	1
Hungary	6,255	2,887	825	13	253	9	4
Slovakia	2,998	1,874	643	21	256	14	8
Latvia	5,394	927	770	14	113	12	2
Belgium	2,142	904	444	21	155	17	4
Netherlands	2,861	553	393	14	63	11	2
Estonia	3,224	1,069	355	11	90	8	3
Slovenia	964	1,057	202	21	155	15	6
Cyprus	675	236	111	16	25	11	6
Luxembourg	124	135	30	24	28	21	3
Malta	20	9	5	23	2	24	0
EU	**299,062**	**102,772**	**59,166**	**20**	**17,597**	**17**	**3**

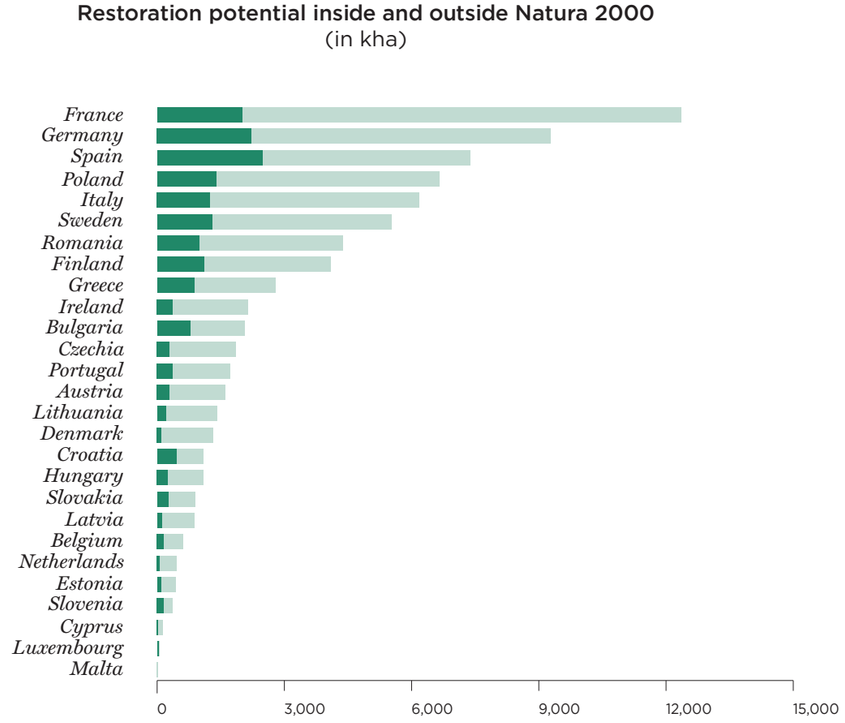


Figure 13 - Restoration potential inside and outside Natura 2000 protected areas (kha).

5.3 NATURAL CANOPY RESTORATION POTENTIAL IN ABANDONED AREAS

This section assesses the natural canopy restoration potential in abandoned areas outside Natural 2000 (see Table 9, Table 10 and Figure 14). Abandoned areas cover **43 million hectares** in the EU (14% of the total EU area outside Natura 2000) and represent an important opportunity for ecosystem recovery in general, and natural tree restoration in particular.

Interestingly, the results show that, at EU-level, the relative restoration potential is similar (difference of 1%) within abandoned land vs. land in use (Table 10 and Figure 14). This means that ecosystems in abandoned land or land in use have a similar recovery potential before reaching ecosystem maturity. However, the numbers at the country level reveal some variations. In most countries, the relative restoration potential is higher in abandoned land compared to land in use. There are some exceptions though: Austria (-7% in abandoned land vs land in use), Ireland (-6%), Italy (-4%), Denmark (-3%), the Netherlands (-3%) Slovenia (-3%) and France (-2%) show a higher natural canopy restoration potential in land currently in use. Slovakia, Belgium, and Cyprus present no difference between the two.

At the country level, on average 12% of the total natural canopy restoration potential outside Natura 2000 is located in abandoned areas. However, this percentage varies considerably between countries (standard deviation = 11 %) with a minimum of 2 % in Germany and a maximum of 44% in Cyprus.

The bulk of the canopy restoration potential in abandoned areas outside Natura 2000 protected areas is found in 6 Member Countries: Spain (1.3 million hectares), Sweden (1.2 million hectares), Italy (0.7 million hectares), Finland (0.6 million hectares), Greece (0.5 million hectares) and France (0.5 million hectares). Together these Member Countries represent more than 70% of the total restoration potential in abandoned area outside Natura 2000 protected areas.

Table 9 - Natural canopy restoration potential in abandoned land and land in use outside Natura 2000 protected areas at the Member Country levels: absolute values are presented.

Member Country	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
	Abandoned area	Area in use	Abandoned area			Area in use			
	In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
France	2,208	41,106	495	5	298	9,866	95	5,087	46
Germany	490	24,342	142	2	69	6,906	98	3,352	23
Poland	1,338	21,850	338	6	163	4,928	94	2,376	39
Italy	4,035	18,046	755	15	572	4,177	85	2,996	56
Spain	7,948	24,700	1,264	26	1,074	3,652	74	2,981	77
Sweden	5,938	28,295	1,169	28	1,163	3,053	72	2,534	83
Romania	928	15,898	212	6	99	3,189	94	1,478	33
Finland	2,772	22,837	579	19	514	2,415	81	2,366	65
Greece	2,194	6,551	535	28	460	1,389	72	1,171	40
Ireland	684	4,555	197	11	96	1,586	89	769	26
Czechia	314	5,929	89	6	43	1,466	94	712	19
Portugal	536	6,313	112	8	87	1,238	92	974	24
Austria	557	5,963	78	6	34	1,224	94	567	21
Bulgaria	796	5,415	186	14	90	1,098	86	532	29
Lithuania	311	4,875	83	7	40	1,131	93	549	19
Denmark	162	3,409	49	4	24	1,163	96	553	13
Hungary	356	5,899	52	6	25	772	94	375	22
Latvia	484	4,909	67	9	33	703	91	341	22
Slovakia	265	2,733	68	11	32	575	89	269	19
Croatia	920	2,191	215	34	155	411	66	222	28
Belgium	69	2,073	14	3	7	430	97	209	7
Netherlands	83	2,778	9	2	4	385	98	187	7
Estonia	155	3,069	20	6	9	335	94	163	15
Slovenia	28	936	5	3	3	197	97	97	5
Cyprus	298	377	48	44	42	62	56	55	8
Luxembourg	2	122	1	2	0	29	98	14	1
Malta	4	16	1	20	1	4	80	3	1
EU	**43,055**	**256,007**	**8,418**	**14**	**6,193**	**50,749**	**86**	**29,878**	**185**

Table 10 - Natural canopy restoration potential in abandoned land and land in use outside Natura 2000 protected areas at the Member Country levels: values presented are in relation to Member Country area.

Member Country	Area		Natural canopy restoration potential				Difference between canopy restoration potential in abandoned land and land in use in % of surface
	Abandoned area	Area in use	Abandoned area		Area in use		
	In kha	In kha	In kha	In % of surface of abandoned area	In kha	In % of surface of area in use	
France	2,208	41,106	495	22	9,866	24	-2
Germany	490	24,342	142	29	6,906	28	1
Poland	1,338	21,850	338	25	4,928	23	3
Italy	4,035	18,046	755	19	4,177	23	-4
Spain	7,948	24,700	1,264	16	3,652	15	1
Sweden	5,938	28,295	1,169	20	3,053	11	9
Romania	928	15,898	212	23	3,189	20	3
Finland	2,772	22,837	579	21	2,415	11	10
Greece	2,194	6,551	535	24	1,389	21	3
Ireland	684	4,555	197	29	1,586	35	-6
Czechia	314	5,929	89	28	1,466	25	4
Portugal	536	6,313	112	21	1,238	20	1
Austria	557	5,963	78	14	1,224	21	-7
Bulgaria	796	5,415	186	23	1,098	20	3
Lithuania	311	4,875	83	27	1,131	23	4
Denmark	162	3,409	49	31	1,163	34	-3
Hungary	356	5,899	52	15	772	13	2
Latvia	484	4,909	67	14	703	14	0
Slovakia	265	2,733	68	26	575	21	5
Croatia	920	2,191	215	23	411	19	5
Belgium	69	2,073	14	21	430	21	0
Netherlands	83	2,778	9	11	385	14	-3
Estonia	155	3,069	20	13	335	11	2
Slovenia	28	936	5	19	197	21	-3
Cyprus	298	377	48	16	62	16	0
Luxembourg	2	122	1	27	29	24	3
Malta	4	16	1	24	4	23	1
EU	**43,055**	**256,007**	**8,418**	**20**	**50,749**	**20**	**0**

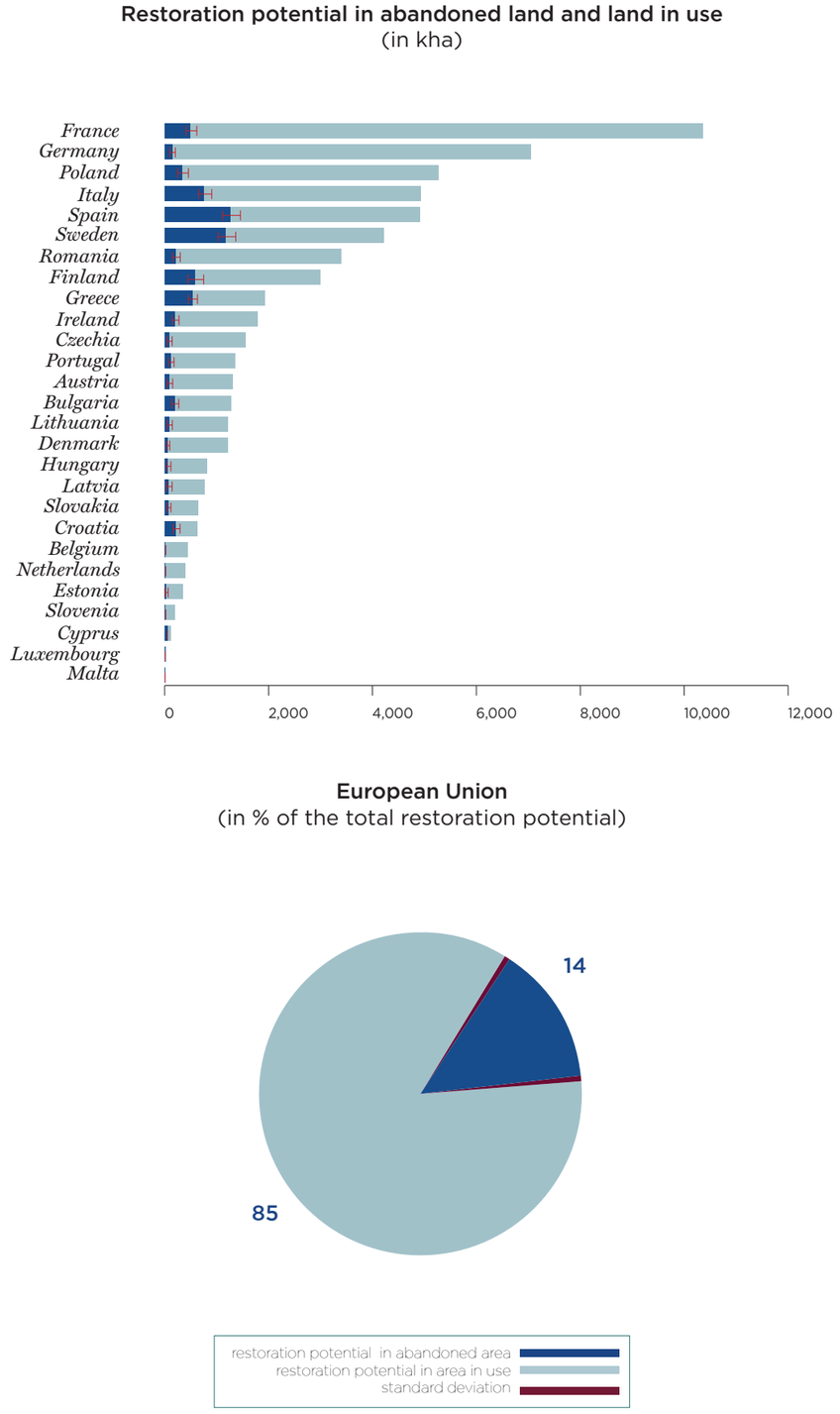


Figure 14 - Restoration potential in abandoned and in use land (in kha).

5.4 NATURAL CANOPY RESTORATION POTENTIAL AT THE EU LEVEL

The total natural canopy restoration potential in the EU, outside Natura 2000 sites, equals 59 million hectares (an area larger than France). This corresponds to the restoration of approximatively 36 billion trees. While two-third of this restoration potential (61%) is found in currently used agricultural lands (Figure 15 and Table 11), important shares of this restoration potential can also be found in forest and semi natural land (26%), in abandoned agricultural area (5%) and in wetlands (1%).

In agricultural land, the biophysical canopy restoration potential is important, yet it should not be considered at the expense of food security or farmers' income. Several actions might however be considered by the different stakeholders to restore the ecosystems functions without decreasing yields or income. These actions are often summarized in the framework of sustainable agriculture[16].

In forests and semi natural land, about a third of their potential can be restored in abandoned lands. This means that, when considering only abandoned lands, the restoration potential of forests and semi natural land is more important than in agricultural land (8% versus 5%).

In wetlands (including peatlands, inland marshes, peat bogs, salt marshes, salines and intertidal flats), the restoration potential is even more important on abandoned land than in wetland currently in use.

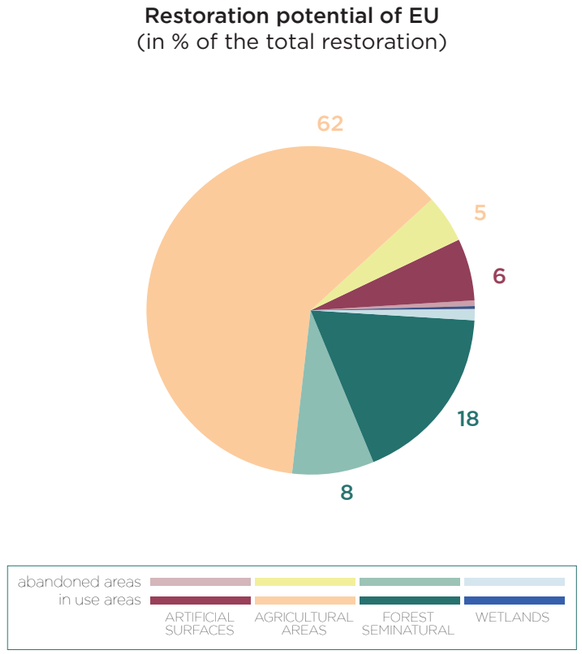


Figure 15 - Natural canopy restoration potential in the EU, outside Natura 2000 protected areas (in % of the total natural restoration potential outside Natura 2000 protected areas).

16 - J. Pretty et al., Global assessment of agricultural system redesign for sustainable intensification. Nat. Sustain. 1, 441–446 (2018).

Table 11 - Natural canopy restoration potential and area in the EU, outside Natura 2000 protected areas.

Land Cover Class	Area	Natura canopy restoration potential			Standard deviation of the estimations in abandoned areas
	In kha	In kha	In % of total	In million trees	In kha
Artificial surfaces (abandoned)	1,009	258	0	161	26
Artificial surfaces (in use)	13,852	3,805	6	2,037	
Artificial surfaces (total)	14,861	4,064	7	2,197	
Agricultural areas (abandoned)	11,641	2,747	5	1,855	102
Agricultural areas (in use)	142,957	36,428	62	20,075	
Agricultural areas (total)	154,598	39,175	66	21,930	
Forest and semi natural areas (abandoned)	26,802	4,599	8	3,881	142
Forest and semi natural areas (in use)	98,978	10,438	18	7,285	
Forest and semi natural areas (total)	125,780	15,037	25	11,166	
Wetlands (abandoned)	2,696	640	1	567	24
Wetlands (in use)	1,128	251	0	211	
Wetlands (total)	3,823	891	2	778	
All classes (abandoned)	43,055	8,418	14	6,193	185
All classes (in use)	256,007	50,749	86	29,878	
All classes (total)	299,062	59,166	100	36,071	

5.5 NATURAL CANOPY RESTORATION POTENTIAL AMONG EU MEMBER COUNTRIES

The distribution of the restoration potential of each land cover types varies substantially among EU Member Countries (Figure 16). Yet, some common patterns/potential restoration strategies can already be identified with summarized statistics, i.e. looking only at the main land cover categories, for (i) northern Member Countries and (ii) southern Member Countries.

Northern Member Countries (Finland, Sweden) present most of their restoration potential within a single land cover category and more than 70% of their restoration potential can be found within forest and semi natural areas.

Southern Member Countries (Cyprus, Greece, Italy, Portugal and Spain) present a restoration potential divided between agricultural areas (55% to 70%) and forest and semi natural areas (20% to 50%).

The rest of the Member Countries display most of their total canopy restoration potential in agricultural areas (more than 60%). There are however exceptions, such as Austria, which displays a "southern Member Country" pattern, with more than 55% of its restoration potential in agricultural areas, and more than 30% in natural and semi natural areas.

Thus, while tailored restoration strategies are required at national and sub-national level for each EU Member Country, these numbers highlight potential common strategies that could be shaped by groups of countries in order to develop a coherent European restoration strategy.

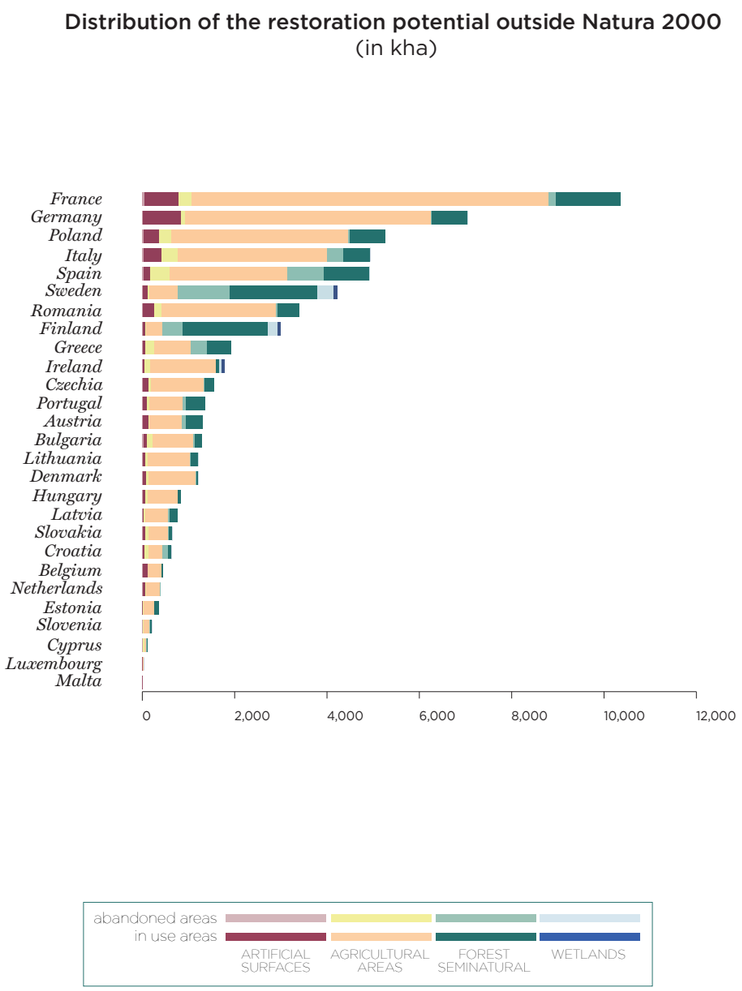


Figure 16 - Distribution of the natural canopy restoration potential in the EU outside Natura 2000 protected areas (in kha).

5.5.1 Artificial surfaces

This section assesses the restoration potential in artificial areas outside Natura 2000, presented in Figure 17 and Table 12. Artificial areas include urban, industrial, commercial and transport infrastructures. There is potential to green cities and artificial surfaces in EU Member Countries particularly in areas in use, however this should be put in perspective with the total restoration potential outside Natura 2000 areas (see Figure 16).

Artificial areas are mainly occupied by dwellings and buildings used by administrative/public utilities as well as occupied by industrial activities of manufacturing, trade, financial activities and services. These areas also include extractive activities and construction sites, man-made waste dump sites and their associated lands. These areas represent about the 5% of the total countries' areas and the first largest 10 countries cover about 80% of the total amount of restoration potential. More than 70% of artificial areas are "discontinuous urban fabric". This class is assigned when urban structures and transport networks associated with vegetated areas and bare surfaces are present and occupy significant surfaces in a discontinuous spatial pattern.

55% of the restoration potential in artificial surfaces in the EU are concentrated in Germany, France, Italy and Poland. The total restoration potential represents approximately 30% of artificial areas and the firsts 10 countries cover more than 80% of the total amount of restoration potential.

The main driver of the distribution seems to be the amount of population and discontinuous urban fabric (with a high correlation coefficient, more than 95%).

Spain has less restoration potential than Poland and Romania although its population is much higher but these two countries present discontinuous urban fabric almost twice than Spain. Italy has a restoration potential which is higher than Poland although its discontinuous urban fabric is sensibly less but has almost double the population.

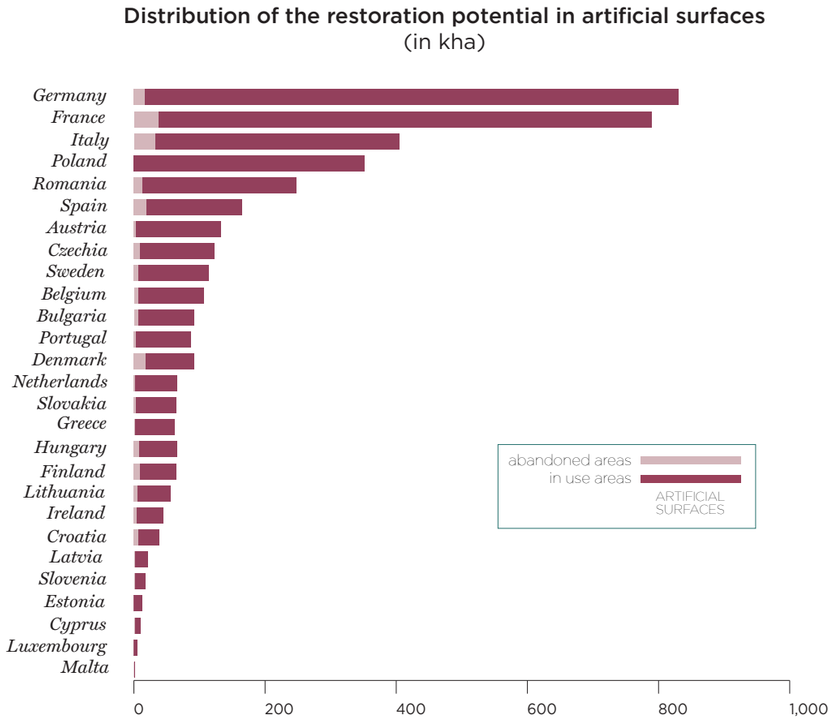


Figure 17 - Distribution of the natural canopy restoration potential in artificial surfaces in the EU outside Natura 2000 protected areas (in kha).

Table 12 - Distribution of the natural canopy restoration potential in artificial surfaces in the EU outside Natura 2000 protected areas (in kha).

ARTIFICIAL SURFACES									
Member Country	**Area**		**Natural canopy restoration potential**						**Standard deviation of the estimations in abandoned areas**
	Abandoned area	Area in use	Abandoned area			Area in use			
	In kha	In kha	In kha	In % of total restoration in artificial surfaces	In million trees	In kha	In % of total restoration in artificial surfaces	In million trees	In kha
Austria	9	363	3	2	1	129	98	60	2
Belgium	27	481	6	5	3	101	95	49	4
Bulgaria	67	289	18	20	9	74	80	36	7
Croatia	19	103	7	18	5	31	82	18	3
Cyprus	16	57	3	24	3	9	76	8	2
Czechia	28	356	9	7	4	113	93	55	5
Denmark	8	270	3	4	1	84	96	38	3
Estonia	3	76	0	3	0	13	97	7	1
Finland	6	425	1	2	1	61	98	58	2
France	122	2,373	37	5	20	753	95	397	9
Germany	60	2,415	17	2	8	813	98	395	7
Greece	38	245	9	14	7	55	86	47	4
Hungary	25	415	3	5	1	61	95	30	5
Ireland	8	107	4	8	2	41	92	20	2
Italy	114	1,173	32	8	24	373	92	232	8
Latvia	9	97	1	5	1	21	95	10	2
Lithuania	15	159	5	8	2	51	92	25	3
Luxembourg	1	15	0	4	0	5	96	2	1
Malta	1	6	0	19	0	1	81	1	1
Netherlands	12	447	2	3	1	64	97	31	3
Poland	105	1,279	25	7	12	326	93	157	9
Portugal	17	271	6	7	4	86	93	57	4
Romania	51	941	13	5	6	234	95	110	6
Slovakia	24	174	8	12	4	57	88	26	4
Slovenia	3	39	1	5	0	17	95	8	1
Spain	115	807	19	12	17	145	88	113	8
Sweden	37	541	7	6	4	107	94	69	5
EU	**1,009**	**13,852**	**258**	**6**	**161**	**3,805**	**94**	**2,037**	**26**

5.5.2 Agricultural surfaces

This section assesses the restoration potential in agricultural surfaces outside Natura 2000, presented in Figure 18 and Table 13. The natural canopy restoration potential in agricultural surfaces among EU Member Countries can mainly be found in agricultural areas in use. However, this does not suggest that land use conversions should take place in agricultural surfaces, but rather that synergies can be sought between productivity and biodiversity corridors, hedges, agroforestry etc. in line with EU policies and priorities of Member Countries.

58% of the total restoration potential in agricultural surfaces lies in five Member Countries (France, Germany, Poland, Italy and Spain).

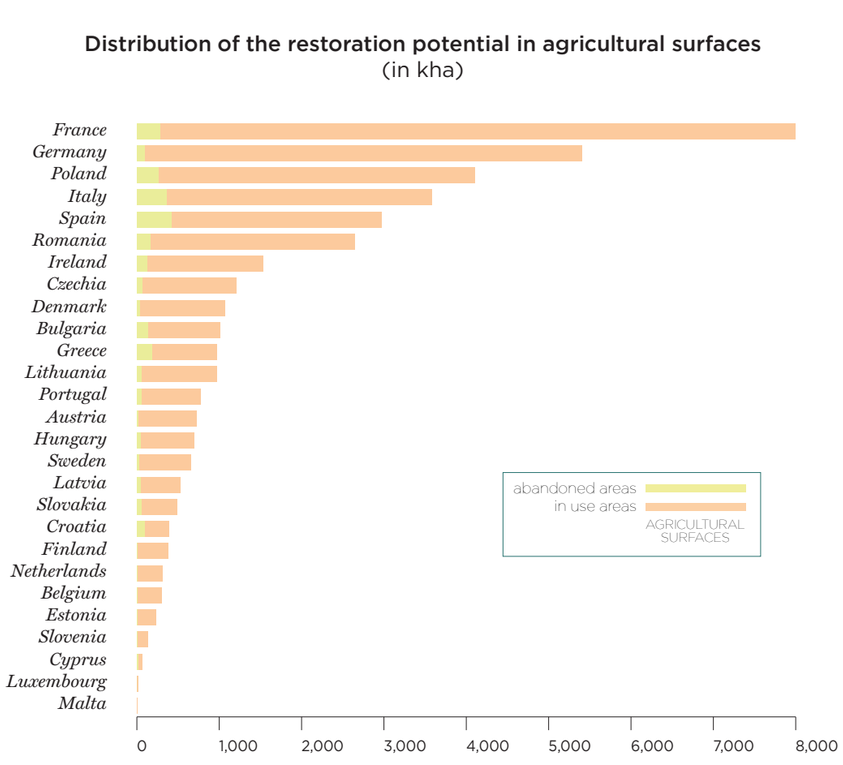


Figure 18 - Distribution of the natural canopy restoration potential in agricultural surfaces in the EU outside Natura 2000 protected areas (in kha).

Table 13 - Distribution of the natural canopy restoration potential in agricultural surfaces in the EU outside Natura 2000 protected areas (in kha).

AGRICULTURAL SURFACES									
Member Country	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
	Abandoned area	Area in use	Abandoned area			Area in use			
	In kha	In kha	In kha	In % of total restoration in agricultural surfaces	In million trees	In kha	In % of total restoration in agricultural surfaces	In million trees	
Austria	33	2,177	10	1	5	717	99	339	5
Belgium	32	1,347	7	2	3	295	98	143	5
Bulgaria	529	3,507	135	13	66	874	87	422	23
Croatia	371	1,180	93	24	59	301	76	156	19
Cyprus	110	274	19	29	17	46	71	41	5
Czechia	221	3,808	67	6	33	1,142	94	554	16
Denmark	114	2,824	39	4	19	1,026	96	489	11
Estonia	44	1,221	8	4	4	226	96	110	7
Finland	48	2,508	8	2	7	367	98	345	5
France	1,002	27,379	280	4	157	7,719	96	3,902	33
Germany	283	15,571	95	2	46	5,309	98	2,578	17
Greece	758	3,319	180	18	155	792	82	668	25
Hungary	275	4,450	42	6	20	655	94	318	21
Ireland	367	3,801	123	8	60	1,409	92	684	20
Italy	1,400	12,171	355	10	290	3,229	90	2,368	37
Latvia	202	2,152	40	8	19	490	92	238	13
Lithuania	197	3,295	56	6	27	911	94	443	15
Luxembourg	2	65	0	2	0	19	98	9	1
Malta	2	10	0	15	0	2	85	2	1
Netherlands	42	2,168	5	2	2	309	98	150	5
Poland	985	14,698	266	6	129	3,834	94	1,850	34
Portugal	216	3,224	51	7	42	728	93	580	16
Romania	639	10,490	166	6	78	2,479	94	1,152	26
Slovakia	188	1,561	53	11	25	434	89	204	16
Slovenia	7	393	3	2	1	133	98	65	2
Spain	2,630	16,781	421	14	367	2,552	86	2,125	51
Sweden	153	3,373	22	3	13	631	97	349	9
EU	**11,641**	**142,957**	**2,747**	**7**	**1,855**	**36,428**	**93**	**20,075**	**102**

5.5.3 Forests and semi-natural areas

This section assesses the restoration potential in forests and semi-natural areas outside Natura 2000, presented in Figure 19 and Table 14. Approximately 25% of the natural canopy restoration potential in Europe can be found in forest and semi-natural areas, 98 % of which are found in specific forest sub-categories such as forest and scrubs (CORINE classes “broad-leaved forest”, “coniferous forest”, “mixed forest”, “natural grassland”, “moors and heatland”, “sclerophyllous vegetation”, ”transitional woodland-shrub”).

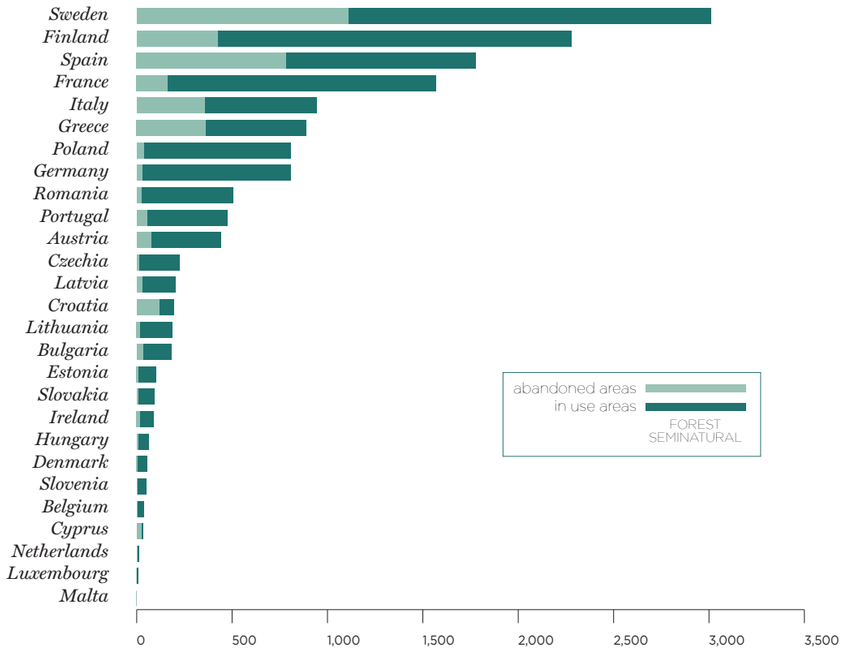


Figure 19 - Distribution of the natural canopy restoration potential in forests and semi-natural areas in the EU outside Natura 2000 protected areas (in kha)

Table 14 - Distribution of the natural canopy restoration potential in forests and semi-natural areas in the EU outside Natura 2000 protected areas (in kha).

FOREST AND SEMI NATURAL AREAS									
Member Country	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
	Abandoned area	Area in use	Abandoned area			Area in use			
	In kha	In kha	In kha	In % of total restoration in forests and semi-natural areas	In million trees	In kha	In % of total restoration in forests and semi-natural areas	In million trees	
Austria	599	3,336	76	17	33	366	83	162	23
Belgium	7	248	1	3	1	35	97	17	2
Bulgaria	193	1,626	33	18	16	150	82	73	15
Croatia	525	912	117	60	93	78	40	46	19
Cyprus	164	53	25	78	22	7	22	6	4
Czechia	48	1,782	10	5	5	213	95	104	8
Denmark	27	307	5	8	2	51	92	25	4
Estonia	78	1,751	9	9	4	90	91	44	12
Finland	1,948	19,595	424	19	385	1,857	81	1,818	67
France	1,008	11,412	162	10	117	1,407	90	792	30
Germany	129	6,350	28	3	13	780	97	378	12
Greece	1,413	2,969	362	41	312	526	59	442	31
Hungary	50	1,024	6	10	3	56	90	27	7
Ireland	85	370	17	20	8	70	80	34	8
Italy	2,351	4,869	354	38	243	588	62	411	37
Latvia	243	2,625	28	14	14	177	86	86	18
Lithuania	76	1,426	17	9	8	169	91	82	10
Luxembourg	0	42	0	0	0	6	100	3	0
Malta	1	1	0	61	0	0	39	0	0
Netherlands	17	164	1	6	0	12	94	6	3
Poland	192	5,906	37	5	18	772	95	371	16
Portugal	302	2,817	54	11	41	424	89	336	18
Romania	159	4,528	25	5	11	481	95	218	18
Slovakia	44	1,006	7	8	3	85	92	39	8
Slovenia	18	503	2	3	1	48	97	23	4
Spain	4,731	7,575	783	44	648	995	56	785	50
Sweden	4,738	23,437	1,110	37	1,081	1,902	63	1,754	84
EU	**26,802**	**98,978**	**4,599**	**31**	**3,881**	**10,438**	**69**	**7,285**	**142**

5.5.4 Wetlands

This section assesses the restoration potential in wetlands outside Natura 2000, presented in Figure 20, Figure 21 and Table 15 and Table 16.

Wetlands are the only land use category where there is a greater restoration potential in the abandoned lands compared to areas in use.

It should be noted here that large parts of European wetlands are comprised within the Natura 2000 protected areas network. As for all the other land cover categories, these Natura 2000 protected areas are excluded from the analysis on the restoration potential.

Wetlands are important and fragile ecosystems. Therefore, the interpretation of the results on the canopy restoration potential needs to be done with care. For instance, an increase of potential canopy cover in the northern regions might be associated to recent increases in temperature, and therefore might indicate climate threats on existing natural ecosystems. However, the results presented show significant canopy restoration potential in abandoned wetlands (mostly peatland areas and bogs). In the case of peatlands and bogs, the results could be interpreted as an indication that a large proportion of them have been degraded by harvesting and grazing and that specific wetland restoration activities could be developed to address their specific ecosystem characteristics.

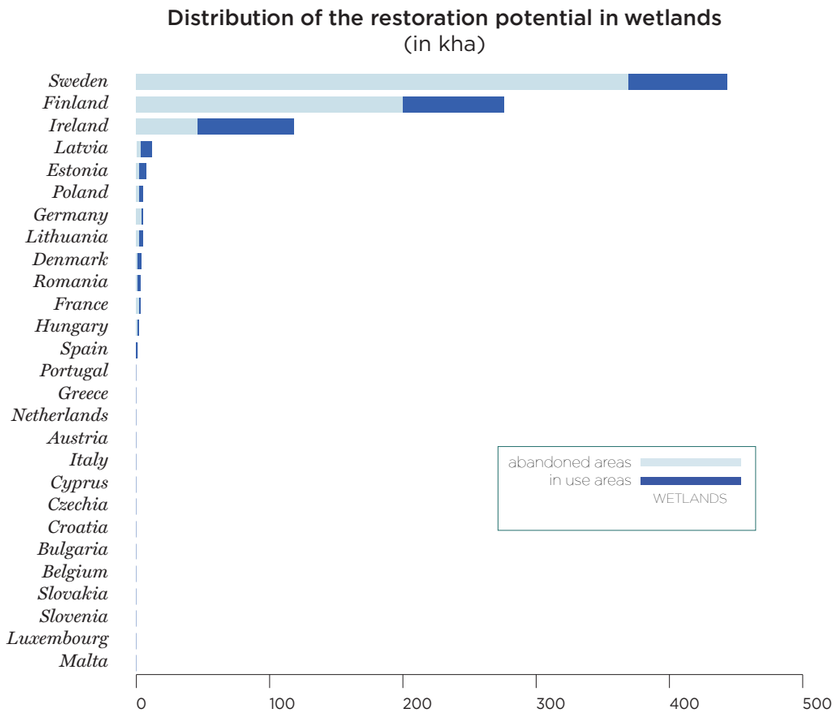
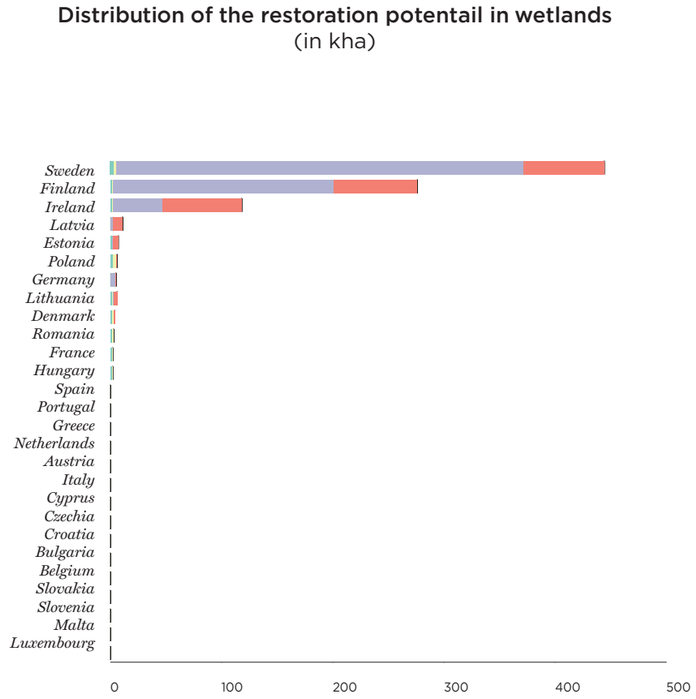


Figure 20 - Distribution of the natural canopy restoration potential in wetlands in the EU outside Natura 2000 protected areas (in kha).

Table 15 - Distribution of the natural canopy restoration potential in wetlands in the EU outside Natura 2000 protected areas (in kha).

WETLANDS									
Member Country	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
	Abandoned area	Area in use	Abandoned area			Area in use			
	In kha	In kha	In kha	In % of total restoration in wetlands	In million trees	In kha	In % of total restoration in wetlands	In million trees	
Austria	1	1	0	52	0	0	48	0	0
Belgium	0	0	0	0	0	0	100	0	0
Bulgaria	0	1	0	0	0	0	100	0	0
Croatia	0	1	0	0	0	0	100	0	-
Cyprus	1	0	0	70	0	0	30	0	0
Czechia	0	1	0	0	0	0	100	0	-
Denmark	6	13	1	26	1	3	74	1	2
Estonia	16	35	2	30	1	5	70	3	3
Finland	757	321	200	72	191	76	28	76	16
France	7	12	2	55	1	1	45	1	2
Germany	11	12	4	74	2	1	26	1	3
Greece	2	1	0	68	0	0	32	0	0
Hungary	6	10	1	30	0	1	70	1	2
Ireland	201	300	46	39	22	72	61	35	12
Italy	2	0	0	100	0	0	0	0	0
Latvia	21	45	3	22	1	9	78	5	4
Lithuania	7	13	2	39	1	3	61	2	2
Luxembourg	0	0	0	0	0	0	100	0	-
Malta	0	0	0	0	0	0	100	0	-
Netherlands	5	5	0	65	0	0	35	0	1
Poland	9	14	2	43	1	3	57	2	2
Portugal	1	2	0	43	0	0	57	0	1
Romania	6	12	1	33	1	2	67	1	2
Slovakia	0	0	0	0	0	0	100	0	-
Slovenia	0	0	0	0	0	0	100	0	-
Spain	7	2	1	71	1	0	29	0	1
Sweden	1,567	386	369	83	355	74	17	72	22
EU	**2,696**	**1,128**	**640**	**72**	**567**	**251**	**28**	**211**	**24**



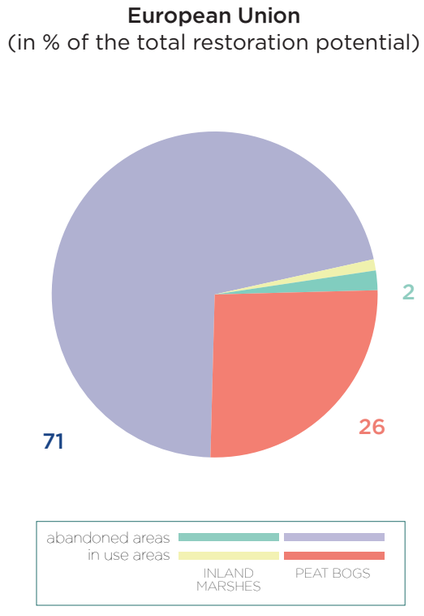


Figure 21 - Distribution of the natural canopy restoration potential in wetlands in the EU outside Natura 2000 protected areas, between 5 subclasses (in kha and %)

Table 16 - Distribution of the natural canopy restoration potential in wetlands in the EU outside Natura 2000 protected areas, between 5 sub-classes (in kha) and in the top 3 Member Countries in terms of potential in wetlands: Finland, Ireland and Sweden. Details for wetlands for all and each Member Country can be found in Annex 8.3.

WETLANDS									
Member Country	Wetland sub-class	Area		Natural canopy restoration potential					
		Abandoned area	Area in use	Abandoned area			Area in use		
		In kha	In kha	In kha	In % of total restoration in wetlands	In million trees	In kha	In % of total restoration in wetlands	In million trees
Finland	Inland marshes	6	8	1	57	1	1	43	1
	Peat bogs	752	311	199	73	190	75	27	75
	Salt marshes	1	2	0	0	0	0	100	0
	Salines	0	0	0	0	0	0	100	0
	Intertidal flats	0	0	0	0	0	0	100	0
Ireland	Inland marshes	2	3	1	45	0	1	55	0
	Peat bogs	199	295	45	39	22	71	61	35
	Salt marshes	0	0	0	0	0	0	100	0
	Salines	0	0	0	0	0	0	100	0
	Intertidal flats	0	2	0	0	0	0	100	0
Sweden	Inland marshes	22	12	3	64	3	2	36	1
	Peat bogs	1,550	370	366	83	352	73	17	71
	Salt marshes	0	0	0	0	0	0	100	0
	Salines	0	0	0	0	0	0	100	0
	Intertidal flats	0	0	0	0	0	0	100	0
EU	Inland marshes	113	58	17	61	10	11	39	6
	Peat bogs	2,612	1,013	630	73	565	230	27	194
	Salt marshes	11	5	1	69	1	1	31	0
	Salines	1	3	0	36	0	0	64	0
	Intertidal flats	4	5	1	42	0	1	58	0

6. CONCLUSIONS

This report summarizes the results of the customization of the global tree restoration potential to the case of EU Member Countries. The numbers highlighted in this report, both in terms of canopy cover or number of trees, only refer to the biophysical restoration potential of EU Member Countries. They do not include socio-economic aspects, which are important to take into account when implementing the restoration potential.

The natural restoration potential of EU Member Countries reported here can theoretically be reached without "planting" a single tree, but mostly through natural regeneration. However, in some cases, the lands will be too degraded or depleted and will require assisted natural regeneration, which involves the action of "planting". Assisted natural regeneration can play a crucial role to speed up the natural restoration process, especially in situations of severely degraded or depleted lands or after disturbances such as fires, strong winds, grazing, etc. The assessment of areas suited for natural regeneration and natural assisted regeneration will be a key objective to tackle for further work.

The key message of this report is that the potential tree restoration in the EU presented here is larger than the ambitious target of 3 billion trees set by the European Commission in the EU Biodiversity Strategy for 2030, i.e. 6 billion mature trees in abandoned lands outside Natura 2000. This implies that the target set by the European Commission is entirely feasible from a biophysical perspective.

6.1 MAIN RESULTS

This report reveals that an extra **59 million hectares** of land could be covered by trees within EU, when looking only at the biophysical potential of EU outside Natura 2000 sites. This corresponds to an estimated 36 billion of mature trees, i.e. trees with a diameter at breast height ≥ 10cm. In abandoned lands, which cover about 15% of European lands, large areas are also available for tree restoration. Indeed about **8 million hectares** of land outside Natura 2000 in abandoned lands could be covered by trees, corresponding to about 6 billion of mature trees.

The report also reveals that the distribution of the restoration potential among land cover categories present some similarities between different groups of EU Member Countries. In particular, there is a substantial difference between the restoration potential of northern countries, dominated by a potential in forest and semi-natural areas, compared to the restoration potential of the southern countries, with a potential distributed between agriculture and forest and semi-natural areas. Therefore, while it is clear that Member Country specific restoration strategies should be adopted, the results presented show some potential convergence between Member Countries.

6.2 LIMITATIONS

The current report presents the tree restoration potential of EU Member Countries from the biophysical perspective only.

This biophysical potential is likely to be underestimated. Indeed, about a third of protected areas, used here as a reference of ecosystem maturity, are actually degraded[17] and are likely to present a lower tree cover than expected at maturity. Moreover, many sites that are classified as "protected areas" in Europe are actually found within agricultural landscapes (representing about 33 million hectares), which by default have a very low tree cover. This leads the model to underestimate the tree cover in many agricultural regions of the EU.

Another limitation is the time mismatch between the natural (biophysical) tree cover potential reported in the present document (2015) and the datasets that were used (current tree cover reported by Hansen, forest land use in CORINE and LUCAS databases). This might also result in a potential underestimation of the natural tree restoration potential as the present report misses, for instance, important tree mortality due to the recent major bark-beetle outbreaks or the recent major droughts.

The definition of "abandoned land/land in use" is dependent of the quality of the LUCAS database. As this definition is crucial to assess EU restoration capacity, further work should propagate accuracy assessment of the LUCAS database when assessing the restoration capacity of EU Member Countries, in particular at finer scale.

The carbon mitigation potential associated to restoration is not calculated in this report. This estimation should be further calculated in collaboration with European experts and in particular with the Joint Research Centre of the European Commission.

17 - Jones, K.R., Venter, O., Fuller, R.A., Allan, J.R., Maxwell, S.L., Negret, P.J., et al. (2018). One-third of global protected land is under intense human pressure. Science, 360, 788–791.

7. FUTURE CONSIDERATIONS AND POSSIBLE IMPROVEMENTS

This report constitutes a first preliminary assessment of the restoration potential of European ecosystems. The aim of this report is to start to shape a framework in terms of restoration for the 27 Member Countries. It constitutes a benchmark on which further work must be conducted before leading to concrete restoration actions.

Several points should be considered for further improvement: the model, the data, the scale, the calculations on the mitigation potential.

7.1 THE MODEL

The current preliminary report is based on the exact same modelling framework that was published in Bastin et al. (2019), which was optimized for yielding robust statistics at a global level. A future consideration is to re-build a model fully customized for the European level using the latest advances in machine learning modelling methods (e.g. Neural Network). Several modelling techniques should be tested and further compared and specific EU layers should also be implemented in the model (see section 7.2 below “The data”).

7.2 MODEL COVARIATES AND RESPONSE

The current natural tree cover potential has been modelled from 10 variables (Table 1) selected from an original set of 58 variables (see Annex 8.2.1) in order to minimize the risks of overfitting due to autocorrelated variables. A future consideration is to reconsider the original set of variables for the specific case of the EU, using specific tree cover, climate, edaphic and topographic layers developed and used for and by European research centres and, in particular, by Copernicus (e.g. EU Tree density 2015 at 20 m resolution) or by the Joint Research Centre of the European Commission.

Further restoration assessments for EU Member Countries should go beyond the tree cover as a sole metric to characterize the state of the ecosystem. This could encompass other vegetation elements (herbs, shrubs), floristic composition (biodiversity, ecosystem services), soil properties (soil physics and chemistry, soil micro-organism) and fauna descriptors.

7.3 NON-BIOPHYSICAL DESCRIPTORS

This report presents results on the EU restoration potential from a biophysical point of view. Many improvements might be implemented at this level, yet the ultimate decision on restoration must also consider factors that go beyond the biophysical restoration potential.

Current and future work on the natural restoration potential should therefore serve as a benchmark for policymakers to take decisions on restoration while carefully considering specific socio-economic aspects of each Member Country, each region and each sector involved in land management like historical factors, land ownership and rights, etc.

7.4 THE SCALE

The current restoration tree cover potential has been assessed at a 1 km ground spatial resolution. To enable the implementation of restoration actions it will be necessary to downscale the spatial resolution by a factor ranging from 10 to 100. It is expected that the use of European satellite products from Copernicus (e.g. Sentinel missions) will play a key role in refining the resolution.

In addition, this future very high-resolution potential tree cover map will have to be studied in parallel to land cover and land use products with a similar spatial resolution (that is compared to the current CORINE database that was used). This will require a close hand-in-hand collaboration with experts of each country, each region and each sector of the 27 Member Countries.

7.5 NATURAL REGENERATION VS. NATURAL ASSISTED REGENERATION

This report presents results regarding the natural restoration potential of EU Member Countries. This encompasses two possible actions for restoration: allocating lands for natural regeneration (without any kind of human intervention) and allocating lands for natural assisted regeneration (requiring intervention such as species selection and dispersal/planting activities with respect to endemic diversity). The present report does not make the distinction between the two options as more information on requirements associated to both options are required.

The clear distinction between areas suited for natural regeneration versus natural **assisted** regeneration is a key objective that could be considered in further improvements of this work.

7.6 THE SPECIES

This report presents results on the EU restoration potential in terms of tree cover and canopy area. These numbers respect the expected natural structure of the vegetation, from 0% to 100% of tree cover. As previously explained, the restoration should aim to recover the natural state of the vegetation and not to maximize its tree cover. It is therefore recommended to restore endemic species respecting endemic diversity. Further work could provide a concrete map containing this “endemic” species information.

7.7 ADAPTATION TO FUTURE CONDITIONS

This report presents results on the EU restoration potential considering current conditions (current tree cover, current climate conditions, current land cover). Further work could consider the EU restoration potential in the framework of global change (socio-economic change, climate change). In particular, the future natural restoration potential will differ from the present natural restoration potential as future climate conditions are very likely to change the ecological niche of tree species[18]. Research on future projected natural vegetation[19], in terms of structure and of species composition, could therefore considered.

7.8 NUTS2 LEVEL

This report has presented data at the national level. For many European Member Countries, this represents a mean of a very heterogenous territory and data at national level do not always best describe the reality. The same data analysed at the regional level (NUTS2) could provide a very different perspective. It is likely that the NUTS2 level data and analyses are needed to fully implement the restoration potential in the EU.

The figures below provide an example of analyses done at NUTS2 level and show that further reflection is needed. A more in-depth analysis at this level could be done in the future.

18 - Bastin, J.-F., Finegold, Y., Garcia, C., Mollicone, D., Rezende, M., Routh, D., Zohner, C.M. & Crowther, T.W. (2019) The global tree restoration potential. Science (New York, N.Y.), 365, 76–79.

19 - Hickler, T., Vohland, K., Feehan, J., Miller, P.A., Smith, B., Costa, L., Giesecke, T., Fronzek, S., Carter, T.R., Cramer, W., Kühn, I. & Sykes, M.T. (2012) Projecting the future distribution of European potential natural vegetation zones with a generalized, tree species-based dynamic vegetation model. Global Ecology and Biogeography, 21, 50–63.

Distribution of the restoration outside Natura 2000
(in kha)

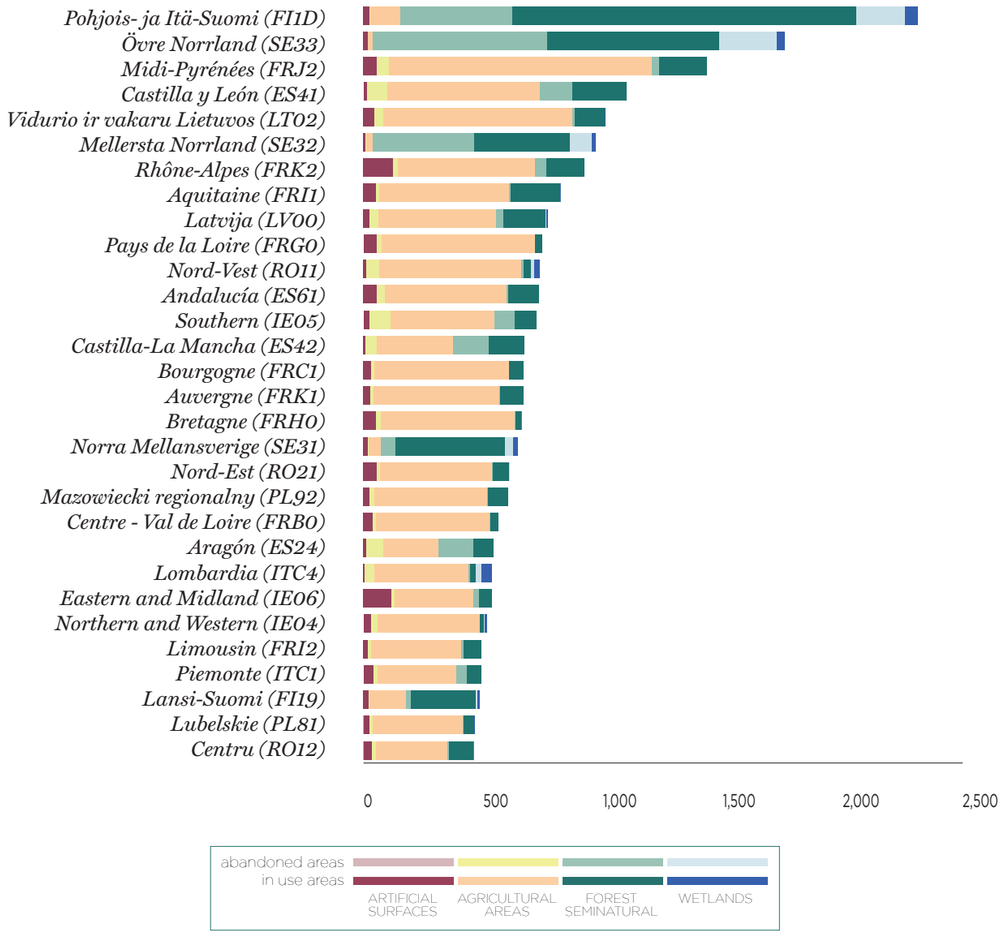


Figure 22 Distribution of the natural canopy restoration potential in the EU outside Natura 2000 protected areas: the 30 regions (NUTS2 level subdivision) presenting the largest natural canopy restoration potential (in kha).

Distribution of the restoration in artificial surfaces
(in kha)

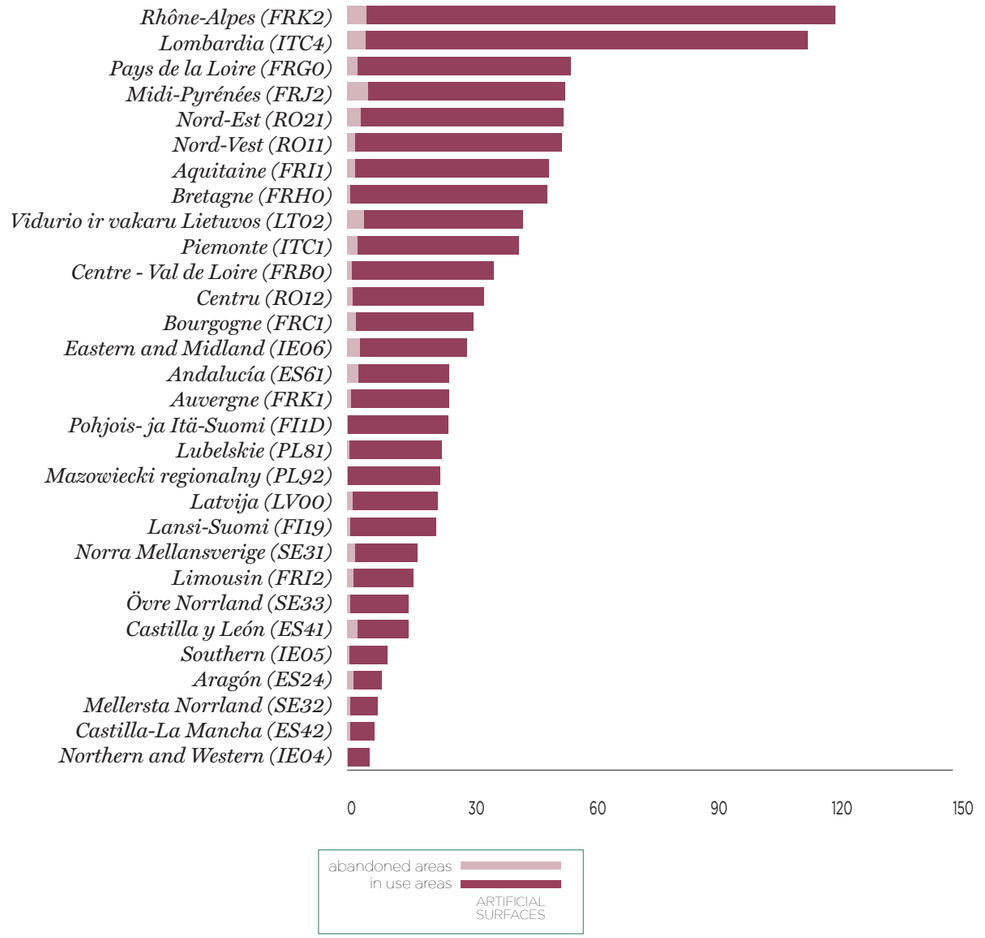


Figure 23 Distribution of the natural canopy restoration potential in artificial surfaces in the EU outside Natura 2000 protected areas: the 30 regions (NUTS2 level subdivision) presenting the largest natural canopy restoration potential in artificial surfaces (in kha).

Distribution of the restoration potential in agricultural surfaces
(in kha)

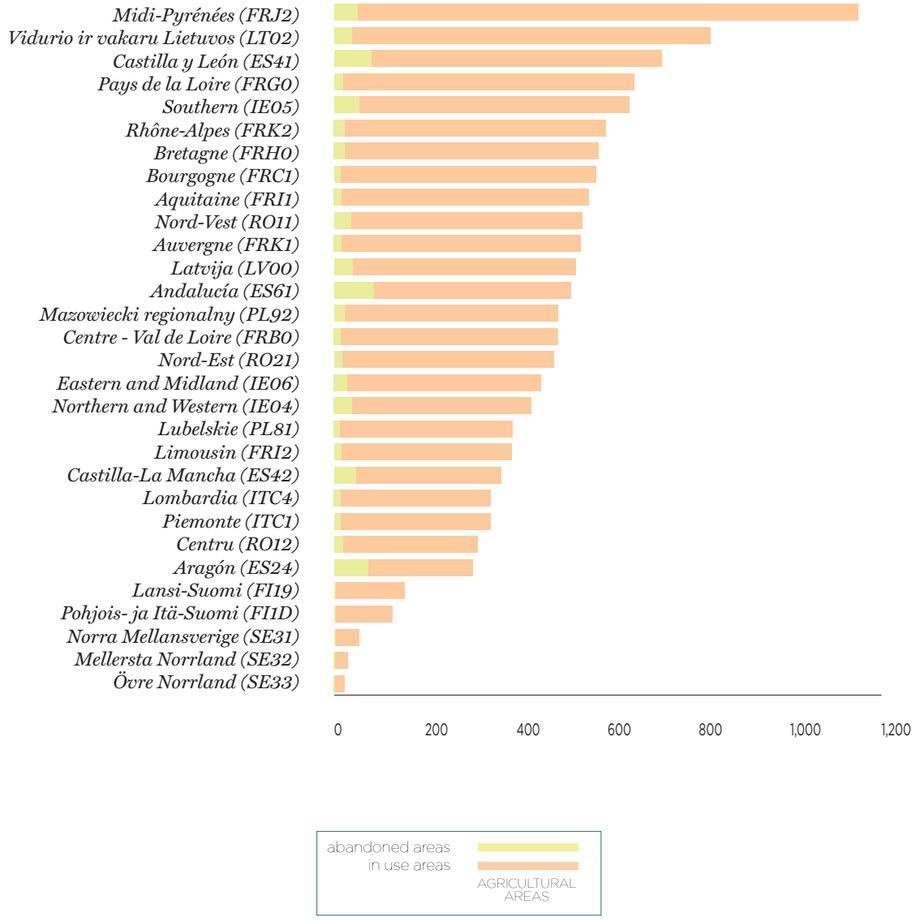


Figure 24 Distribution of the natural canopy restoration potential in agricultural surfaces in the EU outside Natura 2000 protected areas: the 30 regions (NUTS2 level subdivision) presenting the largest natural canopy restoration potential in agricultural surfaces (in kha).

Distribution of the restoration potential in forest and semi natural areas
(in kha)

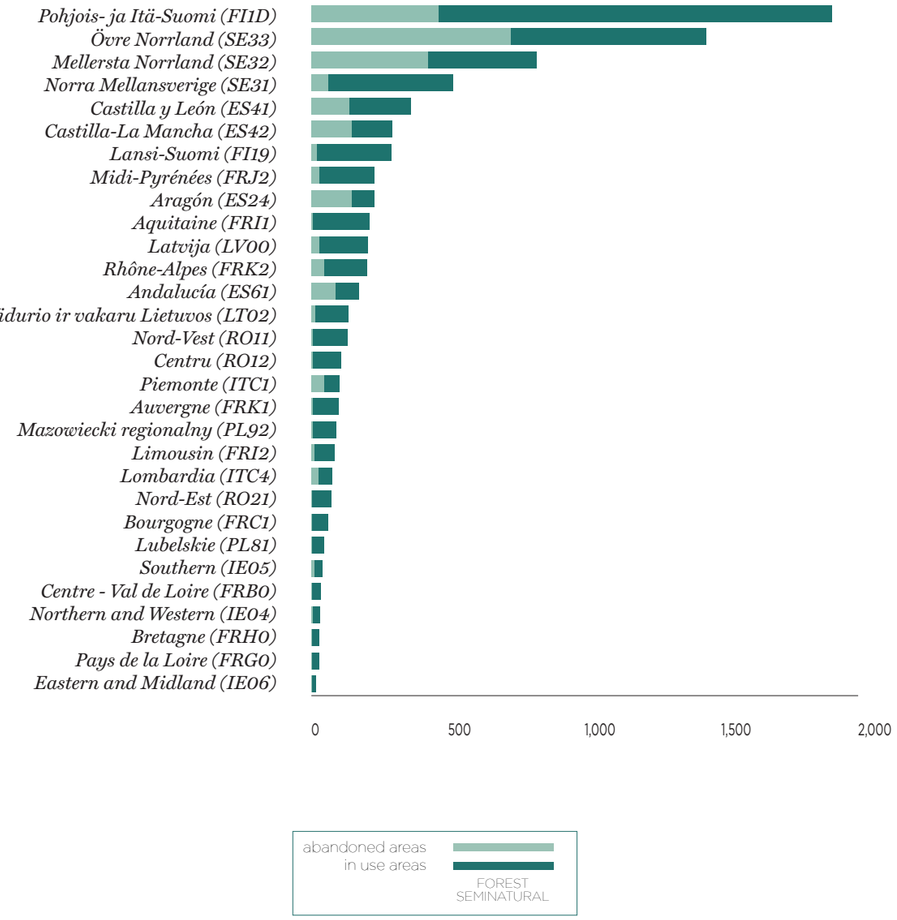


Figure 25 Distribution of the natural canopy restoration potential in forests and seminatural areas in the EU outside Natura 2000 protected areas: the 30 regions (NUTS2 level subdivision) presenting the largest natural canopy restoration potential in forests and seminatural areas (in kha).

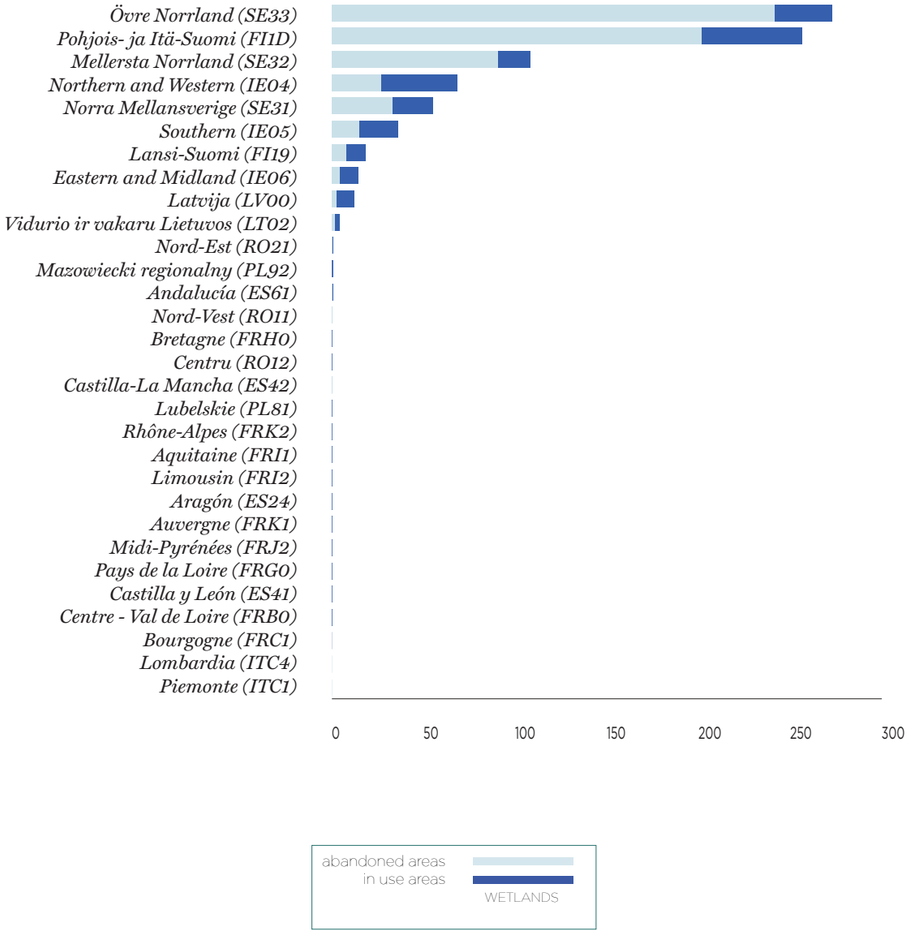


Figure 26 Distribution of the natural canopy restoration potential in wetlands in the EU outside Natura 2000 protected areas: the 30 regions (NUTS2 level subdivision) presenting the largest natural canopy restoration potential in wetlands (in kha).

8. ANNEX

8.1 DEFINITIONS / GLOSSARY

Canopy area: the canopy area refers to a value calculated for a given spatial extent (a region, a country, a biome, a continent). The canopy area is defined as the area covered by trees of a given region of interest. In the case of the present report, it is expressed at European, country and regional level, for each land category considered (CORINE, LUCAS, Natura 2000).

Ecosystem maturity: it corresponds to the average natural tree cover of each ecosystem as observed in protected area. At ecosystem maturity, the tree cover of the ecosystem is not the maximal tree cover that could be achieved (e.g. through reforestation or afforestation), it corresponds to the tree cover that is the most likely to happen under natural conditions, without human activity.

Natural: Adjective employed in the present document to describe an observation of the state of an ecosystem with no human activity (here in protected areas).

Natural 'canopy'/ 'tree cover' potential: it refers to the biophysical potential, in terms of canopy area or tree cover, of a given region or point of interest.

Potential: Adjective employed in the present document to characterize the result of the model. It can be used to characterize the natural potential (total tree carrying capacity) of a region or to characterize the restoration potential (additional tree carrying capacity).

Restoration: In the present document it describes the difference between the potential state of the ecosystem at maturity and the observed state of the ecosystem.

Restoration 'canopy'/ 'tree cover' potential: it refers to the positive 'canopy'/ 'tree cover' that results from the difference between the natural 'canopy'/ 'tree cover' potential and the current tree cover.

Tree cover: the tree cover refers to a value at a pixel level. The tree cover is here defined as the percentage of trees, ranging from 0 to 100%, for a single observed point. In the case of the present report, it concerns the tree cover of a pixel, whether it is expressed for the current tree cover (Hansen et al. 2013) or the natural/restoration potential tree cover (Bastin et al. 2019)

8.2 METHODOLOGICAL TECHNICAL ANNEXES

8.2.1 Original set of 58 variables considered for the prediction of the potential tree cover

Band Name	Layer Group	Original Spatial Resolution	Units	Source
Absolute_depth_to_bedrock	Soil	≈250m	cm	https://www.soilgrids.org
Bulk_density_000cm			kg / cubic–meter	
Bulk_density_005cm				
Bulk_density_015cm				
Bulk_density_030cm				
CEC_000cm			cmolc/kg	
CEC_005cm				
CEC_015cm				
CEC_030cm				
Clay_Content_000cm			mass fraction in %	
Clay_Content_005cm				
Clay_Content_015cm				
Clay_Content_030cm				
Coarse_fragments_000cm			%	
Coarse_fragments_005cm				
Coarse_fragments_015cm				
Coarse_fragments_030cm				
Depth_to_bedrock			cm (up to 200)	
Sand_Content_000cm			mass fraction in %	
Sand_Content_005cm				
Sand_Content_015cm				
Sand_Content_030cm	Soil	≈250m	mass fraction in %	https://www.soilgrids.org
Silt_Content_000cm				
Silt_Content_005cm				
Silt_Content_015cm				
Silt_Content_030cm				
SOC_Content_000cm			g per kg	
SOC_Content_005cm				
SOC_Content_015cm				
SOC_Content_030cm				
SOC_Density_000cm			kg / cubic–meter at depth	
SOC_Density_005cm				
SOC_Density_015cm				
SOC_Density_030cm				
Annual_Mean_Temperature	Climatic	30 arcsec (≈900m at equator)	ºC	WorldClim2
Annual_Precipitation			mm	
Isothermality			Unitless	
Max_Temperature_of_Warmest_Month			ºC	
Mean_Diurnal_Range			ºC	
Mean_Temperature_of_Coldest_Quarter			mm	
Mean_Temperature_of_Driest_Quarter			ºC	
Mean_Temperature_of_Warmest_Quarter			ºC	
Mean_Temperature_of_Wettest_Quarter			ºC	

Band Name	Layer Group	Original Spatial Resolution	Units	Source
Min_Temperature_of_Coldest_Month	Climatic	30 arcsec (≈900m at equator)	ºC	WorldClim2
Precipitation_of_Coldest_Quarter			mm	
Precipitation_of_Driest_Month				
Precipitation_of_Driest_Quarter				
Precipitation_of_Warmest_Quarter				
Precipitation_of_Wettest_Month				
Precipitation_of_Wettest_Quarter				
Precipitation_Seasonality				
Temperature_Annual_Range			ºC	
Temperature_Seasonality				
Aspect	Topography		(see reference for more information on units)	https://www.earthenv.org/topography
Elevation				
Hillshade				
Roughness				
Slope				

8.2.2 ADDITIONAL INFORMATION ON EUROPEAN DATABASES USED

Natura 2000

The aim of the project is to ensure the long-term survival of Europe's most valuable species and habitats, according to the 1979 Birds Directive and the 1992 Habitats Directive. Over 27,000 sites are currently included in the Natura 2000 network, covering a surface of about 1,150,000km^2 across all the EU Member Countries both on land and at sea. The total land area covered by the Natura 2000 represents around 18% of the total land EU surface and approximately 4% of the European marine area. Scientific criteria are applied on the choice of sites. Endangered, vulnerable, rare or endemic sites are considered to be important at European level because they are examples of typical characteristics of one or more of EU's biogeographical regions. Indeed, Natura 2000 includes different types of ecosystems, such as terrestrial, freshwater and marine ecosystems. However, in the network some ecosystems are more abundant than others. For instance, about 50% of the surface of Natura 2000 is represented by forest ecosystems, whereas about 40% is covered by agro-ecosystems. This network is not a system of strict nature reserves. While it includes strictly protected nature reserves, most of the land remains privately owned. The aim of the project is to highlight that EU Member Countries can better protect nature by working together across Europe, ensuring a sustainable management of the Natura 2000 sites, at both ecological and economical level.

Eurostat - LUCAS

Since 2006, EUROSTAT has carried out LUCAS surveys every three years. The most recent surveys happened in the spring-summer of 2009, 2012 and 2015. Since the LUCAS surveys are carried out in situ, this means that observations are made and registered on the ground by field surveyors. A panel approach is used, so some points have been visited in subsequent years. In the field, the surveyor classifies the land cover and the visible land use according to the harmonized LUCAS Survey land cover and land use classifications. Landscape pictures are taken in the four cardinal directions. A transect of 250m is run from the point to the east direction, where the surveyor records all transitions of land cover and existing linear features.

From the LUCAS survey in situ data collection, different types of information are obtained:

1. Micro data
2. Images
3. Statistical tables

The LUCAS classification is characterised by:

1. clear separation of land cover and land use:

this distinction is particularly worthwhile and also allows the analysis of the interactions between the two

- **Land Cover** is the physical cover of the earth's surface;

- **Land Use** is the socio-economic function of the land. It is important to specify that the figures refer specifically to the use of the land for which any sign is visible in the ground. Therefore, data reported in any table referring to the use has to be interpreted as the visible use.

2. full hierarchy:

LUCAS classifications are hierarchical, having the ability to accommodate different levels of information, starting with structured broad-level classes, which allow further systematic subdivision into more detailed sub-classes. At each level the defined classes are mutually exclusive.

3. comparability with other existing land cover/use systems:

Compatibility of the adopted definitions with the main international concepts and definitions is guaranteed. Additional parameters have been introduced where needed to allow the match, while keeping an independency and flexibility in the main item classification.

LUCAS Classification consists of several sub elements:

- LUCAS SU LC (LUCAS Survey Land Cover)
- LUCAS SU LU (LUCAS Survey Land Use)
- LUCAS SU FT (LUCAS Survey Forest Types)
- LUCAS SU LF (LUCAS Survey Linear Features)
- LUCAS SU WF (LUCAS Survey Water Features)
- LUCAS ST LC (LUCAS Statistics Land Cover)
- LUCAS ST LU (LUCAS Statistics Land Use)

Methodology

The land cover/use statistics derived from the LUCAS survey are unique as they are fully standardised to use the **same definitions and methodology** and are comparable among Member Countries. Types of land cover and visible land use are broken down into harmonised LUCAS categories. The full supporting documents for the survey comprise a field form, where all the measured variables are listed, and detailed field surveyors' instructions, which describe quality control procedures. The full description of the statistical data set is available in the land cover/use statistics metadata.

The LUCAS surveys are carried out on a two-phase sample. The first phase is a systematic sample with points. Each point is photo-interpreted and assigned a predefined land cover class. LUCAS points belong to the intersections of a 2km grid that includes around **1 million points all over the EU**. The points are selected on the basis of stratification information. Afterward the field sample is drawn, the stratified first phase sample allows to define a second phase sample of points.

Copernicus - CORINE

CLC2018 is one of the datasets produced within the framework of the Corine Land Cover program referring to land cover/land use status of year 2018. The reference year of the first CLC inventory was 1990 and the first update was carried out in 2000. Later, the update cycle has become 6 years. This vector-based dataset uses a Minimum Mapping Unit of 25 hectares for areal phenomena and a minimum of 100m for linear phenomena. The time series are complemented by change layers, which highlight changes in land cover with an MMU of 5 hectares. The CORINE Land Cover mapping scale is 1:100,000. Satellite imagery provides the geometrical and thematic basis for mapping with in situ data as essential ancillary information. The basic technical parameters of CLC (44 classes in nomenclature, 25 hectares MMU and 100m minimum mapping width) have not changed since the beginning, therefore the results of the different inventories are comparable. The majority of countries produce the data by visual interpretation of high-resolution satellite imagery. In a few countries, national in situ data, GIS integration and satellite image processing are combined.

CORINE CATEGORIES

Class 1: Artificial areas

Class 1.1 Urban fabric
Areas mainly occupied by dwellings and buildings used by administrative/public utilities, including their connected areas (associated lands, approach road network, parking lots).

Class 1.2 Industrial, commercial and transport units
Areas mainly occupied by industrial activities of manufacturing, trade, financial activities and services, transport infrastructures for road traffic and rail networks, airport installations, river and sea port installations, including their associated lands and access infrastructures. Includes industrial livestock rearing facilities.

Class 1.3 Mine, dump and construction sites
Artificial areas mainly occupied by extractive activities, construction sites, man-made waste dump sites and their associated lands.

Class 1.4 Artificial non-agricultural vegetated areas
Areas voluntarily created for recreational use. Includes green or recreational and leisure urban parks, sport and leisure facilities.

Class 2: Agricultural areas

Class 2.1 Arable land
Lands under a rotation system used for annually harvested plants and fallow lands, which are rain-fed or irrigated. Includes flooded crops such as rice fields and other inundated croplands.

Class 2.2 Permanent crops
All surfaces occupied by permanent crops, not under a rotation system. Includes ligneous crops of standard cultures for fruit production such as extensive fruit orchards, olive groves, chestnut groves, walnut groves shrub orchards such as vineyards and some specific low-system orchard plantation, espaliers and climbers.

Class 2.3 Pastures
Lands that are permanently used (at least 5 years) for fodder production. Includes natural or sown herbaceous species, unimproved or lightly improved meadows and grazed or mechanically harvested meadows. Regular agriculture impacts the natural development of natural herbaceous species composition.

Class 2.4 Heterogeneous agricultural areas

Areas of annual crops associated with permanent crops on the same parcel, annual crops cultivated under forest trees, areas of annual crops, meadows and/or permanent crops which are juxtaposed, landscapes in which crops and pastures are intimately mixed with natural vegetation or natural areas.

Class 3: Forest and semi-natural areas

Class 3.1 Forests
Areas occupied by forests and woodlands with a vegetation pattern composed of native or exotic coniferous and/or broad-leaved trees and which can be used for the production of timber or other forest products. The forest trees are under normal climatic conditions higher than 5m with a canopy closure of 30% at least. In case of young plantation, the minimum cut-off point is 500 subjects per hectare.

Class 3.2 Shrubs and/or herbaceous vegetation associations
Temperate shrubby areas with Atlantic and Alpine heaths, sub-Alpine bush and tall herb communities, deciduous forest re-colonisation, hedgerows, dwarf conifers.
All transitional forest development stages (regenerative and degenerative: natural development of forest – bushy formations on abandoned meadows, pastures or forest clear cut and also forest after calamities of various origin) should be classified as 3.2.4.
Shrubby formation with sparse trees (< 15 % canopy closure in climax stage and the height of trees can be > 5-7m) composed of dwarf forms of Betula spp. and Salix spp., plus Vaccinium spp. Empetrum migrum, Ledum palustre, Carex spp., Cladonia spp., etc. (cover > 50% of surface) frequently interrupted by rock outcrops (typical of Scandinavia and the Northern Atlantic) should be classified as moors and heathland – tundra (3.2.2).
Mediterranean and sub-Mediterranean evergreen sclerophyllous bush and scrub (maquis, garrigue, matorral, phrygana sensu lato), re-colonisation and degradation stages of broad-leaved evergreen forests.
Dry thermophilous grasslands of the lowlands, hills and mountain zone. Poor Atlantic a sub- Atlantic mat-grasslands of acid soils; grasslands of decalcified sands; Alpine and sub-Alpine grasslands. Humid grasslands and tall herb communities; lowland and mountain mesophile pas- tures and hay meadows.

Class 3.3 Open spaces with little or no vegetation
Natural areas covered with little or no vegetation, including open thermophile formations of sandy or rocky grounds distributed on calcareous or siliceous soils frequently disturbed by erosion, steppic grasslands, perennial steppe-like grasslands, meso- and thermo-Mediterranean xerophile, mostly open, short-grass perennial grasslands, alpha steppes, vegetated or sparsely vegetated areas of stones on steep slopes, screes, cliffs, rock fares, limestone pavements with plant communities colonising their tracks, perpetual snow and ice, inland sand-dune, coastal sand-dunes and burnt natural woody vegetation areas.

Class 4: Wetlands

Class 4.1 Inland wetlands
Areas flooded or liable to flooding during the great part of the year by fresh, brackish or standing water with specific vegetation coverage made of low shrub, semi-ligneous or herbaceous species. Includes water-fringe vegetation of lakes, rivers, and brooks and of fens and eutrophic marshes, vegetation of transition mires and quaking bogs and springs, highly oligotrophic and strongly acidic communities composed mainly of sphagnum growing on peat and deriving moistures of raised bogs and blanket bogs.

Class 4.2 Coastal wetland
Areas which are submerged by high tides at some stage of the annual tidal cycle. Includes salt meadows, facies of saltmarsh grass meadows, transitional or not to other communities, vegetation occupying zones of varying salinity and humidity, sands and muds submerged for part of every tide devoid of vascular plants, active or recently abandoned salt-extraction evaporation basins.

Class 5: Water bodies

Class 5.1 Inland waters
Lakes, ponds and pools of natural origin containing fresh (non-saline) water and running waters made of all rivers and streams. Man-made freshwater bodies including reservoirs and canals.

Class 5.2 Marine waters
Oceanic and continental shelf waters, bays and narrow channels including sea lochs or loughs, fiords or fjords, rya straits and estuaries. Saline or brackish coastal waters often formed from sea inlets by sitting and cut-off from the sea by sand or mud banks.

8.3 NATURAL CANOPY RESTORATION POTENTIAL AT COUNTRY LEVEL

AUSTRIA

RESTORATION POTENTIAL OUTSIDE NATURA 2000

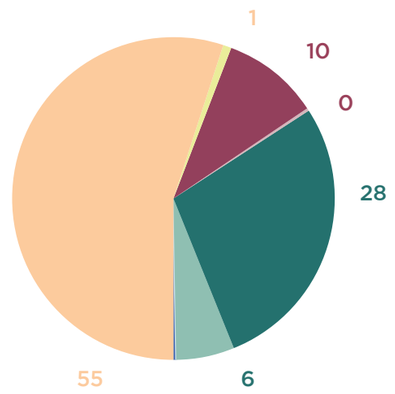


Figure 27 - Restoration potential per class in % of the total restoration potential

Table 17 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	3	10	76	0	89
in use areas	kha	129	717	366	0	1,212
abandoned areas	%	0	1	6	0	7
in use areas	%	10	55	28	0	93

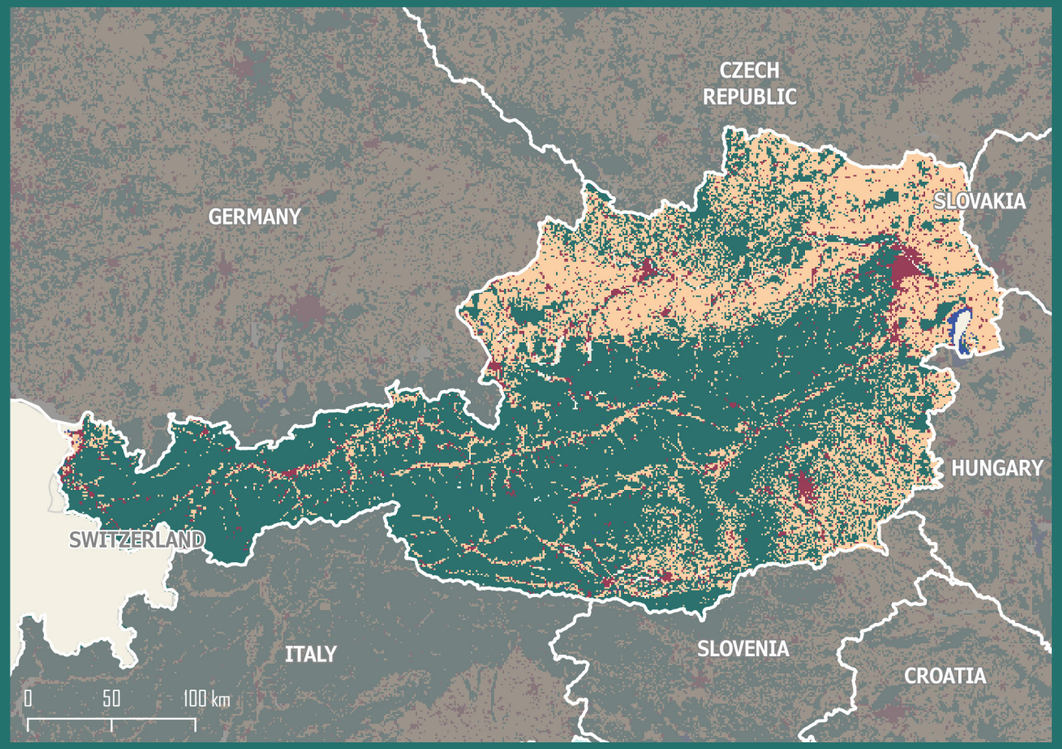


Figure 28 - Map showing the distribution of CORINE Land Cover classes at country level.

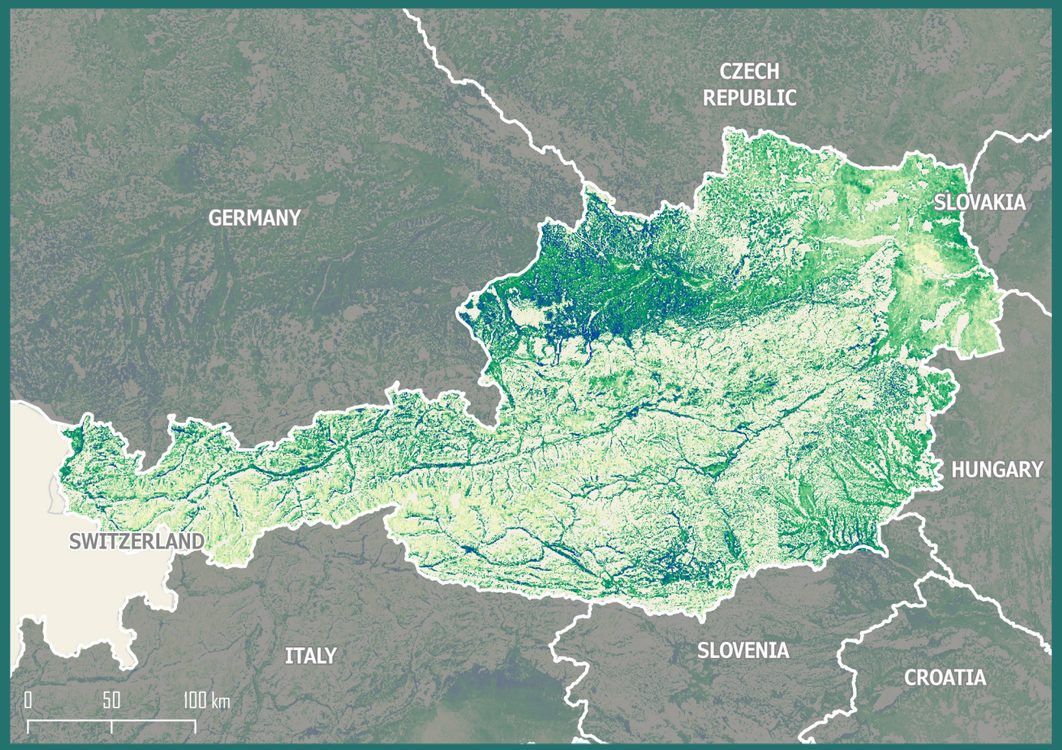


Figure 29 - Map showing the natural tree restoration potential.

Table 18 - Natural canopy restoration potential outside Natura 2000 protected areas in Austria.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	9	0	0	0	3	0	1	0
	Discontinuous urban fabric	6	289	2	0	1	108	8	50	2
	Industrial or commercial units	1	24	0	0	0	9	1	4	1
	Road and rail networks and associated land	1	2	0	0	0	1	0	0	1
	Port areas	0	0	0	0	0	0	0	0	NA
	Airports	0	3	0	0	0	1	0	0	0
	Mineral extraction sites	0	5	0	0	0	2	0	1	0
	Dump sites	0	1	0	0	0	0	0	0	NA
	Construction sites	0	0	0	0	0	0	0	0	NA
	Green urban areas	0	3	0	0	0	1	0	0	0
	Sport and leisure facilities	1	28	0	0	0	5	0	2	1
Artificial surfaces	All sub-classes	9	363	3	0	0	129	10	0	2
Agricultural areas	Non-irrigated arable land	13	1,166	4	0	2	405	31	195	3
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	1	34	0	0	0	9	1	4	1
	Fruit trees and berry plantations	0	1	0	0	0	0	0	0	NA
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	14	575	4	0	2	171	13	78	3
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	2	279	1	0	0	89	7	42	1
	Agriculture associated with natural vegetation	4	122	1	0	0	43	3	20	1
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	33	2,177	10	1	0	717	55	0	5
Forest and semi natural areas	Broad-leaved forest	4	256	1	0	0	25	2	12	2
	Coniferous forest	66	1,903	9	1	4	189	15	84	9
	Mixed forest	27	784	5	0	2	96	7	43	5
	Natural grasslands	249	207	26	2	11	35	3	15	10
	Moors and heathland	59	41	12	1	5	4	0	2	5
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	1	24	0	0	0	2	0	1	1
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	114	8	11	1	5	2	0	1	4
	Sparsely vegetated areas	164	21	20	2	8	4	0	2	6
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	9	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	599	3,336	76	6	0	366	28	0	23
Wetlands	Inland marshes	1	1	0	0	0	0	0	0	0
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	1	1	0	0	0	0	0	0	0
All Classes	All sub-classes	557	5,963	78	6	34	1,224	94	567	21

BELGIUM

RESTORATION POTENTIAL OUTSIDE NATURA 2000

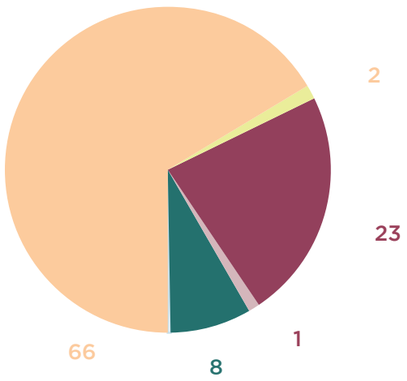


Figure 30 - Restoration potential per class in % of the total restoration potential

Table 19 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	6	7	1	0	14
in use areas	kha	101	295	35	0	430
abandoned areas	%	1	2	0	0	3
in use areas	%	23	66	8	0	97

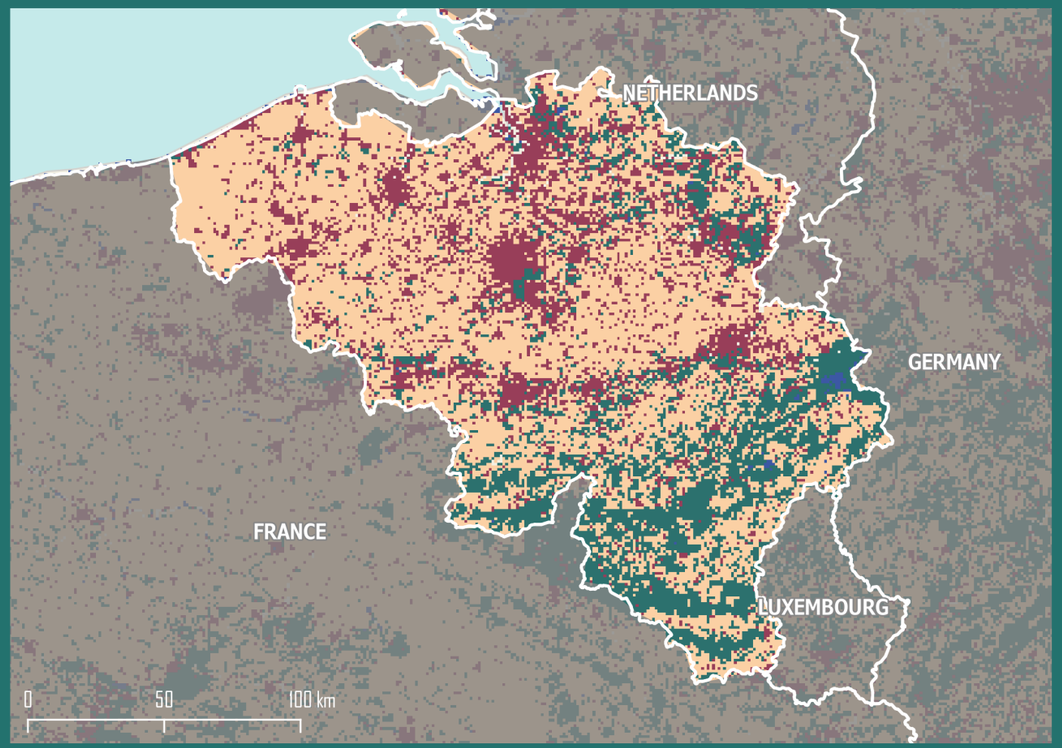


Figure 31 - Map showing the distribution of CORINE Land Cover classes at country level.

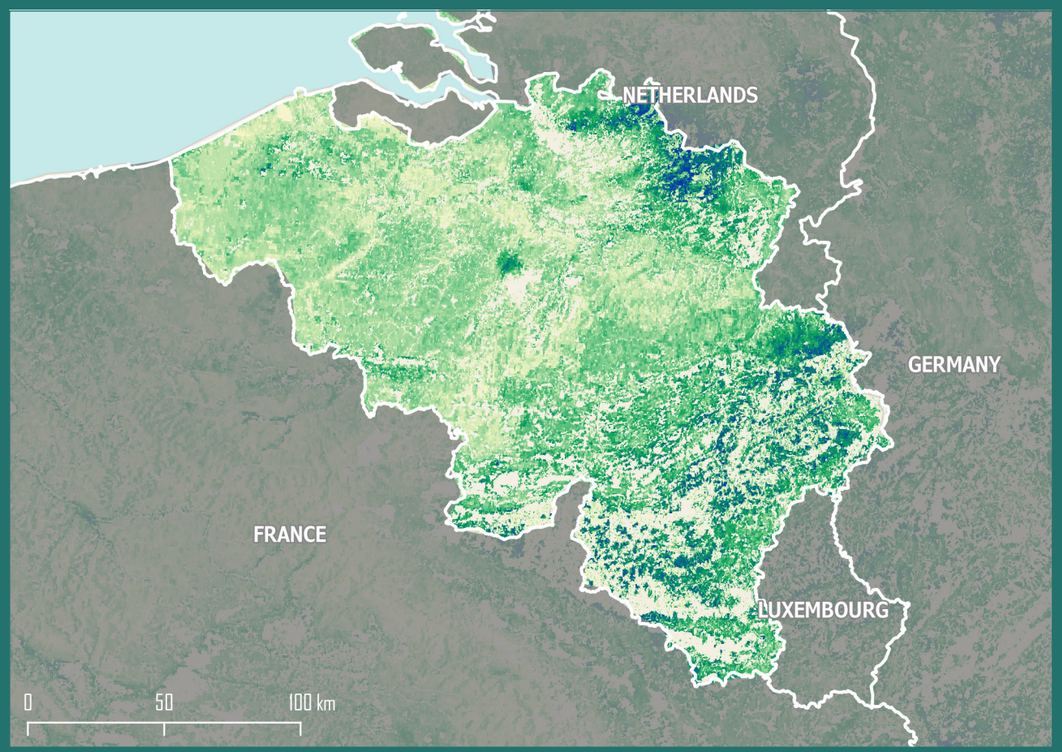


Figure 32 - Map showing the natural tree restoration potential.

Table 20 - Natural canopy restoration potential outside Natura 2000 protected areas in Belgium.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	4	0	0	0	1	0	1	0
	Discontinuous urban fabric	16	403	3	1	1	84	19	41	3
	Industrial or commercial units	7	43	2	0	1	10	2	5	2
	Road and rail networks and associated land	2	5	1	0	0	1	0	0	1
	Port areas	0	5	0	0	0	1	0	1	0
	Airports	0	4	0	0	0	1	0	0	0
	Mineral extraction sites	0	3	0	0	0	1	0	0	0
	Dump sites	1	0	0	0	0	0	0	0	NA
	Construction sites	0	1	0	0	0	0	0	0	0
	Green urban areas	1	2	0	0	0	0	0	0	1
	Sport and leisure facilities	1	11	0	0	0	2	0	1	1
Artificial surfaces	All sub-classes	27	481	6	1	0	101	23	0	4
Agricultural areas	Non-irrigated arable land	10	610	2	0	1	116	26	56	3
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	0	8	0	0	0	1	0	1	0
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	7	220	2	1	1	66	15	32	2
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	7	410	2	0	1	94	21	46	2
	Agriculture associated with natural vegetation	6	99	1	0	0	18	4	9	2
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	32	1,347	7	2	0	295	66	0	5
Forest and semi natural areas	Broad-leaved forest	2	66	0	0	0	6	1	3	1
	Coniferous forest	1	62	0	0	0	11	2	5	1
	Mixed forest	1	114	0	0	0	17	4	8	1
	Natural grasslands	0	0	0	0	0	0	0	0	NA
	Moors and heathland	1	2	0	0	0	0	0	0	1
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	1	4	0	0	0	1	0	0	0
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	7	248	1	0	0	35	8	0	2
Wetlands	Inland marshes	0	0	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	0	0	0	0	0	0	0	0	0
All classes	All sub-classes	69	2,073	14	3	7	430	97	209	7

BULGARIA

RESTORATION POTENTIAL OUTSIDE NATURA 2000

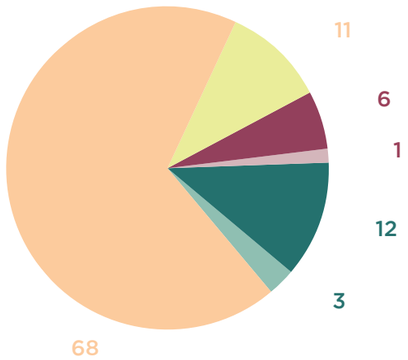


Figure 33 - Restoration potential per class in % of the total restoration potential

Table 21 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	18	135	33	0	186
in use areas	kha	74	874	150	0.11	1,098
abandoned areas	%	1	11	3	0	14
in use areas	%	6	68	12	0	86

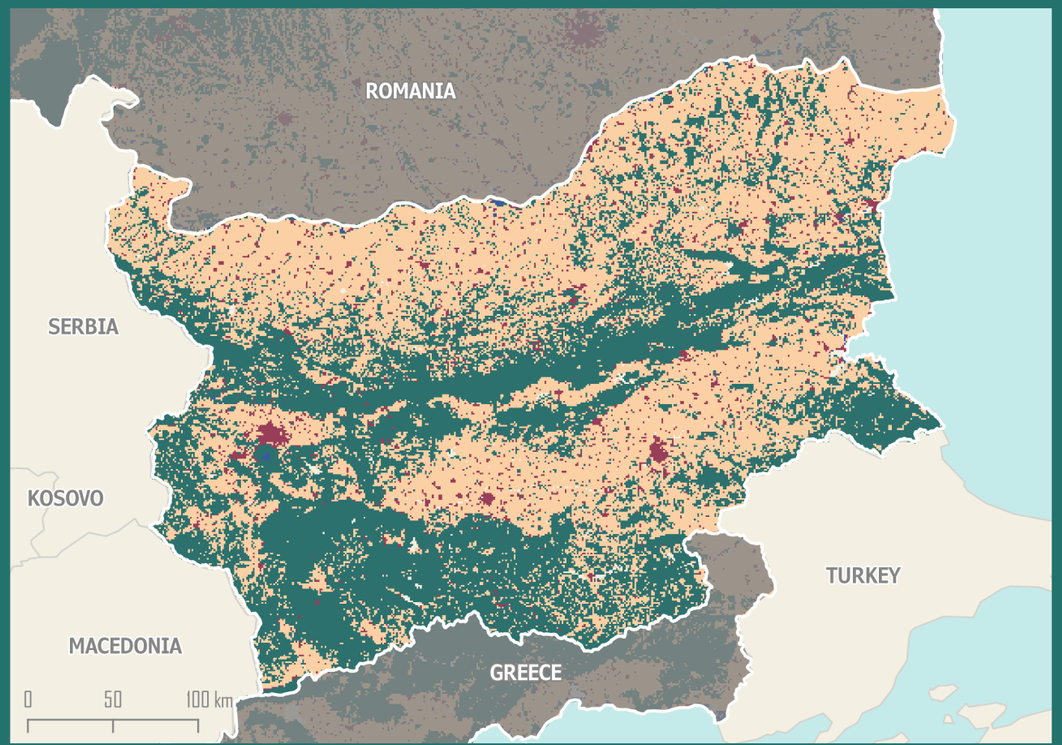


Figure 34 - Map showing the distribution of CORINE Land Cover classes at country level.

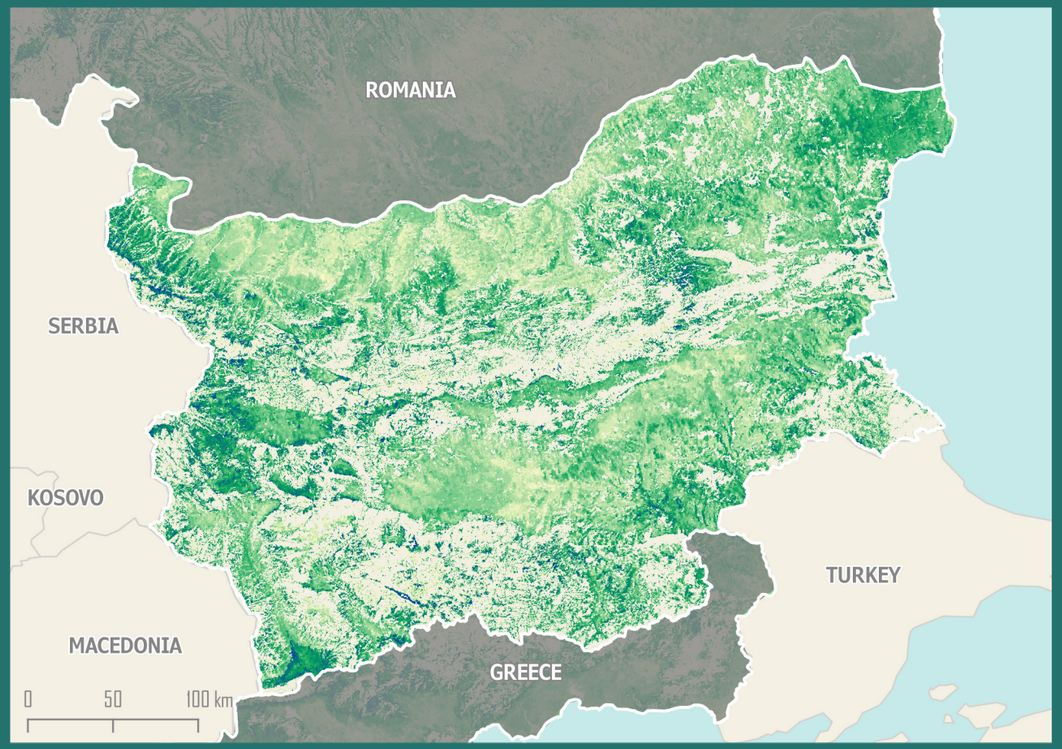


Figure 35 - Map showing the natural tree restoration potential.

Table 22 - Natural canopy restoration potential outside Natura 2000 protected areas in Bulgaria.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	1	0	0	0	0	0	0	NA
	Discontinuous urban fabric	49	214	13	1	6	57	4	27	6
	Industrial or commercial units	13	40	4	0	2	9	1	5	3
	Road and rail networks and associated land	0	1	0	0	0	0	0	0	0
	Port areas	0	1	0	0	0	0	0	0	NA
	Airports	0	5	0	0	0	1	0	1	0
	Mineral extraction sites	4	18	1	0	1	5	0	2	2
	Dump sites	0	1	0	0	0	0	0	0	0
	Construction sites	0	0	0	0	0	0	0	0	NA
	Green urban areas	1	2	0	0	0	0	0	0	1
	Sport and leisure facilities	0	5	0	0	0	1	0	1	0
Artificial surfaces	All sub-classes	67	289	18	1	0	74	6	0	7
Agricultural areas	Non-irrigated arable land	202	2,813	53	4	26	711	55	343	15
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	1	30	0	0	0	6	0	3	1
	Vineyards	22	54	5	0	2	15	1	7	5
	Fruit trees and berry plantations	9	17	2	0	1	3	0	2	2
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	59	133	13	1	6	32	2	16	6
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	54	105	15	1	7	26	2	13	6
	Agriculture associated with natural vegetation	159	377	41	3	20	86	7	42	11
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	529	3,507	135	11	0	874	68	0	23
Forest and semi natural areas	Broad-leaved forest	49	858	5	0	3	53	4	26	8
	Coniferous forest	11	187	2	0	1	19	2	9	4
	Mixed forest	20	284	3	0	2	22	2	11	5
	Natural grasslands	36	62	7	1	3	18	1	9	6
	Moors and heathland	0	0	0	0	0	0	0	0	NA
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	85	221	15	1	7	35	3	17	10
	Beaches, dunes, sands	1	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	4	0	0	0	0	1	0	1	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	193	1,626	33	3	0	150	12	0	15
Wetlands	Inland marshes	0	1	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	0	1	0	0	0	0	0	0	0
All classes	All sub-classes	796	5,415	186	14	90	1,098	86	532	29

CROATIA

RESTORATION POTENTIAL OUTSIDE NATURA 2000

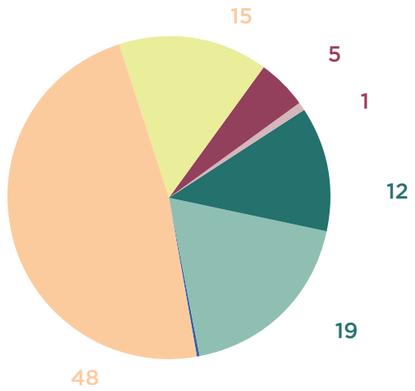


Figure 36 - Restoration potential per class in % of the total restoration potential

Table 23 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	7	93	117	0	216
in use areas	kha	31	301	78	0	410
abandoned areas	%	1	15	19	0	35
in use areas	%	5	48	12	0	65

Figure 37 - Map showing the distribution of CORINE Land Cover classes at country level.

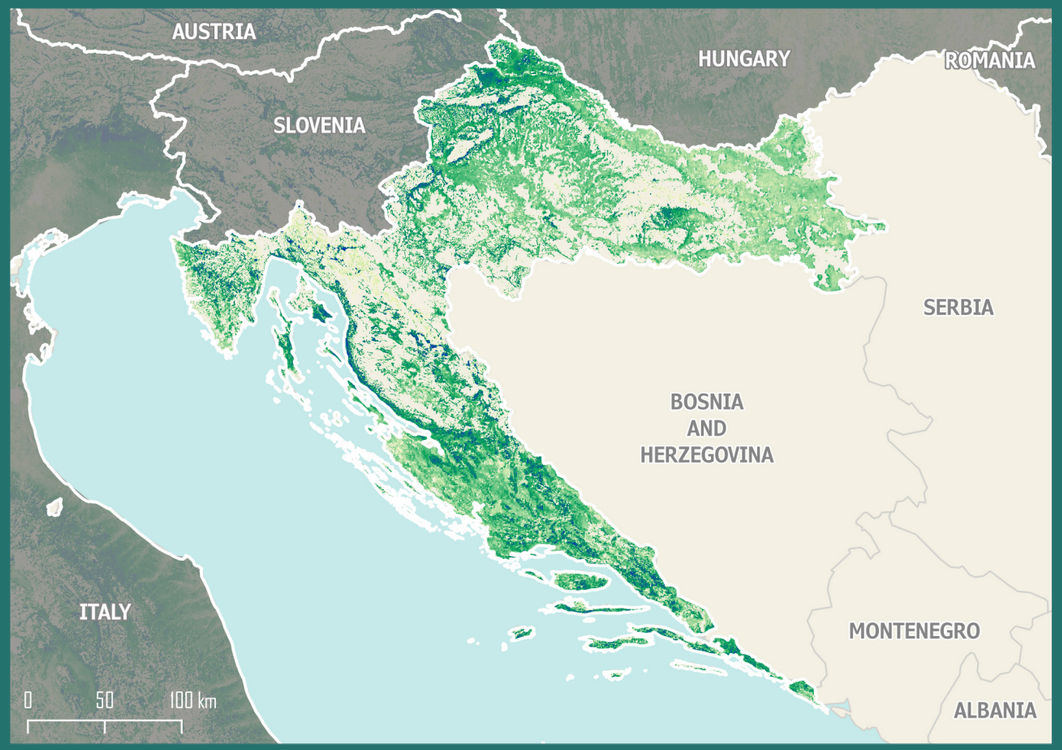


Figure 38 - Map showing the natural tree restoration potential.

Table 24 - Natural canopy restoration potential outside Natura 2000 protected areas in Croatia.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	0	0	0	0	0	0	0	NA
	Discontinuous urban fabric	12	85	5	1	3	26	4	15	3
	Industrial or commercial units	2	10	1	0	0	3	0	2	1
	Road and rail networks and associated land	2	1	1	0	1	0	0	0	1
	Port areas	0	0	0	0	0	0	0	0	NA
	Airports	0	2	0	0	0	1	0	0	0
	Mineral extraction sites	2	0	1	0	1	0	0	0	0
	Dump sites	0	0	0	0	0	0	0	0	NA
	Construction sites	0	0	0	0	0	0	0	0	NA
	Green urban areas	0	1	0	0	0	0	0	0	NA
	Sport and leisure facilities	0	2	0	0	0	0	0	0	0
Artificial surfaces	All sub-classes	19	103	7	1	0	31	5	0	3
Agricultural areas	Non-irrigated arable land	37	480	9	1	4	106	17	52	8
	Permanently irrigated land	0	2	0	0	0	1	0	0	0
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	4	10	1	0	1	3	0	2	3
	Fruit trees and berry plantations	0	6	0	0	0	1	0	1	0
	Olive groves	5	8	1	0	1	3	0	2	3
	Pastures	63	72	19	3	11	21	3	11	6
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	90	471	24	4	14	135	22	70	10
	Agriculture associated with natural vegetation	133	171	31	5	23	39	6	23	9
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	371	1,180	93	15	0	301	48	0	19
Forest and semi natural areas	Broad-leaved forest	232	689	30	5	23	44	7	25	15
	Coniferous forest	7	15	1	0	1	1	0	1	3
	Mixed forest	29	26	3	1	3	2	0	1	4
	Natural grasslands	84	9	31	5	24	4	1	3	3
	Moors and heathland	0	0	0	0	0	0	0	0	NA
	Sclerophyllous vegetation	26	5	10	2	9	2	0	1	2
	Transitional woodland-shrub	119	184	34	5	27	25	4	15	8
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	10	0	5	1	4	0	0	0	0
	Burnt areas	4	0	1	0	1	0	0	0	0
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	525	912	117	19	0	78	12	0	19
Wetlands	Inland marshes	0	0	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	0	1	0	0	0	0	0	0	NA
All classes	All sub-classes	920	2,191	215	34	155	411	66	222	28

CYPRUS

RESTORATION POTENTIAL OUTSIDE NATURA 2000

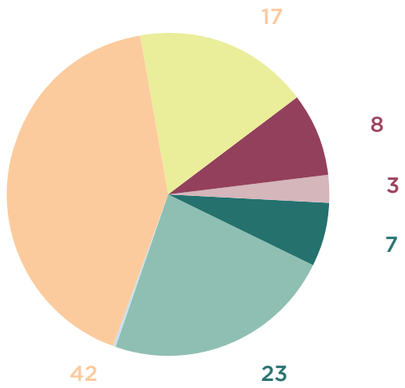


Figure 39 - Restoration potential per class in % of the total restoration potential

Table 25 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	3	19	25	0	48
in use areas	kha	9	46	7	0	63
abandoned areas	%	3	17	23	0	43
in use areas	%	8	42	7	0	57

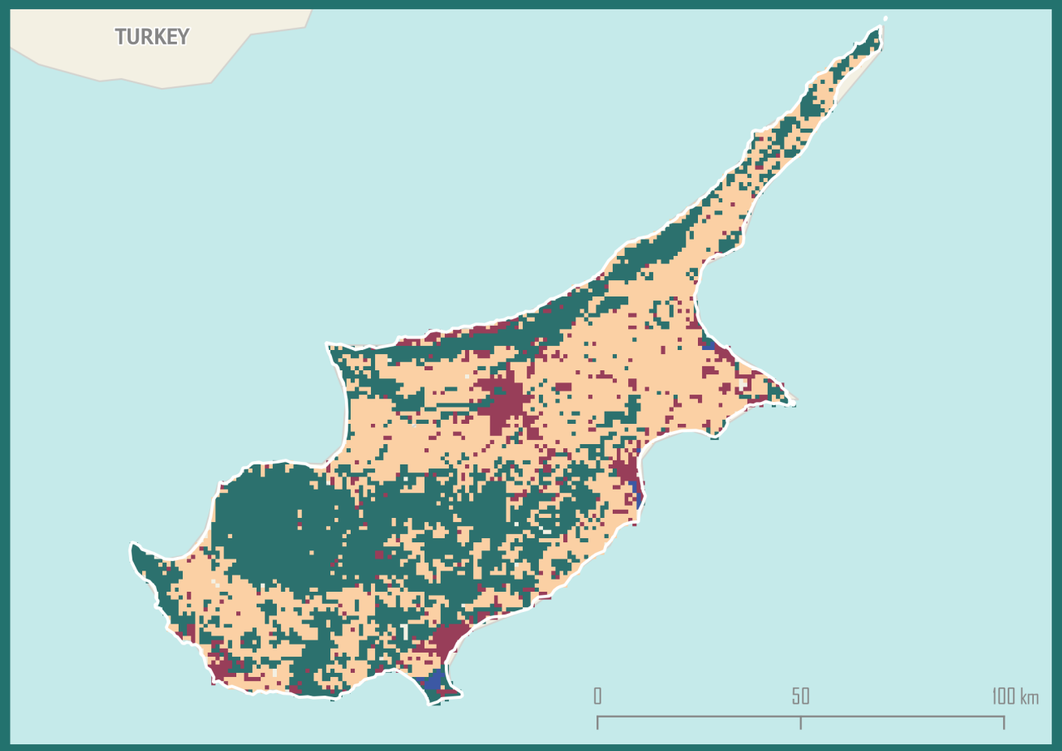


Figure 40 - Map showing the distribution of CORINE Land Cover classes at country level.

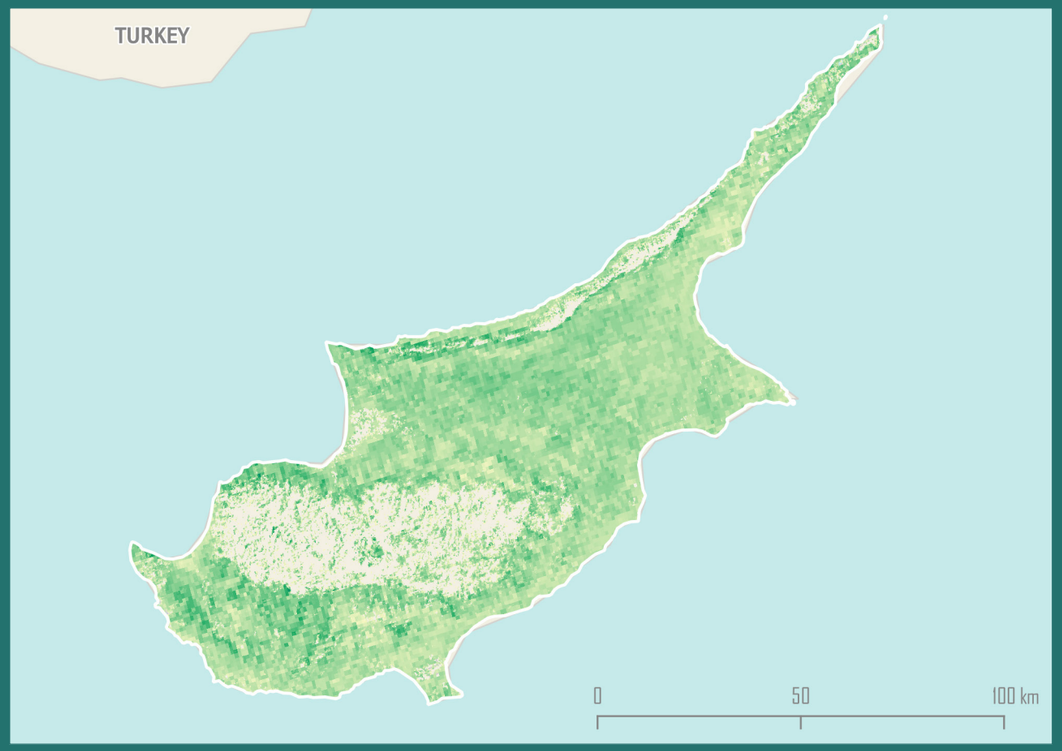


Figure 41 - Map showing the natural tree restoration potential.

Table 26 - Natural canopy restoration potential outside Natura 2000 protected areas in Cyprus.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	0	0	0	0	0	0	0	NA
	Discontinuous urban fabric	9	40	2	1	1	6	6	6	2
	Industrial or commercial units	4	9	1	1	1	1	1	1	1
	Road and rail networks and associated land	0	0	0	0	0	0	0	0	NA
	Port areas	0	0	0	0	0	0	0	0	NA
	Airports	0	2	0	0	0	0	0	0	0
	Mineral extraction sites	1	2	0	0	0	0	0	0	0
	Dump sites	0	0	0	0	0	0	0	0	0
	Construction sites	0	1	0	0	0	0	0	0	0
	Green urban areas	0	0	0	0	0	0	0	0	0
	Sport and leisure facilities	2	3	0	0	0	0	0	0	1
Artificial surfaces	All sub-classes	16	57	3	3	0	9	8	0	2
Agricultural areas	Non-irrigated arable land	46	171	8	8	7	30	27	27	4
	Permanently irrigated land	4	25	1	1	1	4	4	4	1
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	4	6	1	1	1	1	1	1	1
	Fruit trees and berry plantations	2	15	0	0	0	1	1	1	1
	Olive groves	1	4	0	0	0	1	1	1	1
	Pastures	1	0	0	0	0	0	0	0	0
	Annual crops associated with permanent crops	13	13	2	2	2	2	2	2	2
	Complex cultivation patterns	17	33	3	3	2	5	5	5	2
	Agriculture associated with natural vegetation	20	11	3	3	3	2	2	2	1
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	110	274	19	17	0	46	42	0	5
Forest and semi natural areas	Broad-leaved forest	0	0	0	0	0	0	0	0	NA
	Coniferous forest	31	16	3	2	2	1	1	1	2
	Mixed forest	0	0	0	0	0	0	0	0	0
	Natural grasslands	11	6	2	2	2	1	1	1	1
	Moors and heathland	1	0	0	0	0	0	0	0	0
	Sclerophyllous vegetation	91	21	15	14	14	4	3	3	2
	Transitional woodland-shrub	21	6	4	3	3	1	1	1	1
	Beaches, dunes, sands	3	0	0	0	0	0	0	0	0
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	5	2	1	1	1	0	0	0	1
	Burnt areas	1	0	0	0	0	0	0	0	0
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	164	53	25	23	0	7	7	0	4
Wetlands	Inland marshes	0	0	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	1	0	0	0	0	0	0	0	0
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	1	0	0	0	0	0	0	0	0
All classes	All sub-classes	298	377	48	44	42	62	56	55	8

CZECHIA

RESTORATION POTENTIAL OUTSIDE NATURA 2000

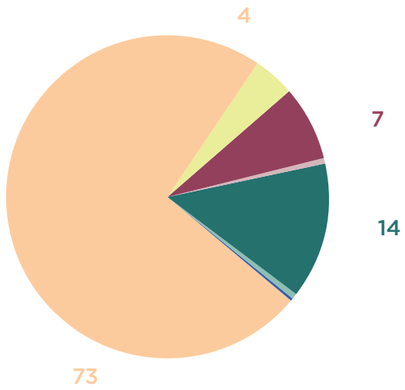


Figure 42 - Restoration potential per class in % of the total restoration potential

Table 27 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	9	67	10	0	87
in use areas	kha	113	1,142	213	0	1,468
abandoned areas	%	1	4	1	0	6
in use areas	%	7	73	14	0	94

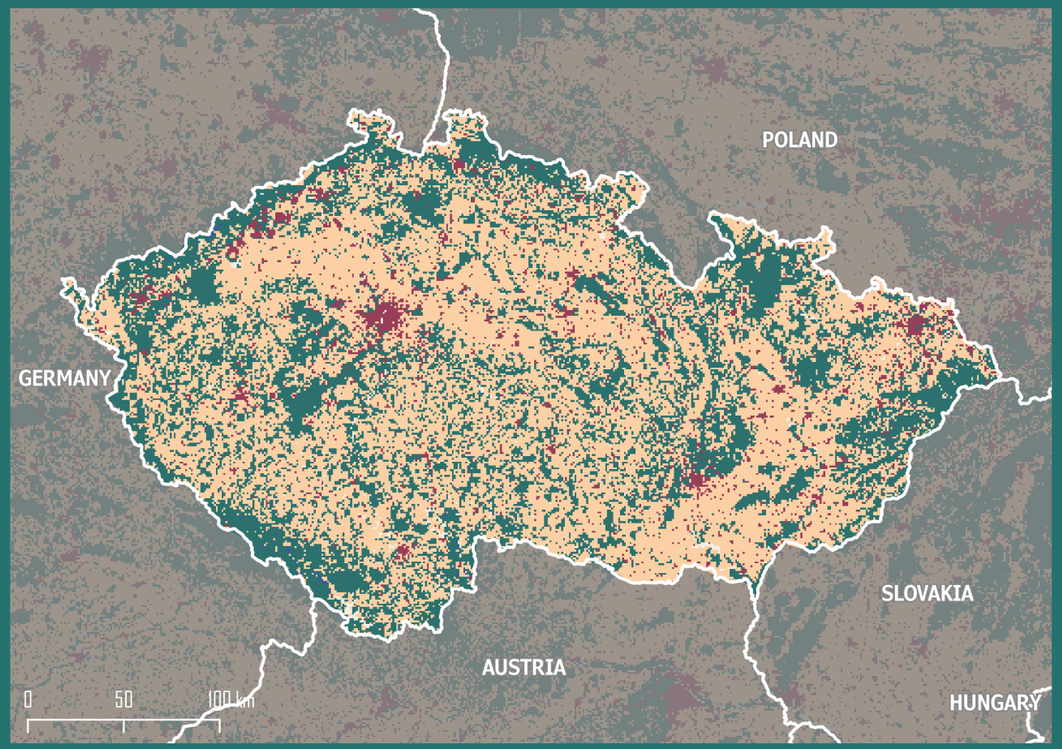


Figure 43 - Map showing the distribution of CORINE Land Cover classes at country level.

Figure 44 - Map showing the natural tree restoration potential.

Table 28 - Natural canopy restoration potential outside Natura 2000 protected areas in Czechia.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	1	0	0	0	1	0	0	0
	Discontinuous urban fabric	19	266	6	0	3	83	5	41	4
	Industrial or commercial units	7	46	2	0	1	14	1	7	3
	Road and rail networks and associated land	5	0	2	0	1	0	0	0	NA
	Port areas	0	0	0	0	0	0	0	0	NA
	Airports	0	5	0	0	0	2	0	1	NA
	Mineral extraction sites	0	15	0	0	0	7	0	3	0
	Dump sites	0	5	0	0	0	2	0	1	0
	Construction sites	1	0	0	0	0	0	0	0	NA
	Green urban areas	1	4	0	0	0	1	0	1	1
	Sport and leisure facilities	1	8	0	0	0	2	0	1	1
Artificial surfaces	All sub-classes	28	356	9	1	0	113	7	0	5
Agricultural areas	Non-irrigated arable land	84	2,820	24	2	12	811	52	394	10
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	9	0	0	0	2	0	1	0
	Fruit trees and berry plantations	2	17	1	0	0	5	0	2	2
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	46	567	17	1	8	210	14	102	8
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	5	25	2	0	1	6	0	3	2
	Agriculture associated with natural vegetation	75	380	21	1	10	110	7	53	8
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	221	3,808	67	4	0	1,142	73	0	16
Forest and semi natural areas	Broad-leaved forest	3	100	1	0	0	12	1	6	2
	Coniferous forest	22	1,240	3	0	1	145	9	70	6
	Mixed forest	15	370	4	0	2	43	3	21	4
	Natural grasslands	0	3	0	0	0	1	0	0	0
	Moors and heathland	0	0	0	0	0	0	0	0	NA
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	6	71	2	0	1	14	1	7	3
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	48	1,782	10	1	0	213	14	0	8
Wetlands	Inland marshes	0	0	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	0	1	0	0	0	0	0	0	NA
All classes	All sub-classes	314	5,929	89	6	43	1,466	94	712	19

DENMARK

RESTORATION POTENTIAL OUTSIDE NATURA 2000

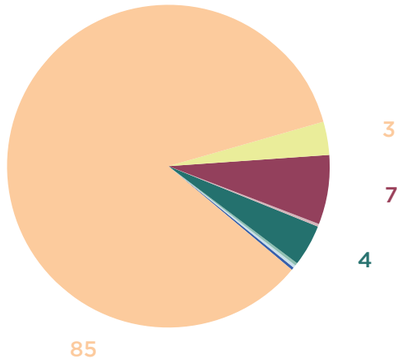


Figure 45 - Restoration potential per class in % of the total restoration potential

Table 29 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	3	39	5	1	48
in use areas	kha	84	1,026	51	3	1,164
abandoned areas	%	0	3	0	0	4
in use areas	%	7	85	4	0	96

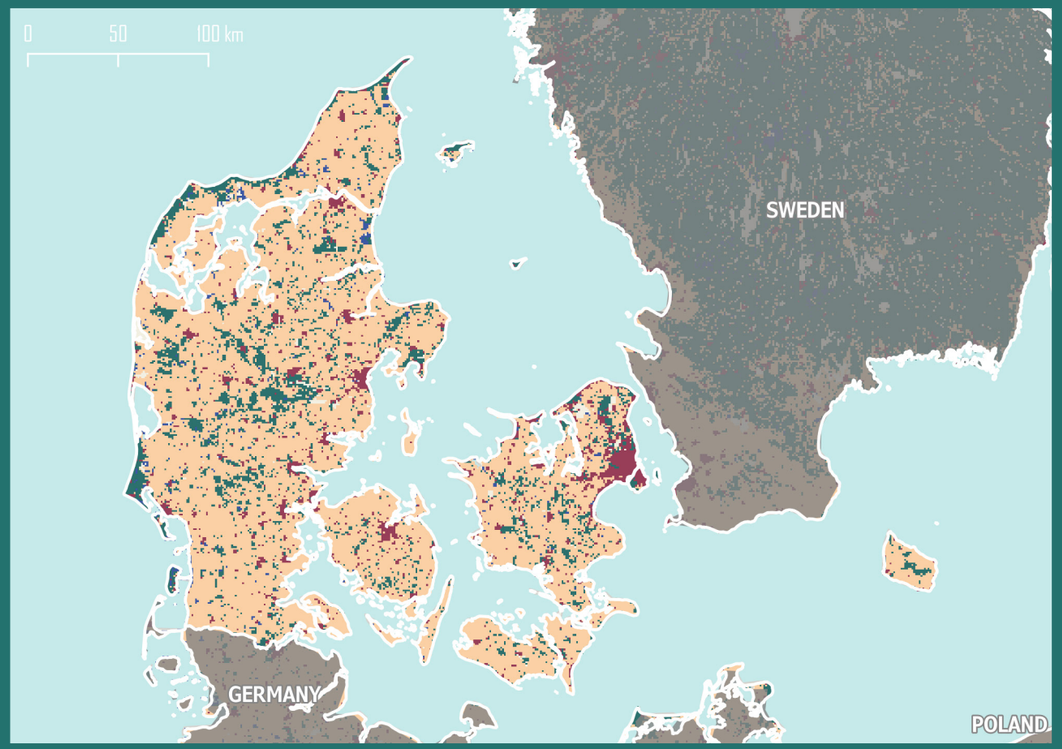


Figure 46 - Map showing the distribution of CORINE Land Cover classes at country level.

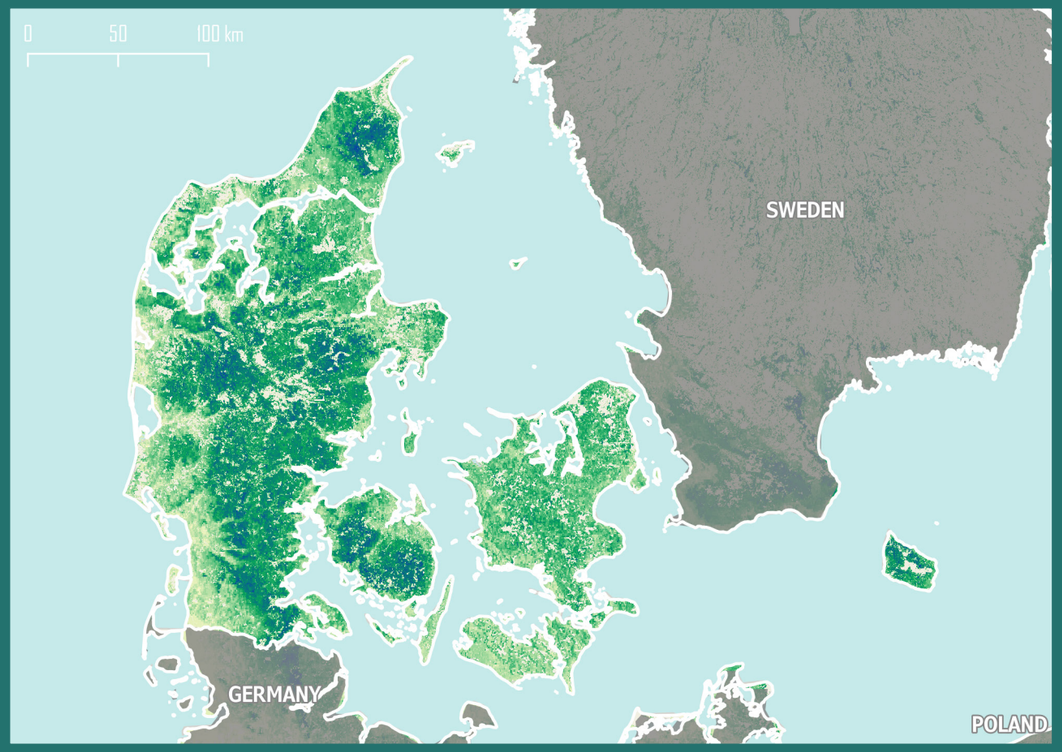


Figure 47 - Map showing the natural tree restoration potential.

Table 30 - Natural canopy restoration potential outside Natura 2000 protected areas in Denmark.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	1	4	0	0	0	1	0	0	1
	Discontinuous urban fabric	4	174	2	0	1	59	5	27	2
	Industrial or commercial units	1	28	1	0	0	9	1	4	1
	Road and rail networks and associated land	0	1	0	0	0	0	0	0	NA
	Port areas	0	3	0	0	0	0	0	0	0
	Airports	0	6	0	0	0	2	0	1	0
	Mineral extraction sites	0	3	0	0	0	1	0	0	0
	Dump sites	0	0	0	0	0	0	0	0	NA
	Construction sites	0	1	0	0	0	0	0	0	0
	Green urban areas	0	8	0	0	0	2	0	1	0
	Sport and leisure facilities	1	43	0	0	0	9	1	4	1
Artificial surfaces	All sub-classes	8	270	3	0	0	84	7	0	3
Agricultural areas	Non-irrigated arable land	73	2,510	27	2	13	922	76	440	9
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	0	2	0	0	0	0	0	0	NA
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	3	28	1	0	1	8	1	4	2
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	6	59	2	0	1	21	2	10	2
	Agriculture associated with natural vegetation	28	229	9	1	4	76	6	36	5
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	114	2,824	39	3	0	1,026	85	0	11
Forest and semi natural areas	Broad-leaved forest	2	38	0	0	0	5	0	2	1
	Coniferous forest	5	105	1	0	0	12	1	6	2
	Mixed forest	2	90	0	0	0	14	1	7	1
	Natural grasslands	2	4	0	0	0	1	0	1	1
	Moors and heathland	3	5	0	0	0	1	0	1	1
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	13	65	2	0	1	18	1	8	3
	Beaches, dunes, sands	0	1	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	27	307	5	0	0	51	4	0	4
Wetlands	Inland marshes	2	8	1	0	0	2	0	1	1
	Peat bogs	5	4	0	0	0	1	0	1	1
	Salt marshes	0	2	0	0	0	0	0	0	0
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	6	13	1	0	0	3	0	0	2
All classes	All sub-classes	162	3,409	49	4	24	1,163	96	553	13

ESTONIA

RESTORATION POTENTIAL OUTSIDE NATURA 2000

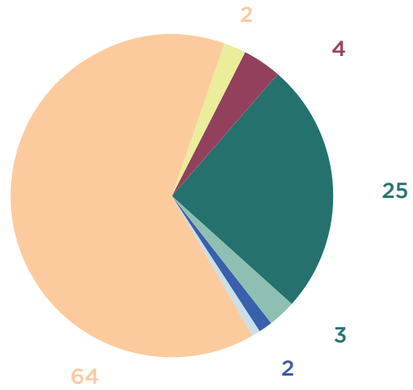


Figure 48 - Restoration potential per class in % of the total restoration potential

Table 31 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	0	8	9	2	20
in use areas	kha	13	226	90	5	334
abandoned areas	%	0	2	3	1	6
in use areas	%	4	64	25	2	94

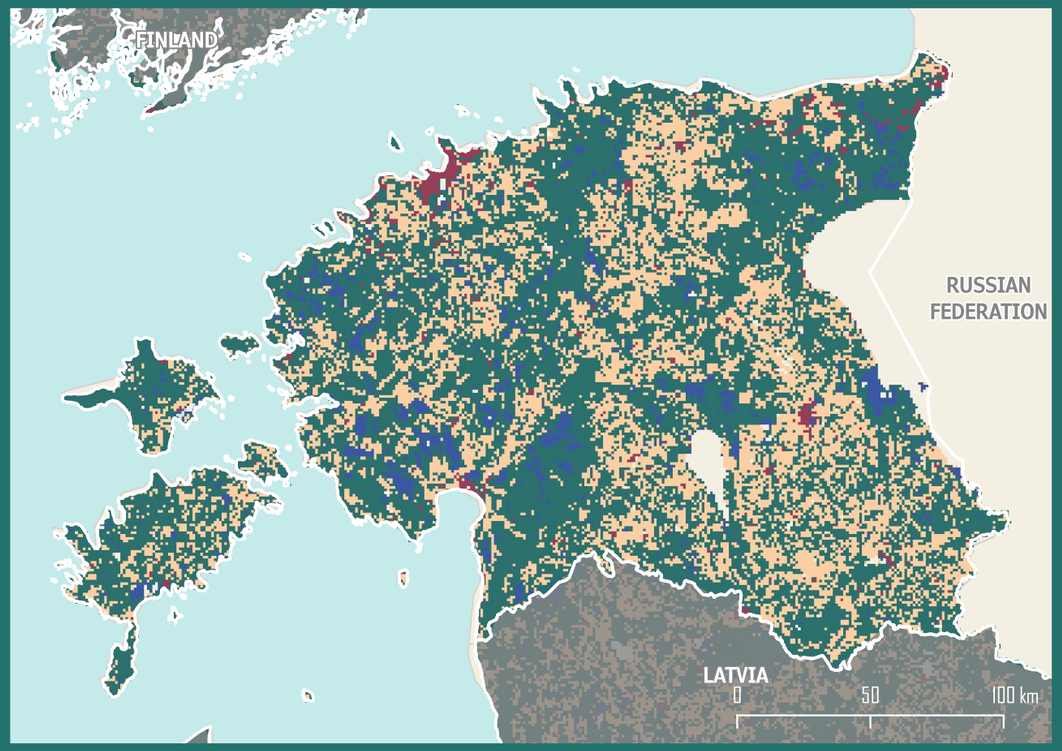


Figure 49 - Map showing the distribution of CORINE Land Cover classes at country level.

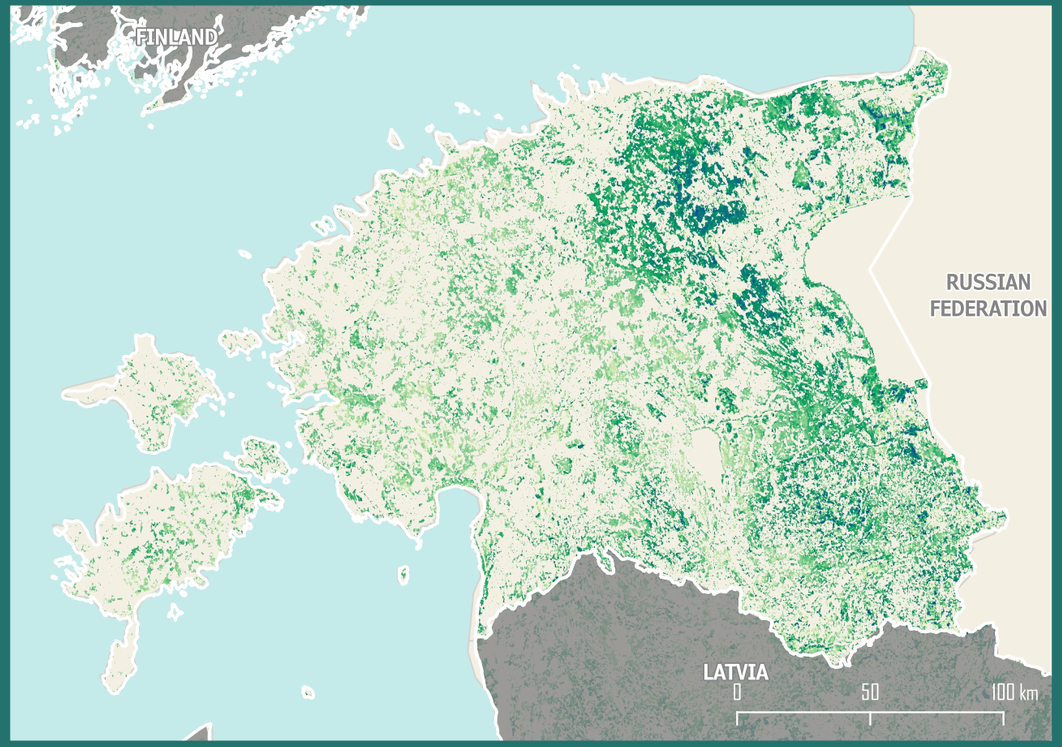


Figure 50 - Map showing the natural tree restoration potential.

Table 32 - Natural canopy restoration potential outside Natura 2000 protected areas in Estonia.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	0	0	0	0	0	0	0	NA
	Discontinuous urban fabric	2	47	0	0	0	8	2	4	1
	Industrial or commercial units	1	14	0	0	0	3	1	1	1
	Road and rail networks and associated land	0	1	0	0	0	0	0	0	0
	Port areas	0	1	0	0	0	0	0	0	NA
	Airports	0	2	0	0	0	0	0	0	NA
	Mineral extraction sites	0	6	0	0	0	1	0	1	0
	Dump sites	0	3	0	0	0	1	0	0	0
	Construction sites	0	0	0	0	0	0	0	0	NA
	Green urban areas	0	1	0	0	0	0	0	0	0
	Sport and leisure facilities	0	1	0	0	0	0	0	0	0
Artificial surfaces	All sub-classes	3	76	0	0	0	13	4	0	1
Agricultural areas	Non-irrigated arable land	7	689	2	0	1	144	41	70	3
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	0	1	0	0	0	0	0	0	0
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	9	239	2	0	1	32	9	16	4
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	7	105	2	1	1	20	6	10	3
	Agriculture associated with natural vegetation	18	191	3	1	1	29	8	14	4
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	44	1,221	8	2	0	226	64	0	7
Forest and semi natural areas	Broad-leaved forest	15	268	1	0	0	9	2	4	6
	Coniferous forest	17	556	1	0	1	34	10	17	6
	Mixed forest	0	743	0	0	0	35	10	17	0
	Natural grasslands	4	2	1	0	0	0	0	0	1
	Moors and heathland	1	1	0	0	0	0	0	0	1
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	26	197	4	1	2	14	4	7	5
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	0
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	78	1,751	9	3	0	90	25	0	12
Wetlands	Inland marshes	8	3	1	0	0	0	0	0	1
	Peat bogs	9	31	1	0	1	5	2	3	2
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	16	35	2	1	0	5	2	0	3
All classes	All sub-classes	155	3,069	20	6	9	335	94	163	15

FINLAND

RESTORATION POTENTIAL OUTSIDE NATURA 2000

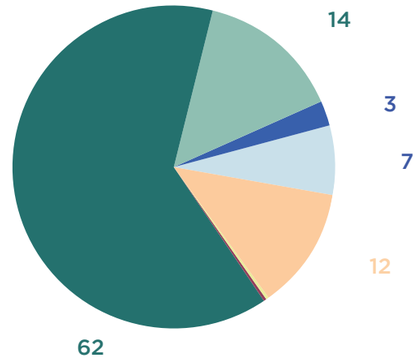


Figure 51 - Restoration potential per class in % of the total restoration potential

Table 33 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	1	8	424	200	633
in use areas		61	367	1,857	76	2,361
abandoned areas	%	0	0	14	7	21
in use areas		2	12	62	3	79

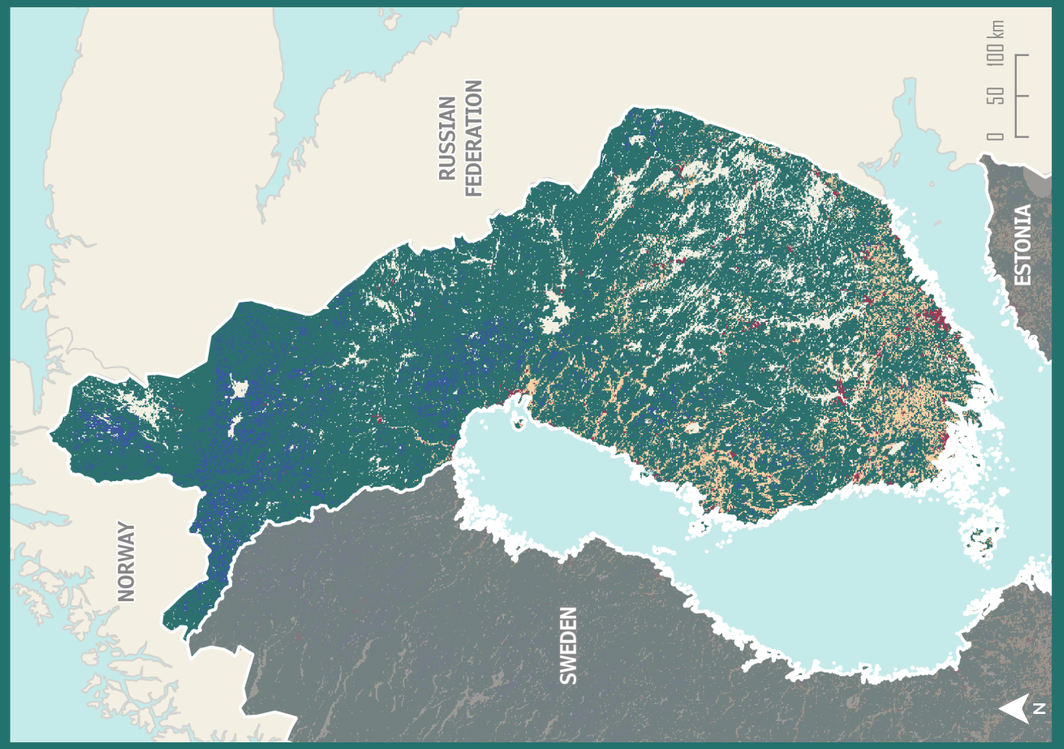


Figure 52 - Map showing the distribution of CORINE Land Cover classes at country level.

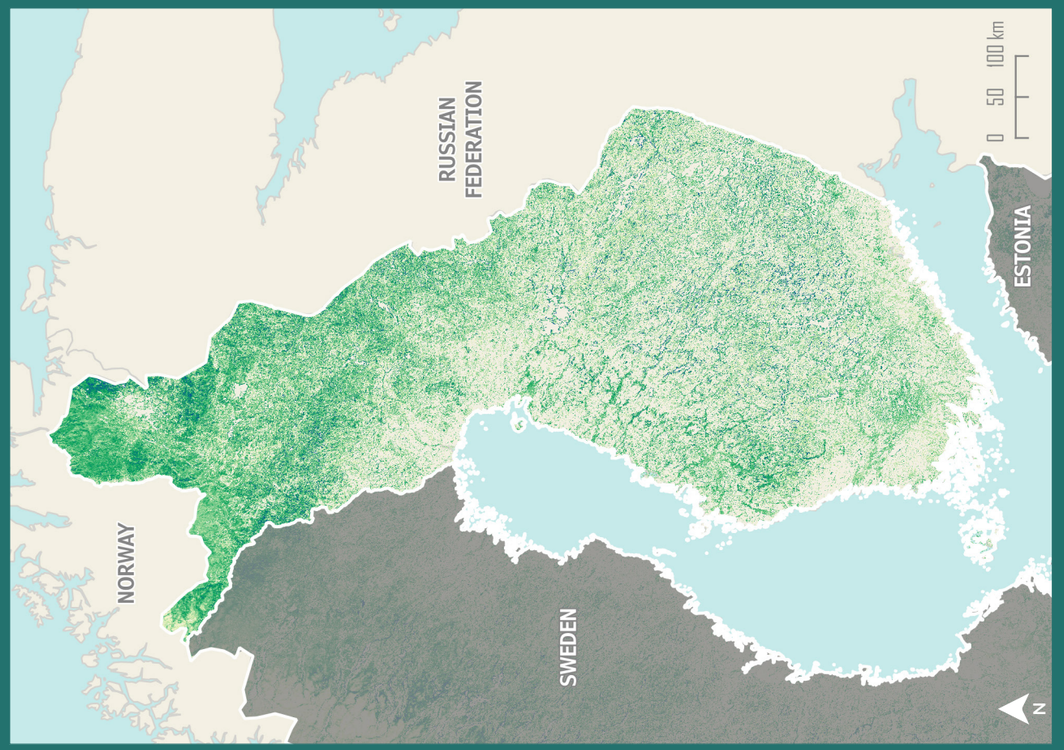


Figure 53 - Map showing the natural tree restoration potential.

Table 34 - Natural canopy restoration potential outside Natura 2000 protected areas in Finland.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	0	0	0	0	0	0	0	NA
	Discontinuous urban fabric	3	313	1	0	1	43	1	41	1
	Industrial or commercial units	1	58	0	0	0	10	0	9	1
	Road and rail networks and associated land	0	1	0	0	0	0	0	0	0
	Port areas	0	3	0	0	0	0	0	0	0
	Airports	0	8	0	0	0	2	0	2	0
	Mineral extraction sites	2	9	0	0	0	1	0	1	1
	Dump sites	0	9	0	0	0	2	0	2	0
	Construction sites	0	1	0	0	0	0	0	0	NA
	Green urban areas	0	5	0	0	0	0	0	0	0
	Sport and leisure facilities	1	17	0	0	0	2	0	2	1
Artificial surfaces	All sub-classes	6	425	1	0	0	61	2	0	2
Agricultural areas	Non-irrigated arable land	18	1,607	3	0	3	259	9	243	3
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	0	0	0	0	0	0	0	0	NA
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	0	1	0	0	0	0	0	0	0
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	0	6	0	0	0	2	0	2	0
	Agriculture associated with natural vegetation	28	896	4	0	4	106	4	100	4
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	48	2,508	8	0	0	367	12	0	5
Forest and semi natural areas	Broad-leaved forest	35	265	14	0	12	33	1	34	8
	Coniferous forest	1,070	11,735	238	8	217	1,213	41	1,184	55
	Mixed forest	361	5,881	53	2	48	419	14	407	26
	Natural grasslands	0	1	0	0	0	0	0	0	NA
	Moors and heathland	74	0	26	1	26	0	0	0	0
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	383	1,705	92	3	86	184	6	180	25
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	17	12	5	0	5	3	0	3	3
	Sparsely vegetated areas	3	0	1	0	1	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	1,948	19,595	424	14	0	1,857	62	0	67
Wetlands	Inland marshes	6	8	1	0	1	1	0	1	2
	Peat bogs	752	311	199	7	190	75	3	75	16
	Salt marshes	1	2	0	0	0	0	0	0	1
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	757	321	200	7	0	76	3	0	16
All classes	All sub-classes	2,772	22,837	579	19	514	2,415	81	2,366	65

FRANCE

RESTORATION POTENTIAL OUTSIDE NATURA 2000

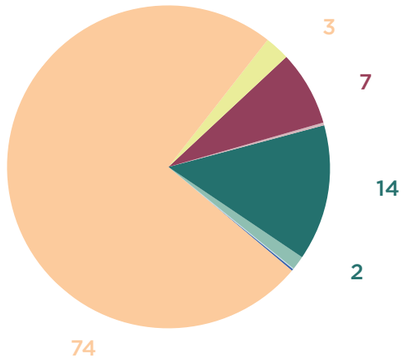


Figure 54 - Restoration potential per class in % of the total restoration potential

Table 35 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	37	280	162	2	480
in use areas	kha	753	7.719	1,407	1	9,880
abandoned areas	%	0	3	2	0	5
in use areas	%	7	74	14	0	95

Figure 55 - Map showing the distribution of CORINE Land Cover classes at country level.

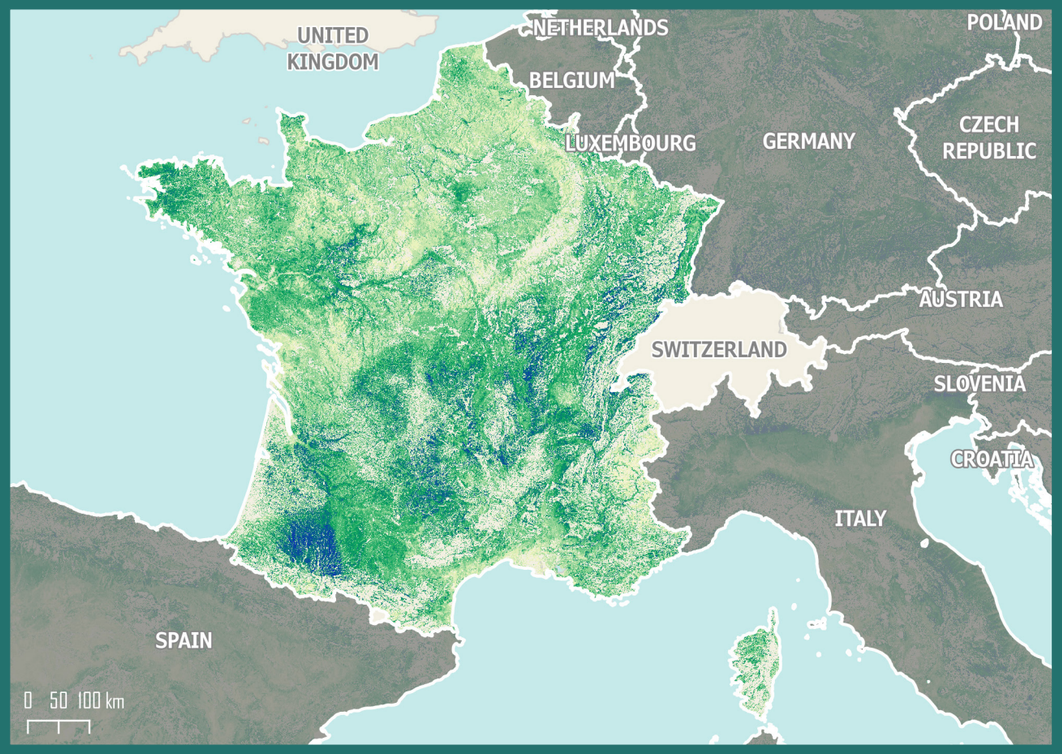


Figure 56 - Map showing the natural tree restoration potential.

Table 36 - Natural canopy restoration potential outside Natura 2000 protected areas in France.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
				Abandoned area			Area in use			
		Abandoned area In kha	Area in use In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	1	35	0	0	0	14	0	7	1
	Discontinuous urban fabric	67	1,830	20	0	11	583	6	308	7
	Industrial or commercial units	32	306	10	0	5	101	1	52	5
	Road and rail networks and associated land	4	28	1	0	0	9	0	5	1
	Port areas	1	8	0	0	0	1	0	1	1
	Airports	1	40	0	0	0	13	0	7	1
	Mineral extraction sites	4	34	2	0	1	8	0	5	2
	Dump sites	0	6	0	0	0	2	0	1	0
	Construction sites	1	1	0	0	0	0	0	0	1
	Green urban areas	3	16	1	0	0	4	0	2	1
	Sport and leisure facilities	6	71	2	0	1	18	0	9	2
Artificial surfaces	All sub-classes	122	2,373	37	0	0	753	7	0	9
Agricultural areas	Non-irrigated arable land	245	14,432	65	1	33	3,513	34	1,737	17
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	10	0	0	0	0	0	0	0
	Vineyards	138	844	39	0	32	272	3	169	14
	Fruit trees and berry plantations	8	116	2	0	1	34	0	20	3
	Olive groves	3	3	1	0	1	1	0	1	2
	Pastures	313	6,716	90	1	45	2,150	21	1,064	18
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	217	4,407	65	1	36	1,496	14	774	14
	Agriculture associated with natural vegetation	85	843	24	0	14	247	2	132	8
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	1,002	27,379	280	3	0	7,719	74	0	33
Forest and semi natural areas	Broad-leaved forest	320	6,113	46	0	29	695	7	366	16
	Coniferous forest	85	2,229	10	0	7	240	2	133	9
	Mixed forest	114	1,306	17	0	12	155	1	88	11
	Natural grasslands	195	409	32	0	20	104	1	64	13
	Moors and heathland	58	135	11	0	9	26	0	17	7
	Sclerophyllous vegetation	175	203	34	0	29	42	0	37	15
	Transitional woodland-shrub	71	649	16	0	12	95	1	54	8
	Beaches, dunes, sands	1	4	0	0	0	1	0	1	1
	Bare rocks	125	15	11	0	7	1	0	0	7
	Sparsely vegetated areas	156	37	20	0	14	11	0	8	8
	Burnt areas	6	2	1	0	1	0	0	0	2
	Glaciers and perpetual snow	12	0	0	0	0	0	0	0	0
Forest and semi natural areas	All sub-classes	1,008	11,412	162	2	0	1,407	14	0	30
Wetlands	Inland marshes	4	5	1	0	0	1	0	0	1
	Peat bogs	0	1	0	0	0	0	0	0	0
	Salt marshes	1	1	0	0	0	0	0	0	1
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	6	0	0	0	1	0	0	NA
Wetlands	All sub-classes	7	12	2	0	0	1	0	0	2
All classes	All sub-classes	2,208	41,106	495	5	298	9,866	95	5,087	46

GERMANY

RESTORATION POTENTIAL OUTSIDE NATURA 2000

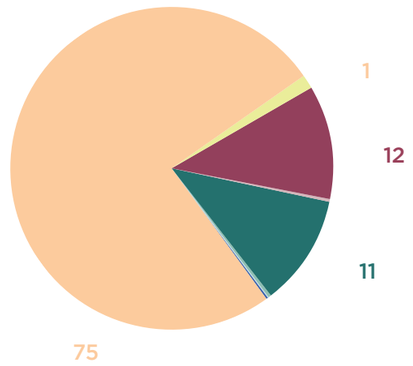


Figure 57 - Restoration potential per class in % of the total restoration potential

Table 37 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	17	95	28	4	143
in use areas	kha	813	5,309	780	1	6,904
abandoned areas	%	0	1	0	0	2
in use areas	%	12	75	11	0	98

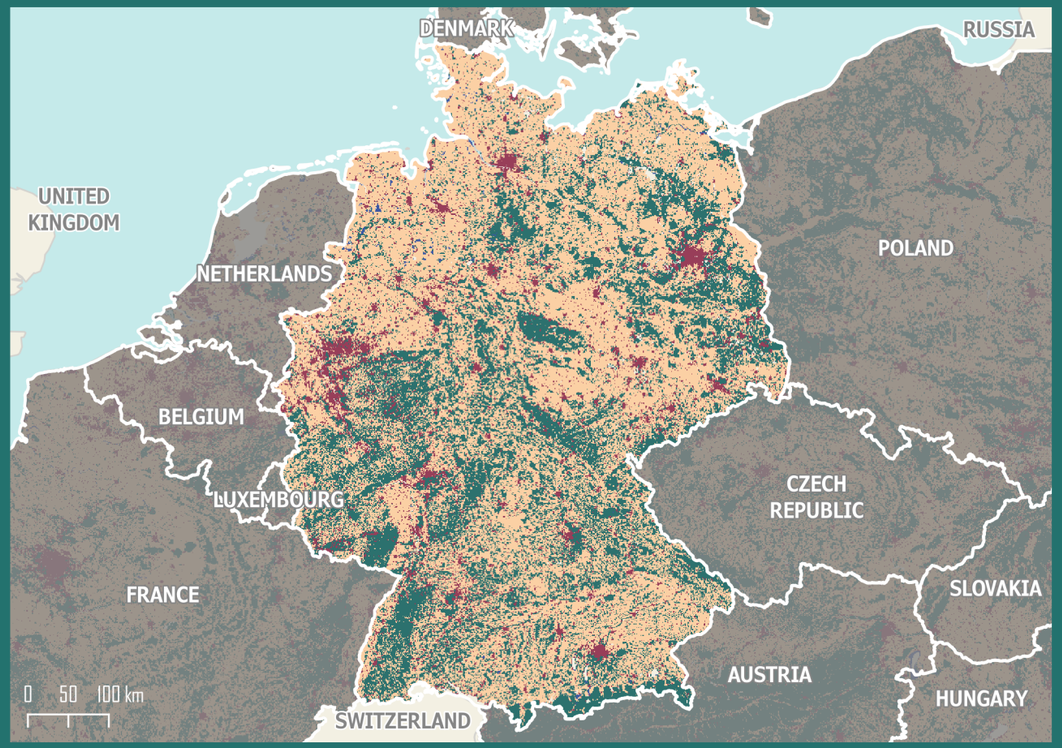


Figure 58 - Map showing the distribution of CORINE Land Cover classes at country level.

Figure 59 - Map showing the natural tree restoration potential.

Table 38 - Natural canopy restoration potential outside Natura 2000 protected areas in Germany.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
				Abandoned area			Area in use			
		Abandoned area In kha	Area in use In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	65	0	0	0	25	0	12	0
	Discontinuous urban fabric	29	1,723	8	0	4	590	8	286	5
	Industrial or commercial units	24	376	7	0	3	128	2	62	5
	Road and rail networks and associated land	1	11	1	0	0	3	0	2	1
	Port areas	0	7	0	0	0	2	0	1	0
	Airports	0	32	0	0	0	10	0	5	0
	Mineral extraction sites	4	56	1	0	0	16	0	8	2
	Dump sites	0	11	0	0	0	3	0	2	0
	Construction sites	0	2	0	0	0	1	0	0	0
	Green urban areas	1	25	0	0	0	5	0	3	1
	Sport and leisure facilities	2	106	0	0	0	30	0	14	2
Artificial surfaces	All sub-classes	60	2,415	17	0	0	813	12	0	7
Agricultural areas	Non-irrigated arable land	125	11,433	41	1	20	4,012	57	1,948	11
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	5	87	2	0	1	30	0	15	4
	Fruit trees and berry plantations	9	90	3	0	2	31	0	15	3
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	145	3,866	47	1	23	1,209	17	587	12
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	1	42	0	0	0	14	0	7	1
	Agriculture associated with natural vegetation	2	48	1	0	0	14	0	7	1
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	283	15,571	95	1	0	5,309	75	0	17
Forest and semi natural areas	Broad-leaved forest	52	1,607	10	0	5	191	3	93	7
	Coniferous forest	43	3,919	9	0	5	474	7	230	7
	Mixed forest	11	706	1	0	1	90	1	43	4
	Natural grasslands	4	27	1	0	1	8	0	4	2
	Moors and heathland	3	6	1	0	0	2	0	1	1
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	8	91	2	0	1	17	0	8	3
	Beaches, dunes, sands	0	1	0	0	0	0	0	0	NA
	Bare rocks	0	1	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	1	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	129	6,350	28	0	0	780	11	0	12
Wetlands	Inland marshes	2	1	0	0	0	0	0	0	1
	Peat bogs	12	8	4	0	2	1	0	0	3
	Salt marshes	0	0	0	0	0	0	0	0	0
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	11	12	4	0	0	1	0	0	3
All classes	All sub-classes	490	24,342	142	2	69	6,906	98	3,352	23

GREECE

RESTORATION POTENTIAL OUTSIDE NATURA 2000

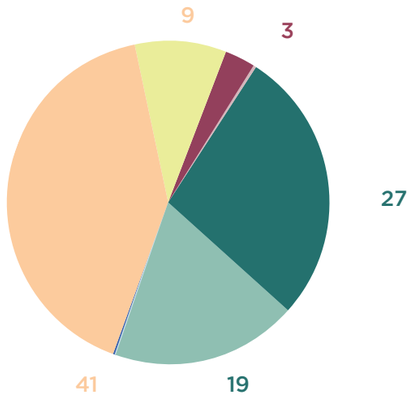


Figure 60 - Restoration potential per class in % of the total restoration potential

Table 39 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	9	180	362	0	551
in use areas	kha	55	792	526	0	1,373
abandoned areas	%	0	9	19	0	29
in use areas	%	3	41	27	0	71

Figure 61 - Map showing the distribution of CORINE Land Cover classes at country level.

Figure 62 - Map showing the natural tree restoration potential.

Table 40 - Natural canopy restoration potential outside Natura 2000 protected areas in Greece.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	2	23	1	0	1	4	0	3	1
	Discontinuous urban fabric	18	133	4	0	4	31	2	26	3
	Industrial or commercial units	7	39	1	0	1	8	0	7	2
	Road and rail networks and associated land	2	7	1	0	0	1	0	1	1
	Port areas	0	1	0	0	0	0	0	0	0
	Airports	1	9	0	0	0	2	0	2	1
	Mineral extraction sites	2	23	0	0	0	7	0	6	1
	Dump sites	0	1	0	0	0	0	0	0	NA
	Construction sites	1	2	1	0	0	0	0	0	1
	Green urban areas	0	1	0	0	0	0	0	0	NA
	Sport and leisure facilities	3	8	1	0	1	2	0	1	1
Artificial surfaces	All sub-classes	38	245	9	0	0	55	3	0	4
Agricultural areas	Non-irrigated arable land	99	848	29	2	24	244	13	202	9
	Permanently irrigated land	60	652	12	1	10	131	7	110	7
	Rice fields	2	14	0	0	0	1	0	1	1
	Vineyards	14	56	4	0	4	14	1	12	4
	Fruit trees and berry plantations	15	108	1	0	1	17	1	13	4
	Olive groves	177	560	42	2	36	130	7	113	14
	Pastures	25	66	8	0	7	19	1	16	4
	Annual crops associated with permanent crops	0	2	0	0	0	1	0	1	0
	Complex cultivation patterns	118	439	29	1	25	105	5	89	9
	Agriculture associated with natural vegetation	293	529	64	3	56	121	6	102	14
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	758	3,319	180	9	0	792	41	0	25
Forest and semi natural areas	Broad-leaved forest	93	642	14	1	11	55	3	43	9
	Coniferous forest	33	357	4	0	4	26	1	23	5
	Mixed forest	70	301	11	1	10	31	2	27	7
	Natural grasslands	196	290	67	3	58	102	5	86	11
	Moors and heathland	9	4	1	0	1	2	0	2	2
	Sclerophyllous vegetation	834	768	205	11	178	199	10	170	23
	Transitional woodland-shrub	230	424	49	3	41	75	4	63	12
	Beaches, dunes, sands	7	3	1	0	1	1	0	1	1
	Bare rocks	5	0	2	0	2	0	0	0	0
	Sparsely vegetated areas	54	51	19	1	16	20	1	17	5
	Burnt areas	5	6	1	0	1	2	0	2	2
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	1,413	2,969	362	19	0	526	27	0	31
Wetlands	Inland marshes	2	1	0	0	0	0	0	0	0
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	1	0	0	0	0	0	0	0	0
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	2	1	0	0	0	0	0	0	0
All classes	All sub-classes	2,194	6,551	535	28	460	1,389	72	1,171	40

HUNGARY

RESTORATION POTENTIAL OUTSIDE NATURA 2000

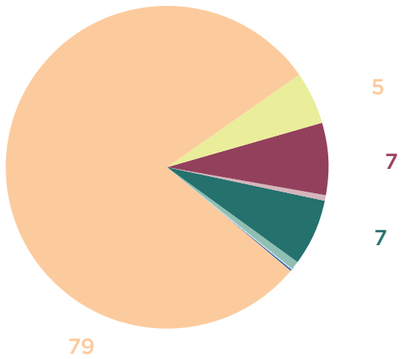


Figure 63 - Restoration potential per class in % of the total restoration potential

Table 41 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	3	42	6	1	52
in use areas	kha	61	655	56	1	773
abandoned areas	%	0	5	1	0	6
in use areas	%	7	79	7	0	94

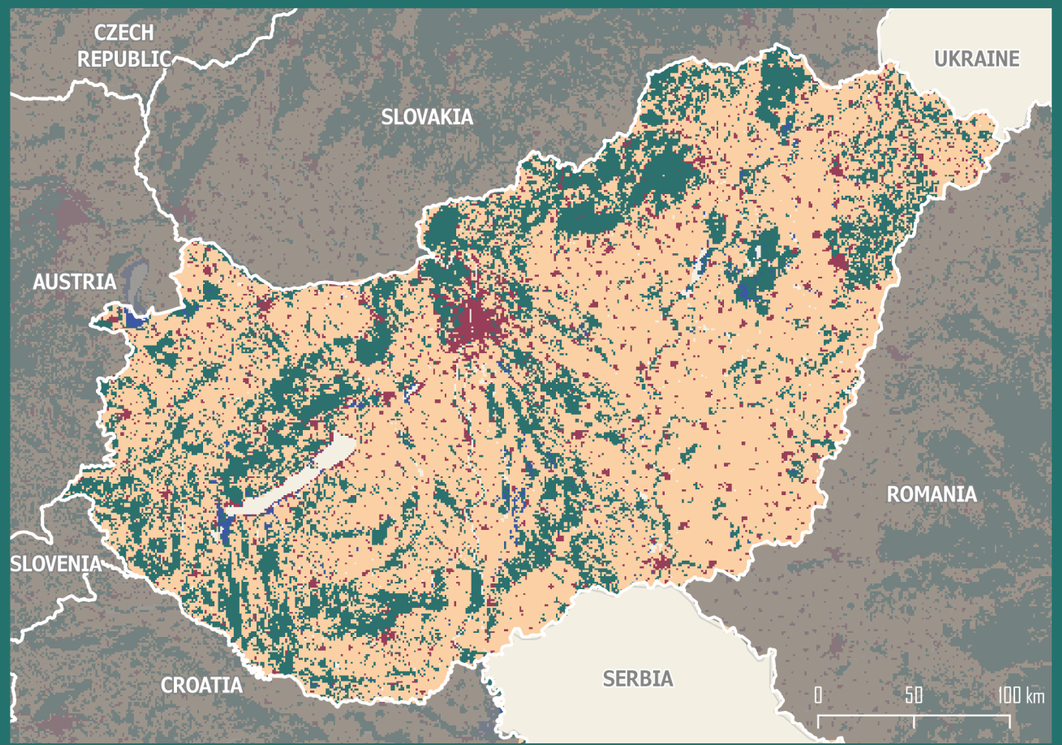


Figure 64 - Map showing the distribution of CORINE Land Cover classes at country level.

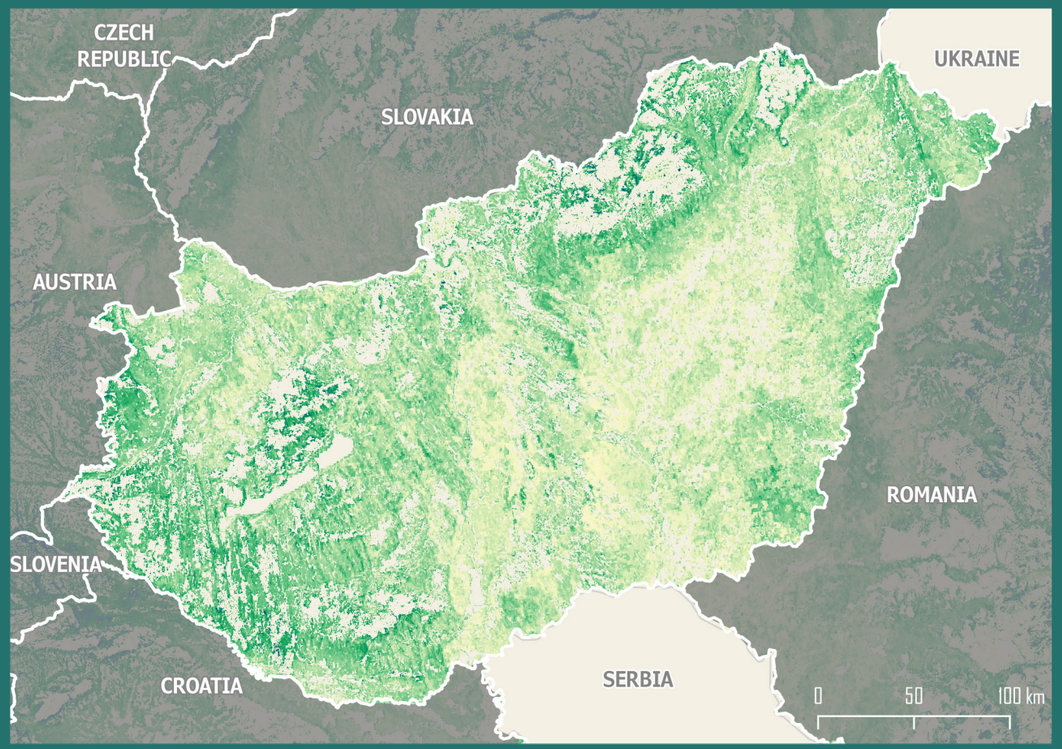


Figure 65 - Map showing the natural tree restoration potential.

Table 42 - Natural canopy restoration potential outside Natura 2000 protected areas in Hungary.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
				Abandoned area			Area in use			
		Abandoned area In kha	Area in use In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	2	0	0	0	0	0	0	0
	Discontinuous urban fabric	14	340	1	0	1	51	6	25	4
	Industrial or commercial units	6	40	1	0	0	5	1	3	2
	Road and rail networks and associated land	0	4	0	0	0	1	0	0	0
	Port areas	0	0	0	0	0	0	0	0	NA
	Airports	0	6	0	0	0	0	0	0	0
	Mineral extraction sites	2	2	0	0	0	1	0	0	1
	Dump sites	2	2	0	0	0	0	0	0	2
	Construction sites	0	1	0	0	0	0	0	0	0
	Green urban areas	1	3	0	0	0	0	0	0	1
	Sport and leisure facilities	2	16	1	0	0	2	0	1	1
Artificial surfaces	All sub-classes	25	415	3	0	0	61	7	0	5
Agricultural areas	Non-irrigated arable land	100	3,882	16	2	8	578	70	281	13
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	2	5	0	0	0	0	0	0	2
	Vineyards	10	67	1	0	0	11	1	5	4
	Fruit trees and berry plantations	4	48	1	0	0	7	1	4	3
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	70	247	12	1	6	32	4	16	9
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	33	153	5	1	2	20	2	10	6
	Agriculture associated with natural vegetation	19	85	2	0	1	11	1	6	4
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	275	4,450	42	5	0	655	79	0	21
Forest and semi natural areas	Broad-leaved forest	17	701	2	0	1	35	4	17	4
	Coniferous forest	0	44	0	0	0	2	0	1	0
	Mixed forest	3	76	1	0	0	4	0	2	2
	Natural grasslands	3	10	1	0	0	2	0	1	1
	Moors and heathland	0	0	0	0	0	0	0	0	NA
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	28	191	2	0	1	15	2	7	5
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	50	1,024	6	1	0	56	7	0	7
Wetlands	Inland marshes	6	8	1	0	0	1	0	0	2
	Peat bogs	0	3	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	6	10	1	0	0	1	0	0	2
All classes	All sub-classes	356	5,899	52	6	25	772	94	375	22

IRELAND

RESTORATION POTENTIAL OUTSIDE NATURA 2000

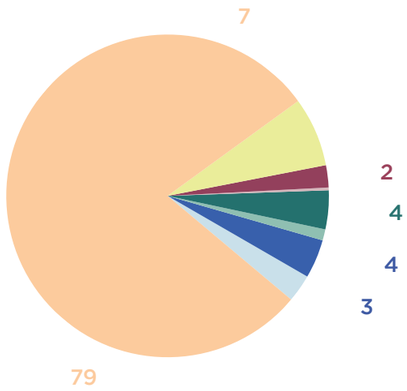


Figure 66 - Restoration potential per class in % of the total restoration potential

Table 43 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	4	123	17	46	190
in use areas	kha	41	1,409	70	72	1,593
abandoned areas	%	0	7	1	3	11
in use areas	%	2	79	4	4	89

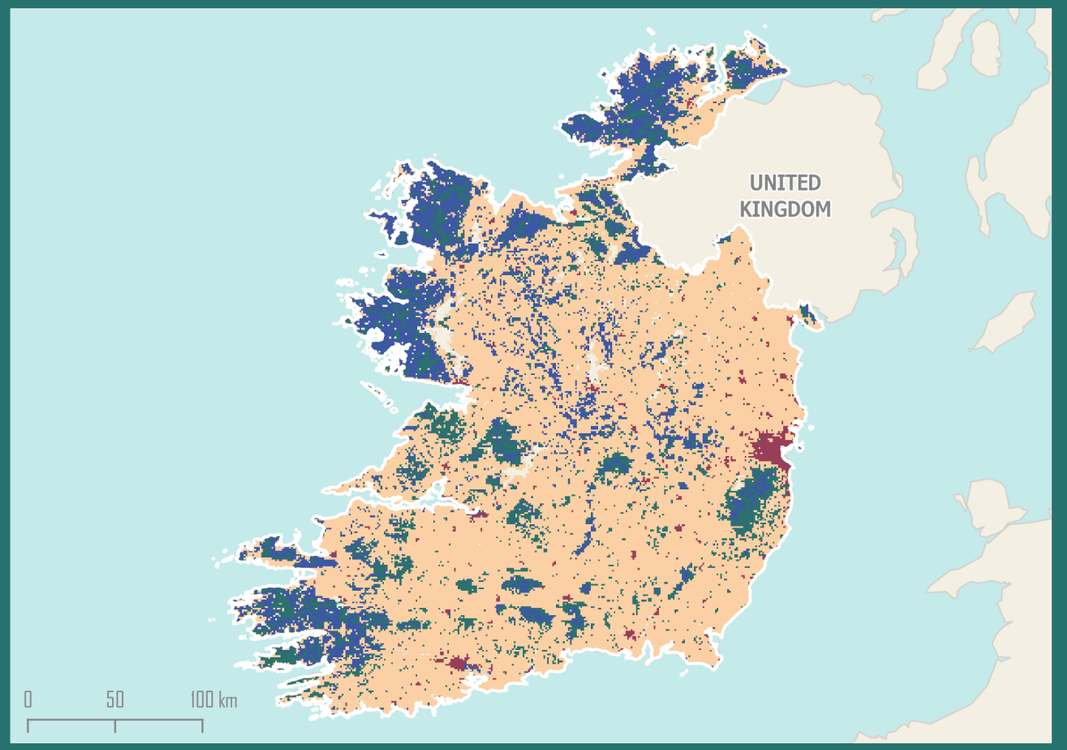


Figure 67 - Map showing the distribution of CORINE Land Cover classes at country level.

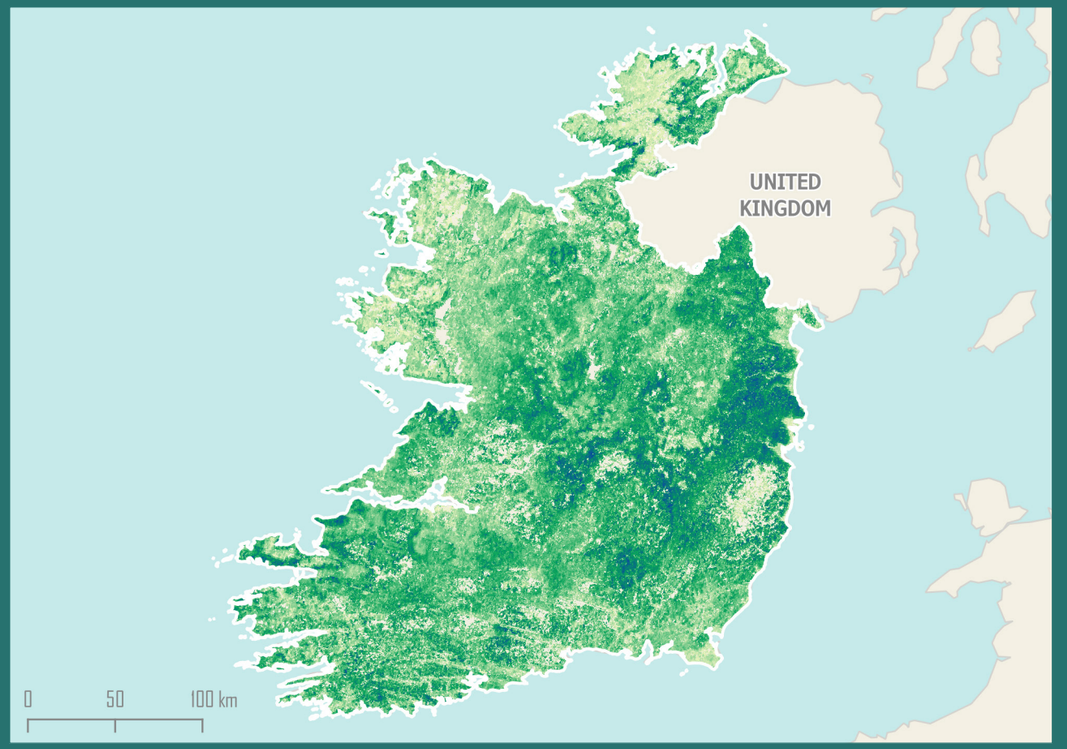


Figure 68 - Map showing the natural tree restoration potential.

Table 44 - Natural canopy restoration potential outside Natura 2000 protected areas in Ireland.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
				Abandoned area			Area in use			
		Abandoned area In kha	Area in use In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	2	0	0	0	1	0	0	0
	Discontinuous urban fabric	4	76	2	0	1	29	2	14	2
	Industrial or commercial units	1	8	0	0	0	4	0	2	1
	Road and rail networks and associated land	0	2	0	0	0	1	0	0	0
	Port areas	0	1	0	0	0	0	0	0	NA
	Airports	0	2	0	0	0	1	0	0	NA
	Mineral extraction sites	1	3	0	0	0	1	0	1	1
	Dump sites	0	1	0	0	0	0	0	0	NA
	Construction sites	0	1	0	0	0	0	0	0	NA
	Green urban areas	1	2	0	0	0	1	0	0	1
	Sport and leisure facilities	0	10	0	0	0	4	0	2	0
Artificial surfaces	All sub-classes	8	107	4	0	0	41	2	0	2
Agricultural areas	Non-irrigated arable land	15	242	7	0	4	101	6	49	3
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	0	0	0	0	0	0	0	0	NA
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	272	3,252	93	5	45	1,209	68	587	18
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	5	39	2	0	1	15	1	7	2
	Agriculture associated with natural vegetation	69	274	19	1	9	85	5	41	8
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	367	3,801	123	7	0	1,409	79	0	20
Forest and semi natural areas	Broad-leaved forest	5	14	1	0	0	3	0	1	1
	Coniferous forest	13	181	2	0	1	31	2	15	3
	Mixed forest	8	34	1	0	1	7	0	3	2
	Natural grasslands	3	13	1	0	0	4	0	2	2
	Moors and heathland	33	19	8	0	4	6	0	3	4
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	22	96	4	0	2	16	1	8	4
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	1	0	0	0	0	0	0	0	0
	Sparsely vegetated areas	6	4	1	0	1	1	0	0	3
	Burnt areas	1	1	0	0	0	0	0	0	0
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	85	370	17	1	0	70	4	0	8
Wetlands	Inland marshes	2	3	1	0	0	1	0	0	1
	Peat bogs	199	295	45	3	22	71	4	35	12
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	2	0	0	0	0	0	0	NA
Wetlands	All sub-classes	201	300	46	3	0	72	4	0	12
All classes	All sub-classes	684	4,555	197	11	96	1,586	89	769	26

ITALY

RESTORATION POTENTIAL OUTSIDE NATURA 2000

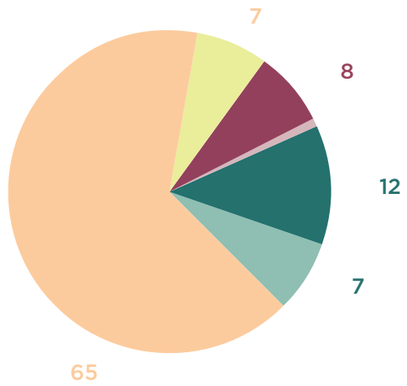


Figure 69 - Restoration potential per class in % of the total restoration potential

Table 45 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	32	355	354	0	741
in use areas	kha	373	3,229	588	0	4,190
abandoned areas	%	1	7	7	0	15
in use areas	%	8	65	12	0	85

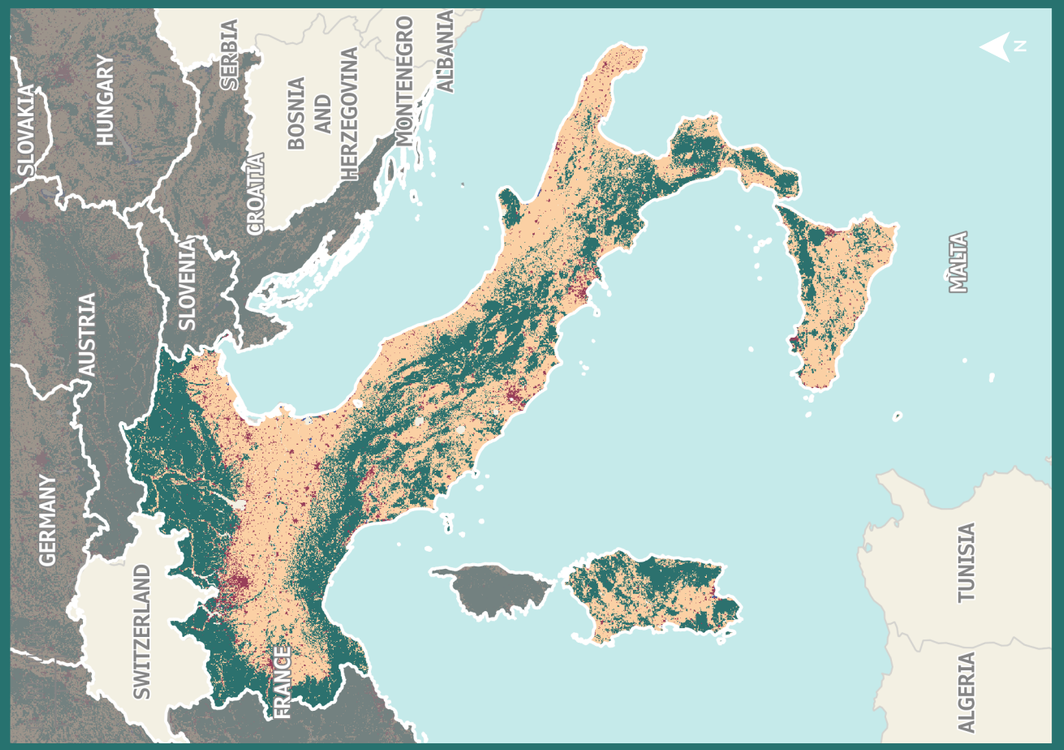


Figure 70 - Map showing the distribution of CORINE Land Cover classes at country level.

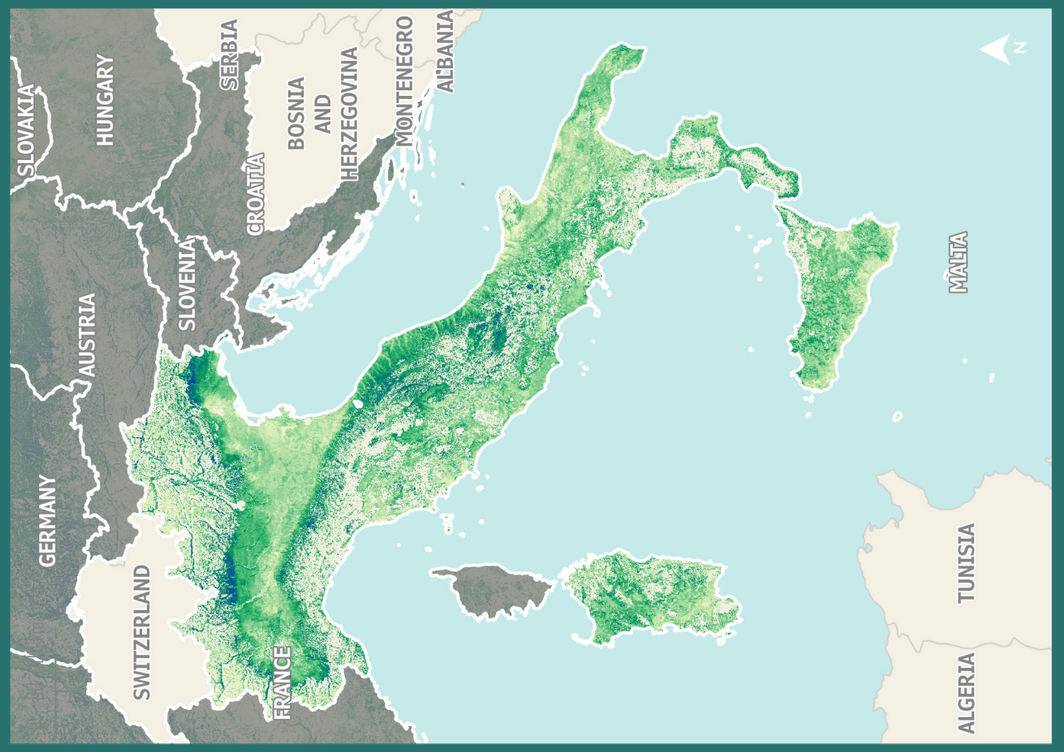


Figure 71 - Map showing the natural tree restoration potential.

Table 46 - Natural canopy restoration potential outside Natura 2000 protected areas in Italy.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	11	129	2	0	1	36	1	28	3
	Discontinuous urban fabric	59	763	18	0	13	256	5	153	6
	Industrial or commercial units	28	206	8	0	5	61	1	38	4
	Road and rail networks and associated land	3	9	1	0	0	2	0	1	1
	Port areas	0	6	0	0	0	1	0	1	0
	Airports	0	19	0	0	0	5	0	3	0
	Mineral extraction sites	12	17	3	0	2	5	0	3	2
	Dump sites	0	2	0	0	0	0	0	0	0
	Construction sites	1	1	0	0	0	0	0	0	1
	Green urban areas	1	6	0	0	0	1	0	1	1
	Sport and leisure facilities	1	14	0	0	0	4	0	2	1
Artificial surfaces	All sub-classes	114	1,173	32	1	0	373	8	0	8
Agricultural areas	Non-irrigated arable land	473	6,672	126	3	103	1,813	37	1,308	21
	Permanently irrigated land	2	60	0	0	0	16	0	11	1
	Rice fields	3	246	1	0	0	67	1	33	2
	Vineyards	60	515	13	0	11	126	3	94	10
	Fruit trees and berry plantations	45	292	8	0	7	48	1	36	8
	Olive groves	239	822	61	1	53	194	4	169	17
	Pastures	51	221	15	0	10	67	1	39	6
	Annual crops associated with permanent crops	34	152	11	0	10	32	1	28	6
	Complex cultivation patterns	195	1,731	50	1	41	469	10	353	13
	Agriculture associated with natural vegetation	333	1,283	78	2	63	344	7	252	17
	Agro-forestry areas	30	112	8	0	7	34	1	30	6
Agricultural areas	All sub-classes	1,400	12,171	355	7	0	3,229	65	0	37
Forest and semi natural areas	Broad-leaved forest	809	2,833	104	2	73	312	6	218	23
	Coniferous forest	204	581	15	0	8	39	1	21	11
	Mixed forest	192	462	22	0	13	38	1	23	10
	Natural grasslands	179	148	41	1	26	44	1	30	9
	Moors and heathland	51	9	6	0	2	1	0	0	2
	Sclerophyllous vegetation	394	253	68	1	60	43	1	38	14
	Transitional woodland-shrub	245	249	51	1	36	54	1	39	10
	Beaches, dunes, sands	13	13	4	0	3	5	0	3	2
	Bare rocks	119	13	9	0	4	1	0	0	4
	Sparsely vegetated areas	304	124	57	1	33	25	1	21	11
	Burnt areas	11	3	2	0	1	1	0	1	2
	Glaciers and perpetual snow	9	0	0	0	0	0	0	0	0
Forest and semi natural areas	All sub-classes	2,351	4,869	354	7	0	588	12	0	37
Wetlands	Inland marshes	1	0	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	1	0	0	0	0	0	0	0	0
	Salines	0	0	0	0	0	0	0	0	0
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	2	0	0	0	0	0	0	0	0
All classes	All sub-classes	4,035	18,046	755	15	572	4,177	85	2,996	56

LATVIA

RESTORATION POTENTIAL OUTSIDE NATURA 2000

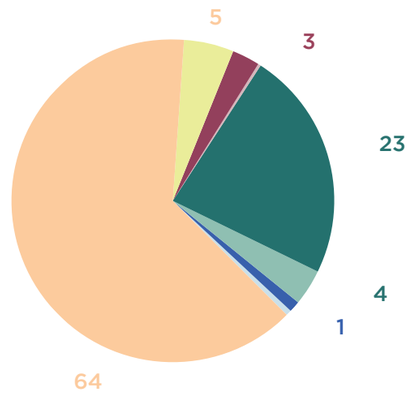


Figure 72 - Restoration potential per class in % of the total restoration potential

Table 47 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	1	40	28	3	72
in use areas	kha	21	490	177	9	698
abandoned areas	%	0	5	4	0	9
in use areas	%	3	64	23	1	91

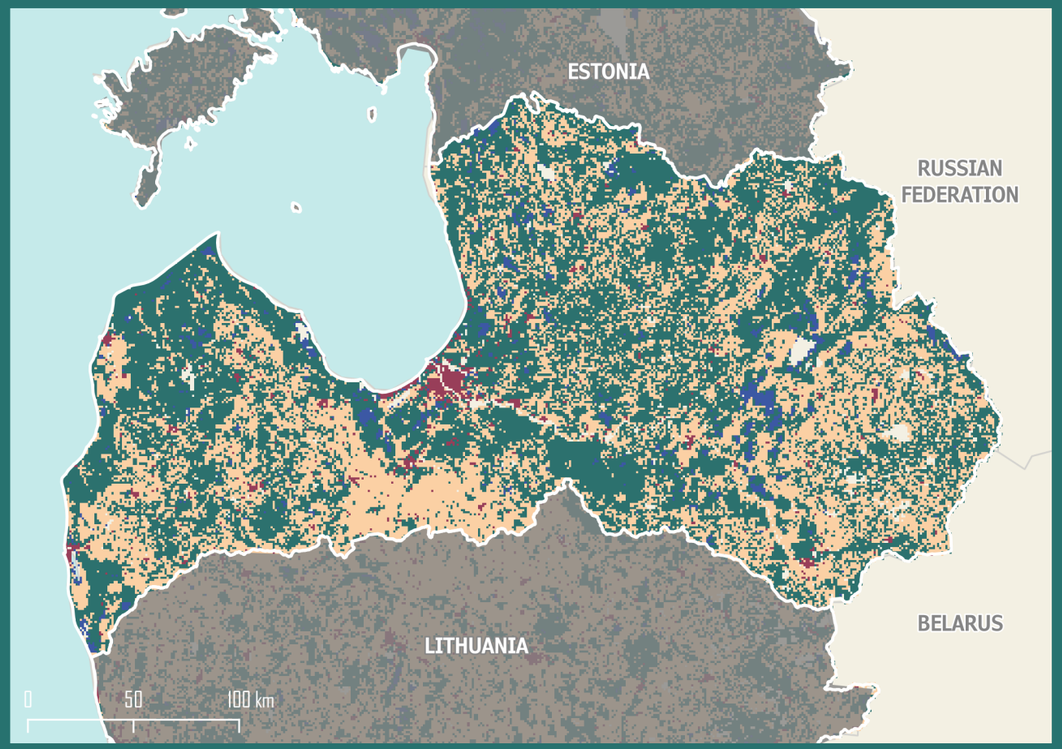


Figure 73 - Map showing the distribution of CORINE Land Cover classes at country level.

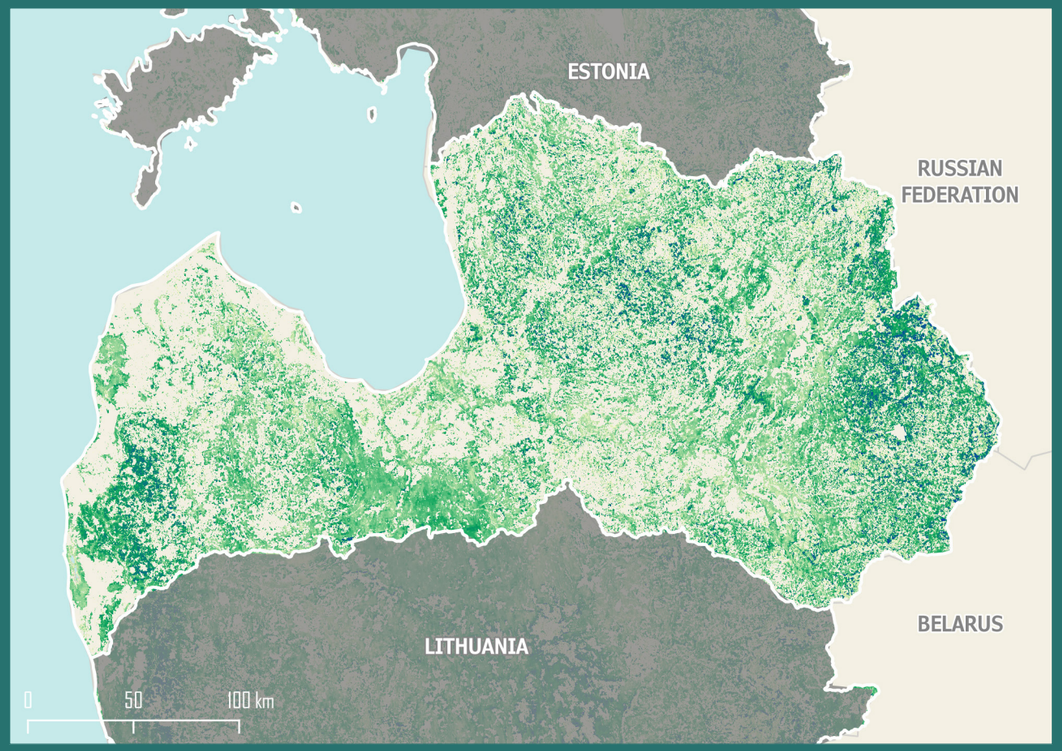


Figure 74 - Map showing the natural tree restoration potential.

Table 48 - Natural canopy restoration potential outside Natura 2000 protected areas in Latvia.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	1	0	0	0	0	0	0	NA
	Discontinuous urban fabric	4	62	1	0	0	14	2	7	2
	Industrial or commercial units	1	17	0	0	0	4	0	2	1
	Road and rail networks and associated land	0	1	0	0	0	0	0	0	0
	Port areas	0	2	0	0	0	0	0	0	NA
	Airports	1	1	0	0	0	0	0	0	1
	Mineral extraction sites	1	2	0	0	0	0	0	0	1
	Dump sites	0	0	0	0	0	0	0	0	NA
	Construction sites	0	0	0	0	0	0	0	0	0
	Green urban areas	1	4	0	0	0	0	0	0	1
	Sport and leisure facilities	0	7	0	0	0	1	0	1	0
Artificial surfaces	All sub-classes	9	97	1	0	0	21	3	0	2
Agricultural areas	Non-irrigated arable land	35	1,211	7	1	4	283	37	138	5
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	0	2	0	0	0	1	0	0	0
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	101	448	20	3	10	100	13	48	9
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	46	291	10	1	5	70	9	34	6
	Agriculture associated with natural vegetation	46	174	8	1	4	31	4	15	6
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	202	2,152	40	5	0	490	64	0	13
Forest and semi natural areas	Broad-leaved forest	39	374	5	1	2	27	3	13	7
	Coniferous forest	52	620	4	1	2	31	4	15	9
	Mixed forest	41	878	4	1	2	67	9	32	8
	Natural grasslands	2	1	0	0	0	0	0	0	1
	Moors and heathland	0	0	0	0	0	0	0	0	NA
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	101	759	13	2	6	54	7	26	11
	Beaches, dunes, sands	0	1	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	1	0	0	0	0	0	0	0
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	243	2,625	28	4	0	177	23	0	18
Wetlands	Inland marshes	3	3	0	0	0	0	0	0	1
	Peat bogs	18	42	2	0	1	9	1	4	3
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	21	45	3	0	0	9	1	0	4
All classes	All sub-classes	484	4,909	67	9	33	703	91	341	22

LITHUANIA

RESTORATION POTENTIAL OUTSIDE NATURA 2000

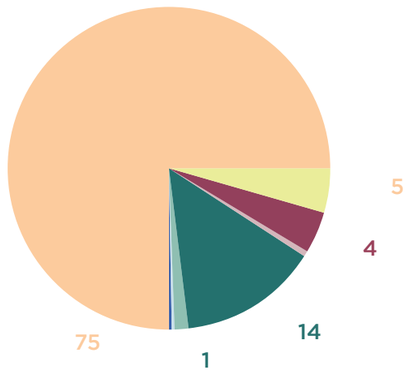


Figure 75 - Restoration potential per class in % of the total restoration potential

Table 49 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	5	56	17	2	79
in use areas	kha	51	911	169	3	1,135
abandoned areas	%	0	5	1	0	7
in use areas	%	4	75	14	0	93

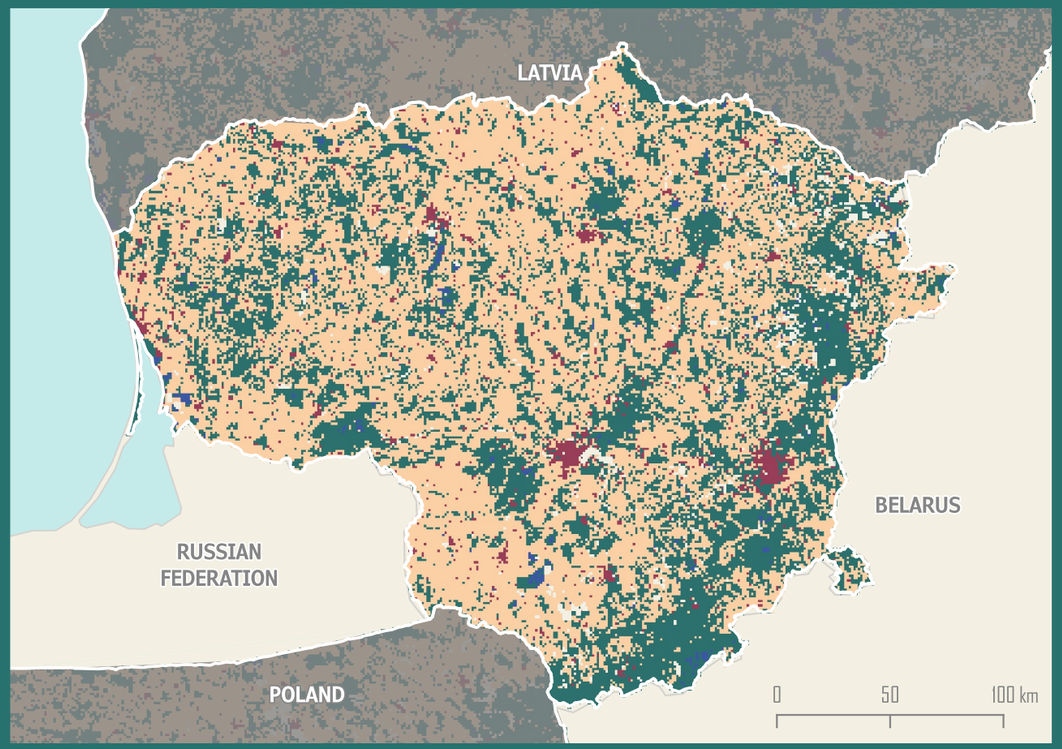


Figure 76 - Map showing the distribution of CORINE Land Cover classes at country level.

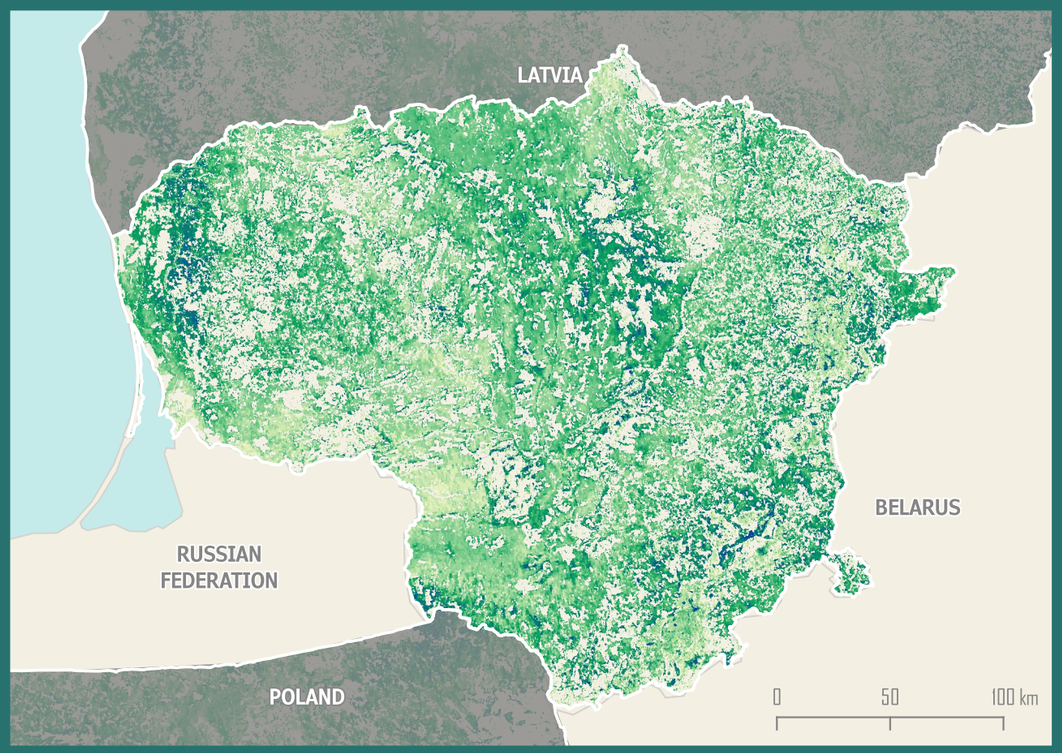


Figure 77 - Map showing the natural tree restoration potential.

Table 50 - Natural canopy restoration potential outside Natura 2000 protected areas in Lithuania.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	0	0	0	0	0	0	0	0
	Discontinuous urban fabric	9	118	3	0	2	38	3	19	2
	Industrial or commercial units	4	19	1	0	1	6	0	3	1
	Road and rail networks and associated land	0	3	0	0	0	1	0	0	0
	Port areas	0	0	0	0	0	0	0	0	NA
	Airports	0	3	0	0	0	1	0	1	0
	Mineral extraction sites	1	3	0	0	0	1	0	1	1
	Dump sites	0	1	0	0	0	0	0	0	NA
	Construction sites	0	1	0	0	0	0	0	0	NA
	Green urban areas	0	6	0	0	0	1	0	0	0
	Sport and leisure facilities	0	5	0	0	0	1	0	1	0
Artificial surfaces	All sub-classes	15	159	5	0	0	51	4	0	3
Agricultural areas	Non-irrigated arable land	32	2,245	10	1	5	608	50	296	7
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	0	7	0	0	0	2	0	1	0
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	40	325	12	1	6	97	8	47	6
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	45	462	12	1	6	144	12	70	6
	Agriculture associated with natural vegetation	51	284	14	1	7	67	6	33	7
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	197	3,295	56	5	0	911	75	0	15
Forest and semi natural areas	Broad-leaved forest	25	282	6	0	3	30	3	15	7
	Coniferous forest	9	465	2	0	1	58	5	28	4
	Mixed forest	18	516	3	0	2	57	5	27	5
	Natural grasslands	1	0	0	0	0	0	0	0	NA
	Moors and heathland	0	0	0	0	0	0	0	0	NA
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	19	164	4	0	2	24	2	12	4
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	1	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	76	1,426	17	1	0	169	14	0	10
Wetlands	Inland marshes	3	3	1	0	0	1	0	0	1
	Peat bogs	3	11	1	0	1	3	0	1	1
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	7	13	2	0	0	3	0	0	2
All classes	All sub-classes	311	4,875	83	7	40	1,131	93	549	19

LUXEMBOURG

RESTORATION POTENTIAL OUTSIDE NATURA 2000

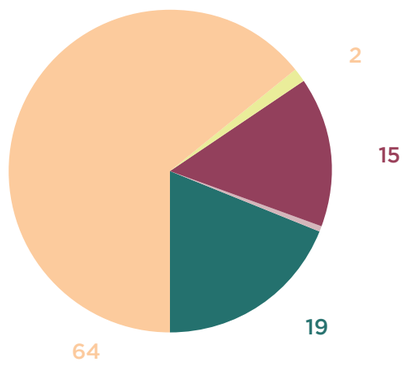


Figure 78 - Restoration potential per class in % of the total restoration potential

Table 51 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	0	0	0	0	1
in use areas		4	19	6	0	29
abandoned areas	%	1	2	0	0	2
in use areas		15	64	19	0	98

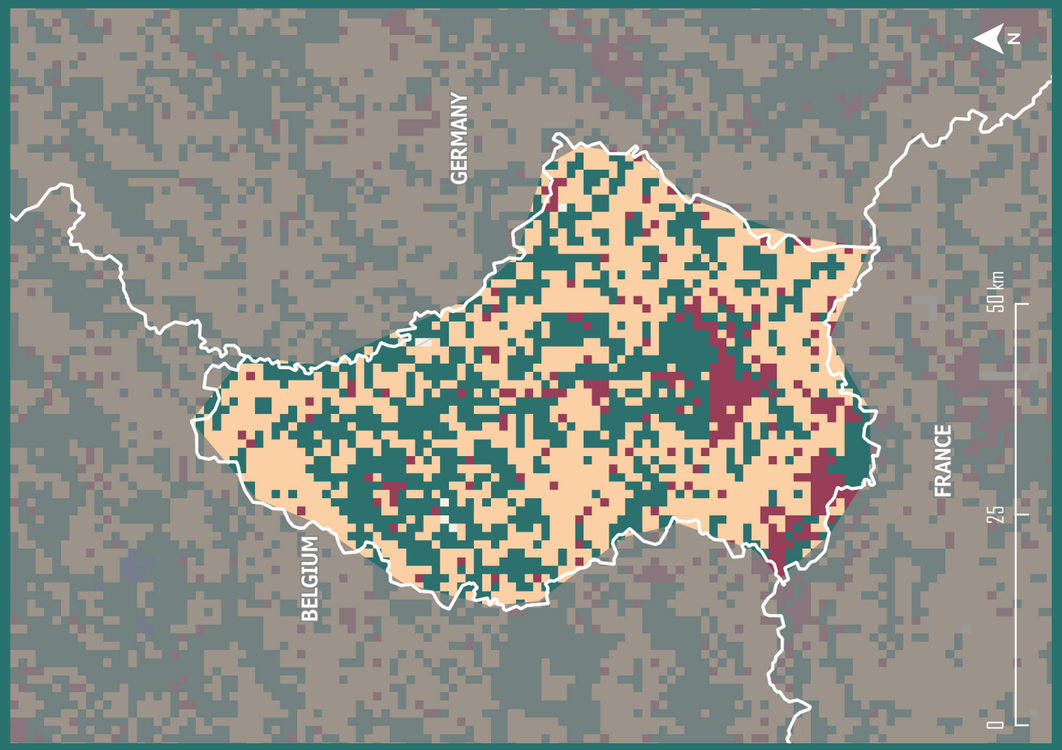


Figure 79 - Map showing the distribution of CORINE Land Cover classes at country level.

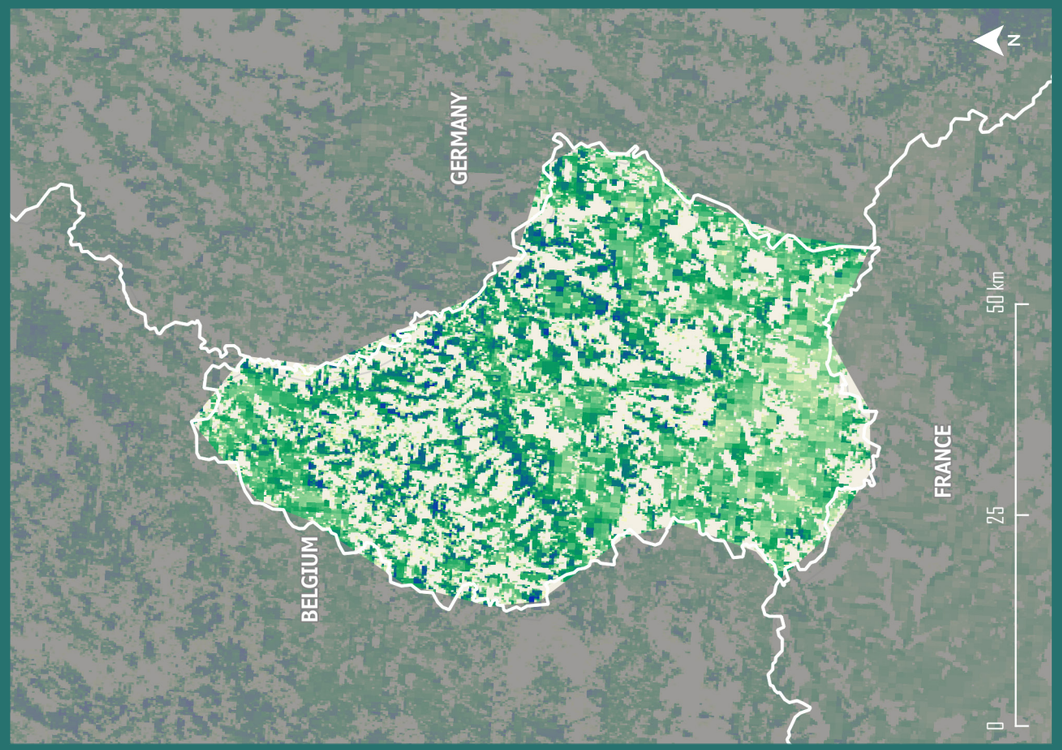


Figure 80 - Map showing the natural tree restoration potential.

Table 52 - Natural canopy restoration potential outside Natura 2000 protected areas in Luxembourg.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	1	0	0	0	0	1	0	NA
	Discontinuous urban fabric	0	10	0	0	0	3	11	2	0
	Industrial or commercial units	0	3	0	0	0	1	2	0	0
	Road and rail networks and associated land	0	0	0	0	0	0	0	0	NA
	Port areas	0	0	0	0	0	0	0	0	NA
	Airports	0	1	0	0	0	0	1	0	NA
	Mineral extraction sites	0	0	0	0	0	0	0	0	NA
	Dump sites	0	0	0	0	0	0	0	0	NA
	Construction sites	0	0	0	0	0	0	0	0	NA
	Green urban areas	0	0	0	0	0	0	0	0	NA
	Sport and leisure facilities	0	0	0	0	0	0	0	0	NA
Artificial surfaces	All sub-classes	1	15	0	1	0	5	15	0	1
Agricultural areas	Non-irrigated arable land	0	27	0	0	0	8	26	4	0
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	0
	Fruit trees and berry plantations	0	0	0	0	0	0	0	0	NA
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	1	17	0	0	0	6	19	3	1
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	0	14	0	1	0	4	12	2	0
	Agriculture associated with natural vegetation	0	7	0	0	0	2	7	1	0
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	2	65	0	2	0	19	64	0	1
Forest and semi natural areas	Broad-leaved forest	0	27	0	0	0	3	12	2	0
	Coniferous forest	0	7	0	0	0	1	3	0	0
	Mixed forest	0	8	0	0	0	1	4	1	0
	Natural grasslands	0	0	0	0	0	0	0	0	NA
	Moors and heathland	0	0	0	0	0	0	0	0	NA
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	0	0	0	0	0	0	0	0	NA
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	0	42	0	0	0	6	19	0	0
Wetlands	Inland marshes	0	0	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	0	0	0	0	0	0	0	0	NA
All classes	All sub-classes	2	122	1	2	0	29	98	14	1

MALTA

RESTORATION POTENTIAL OUTSIDE NATURA 2000

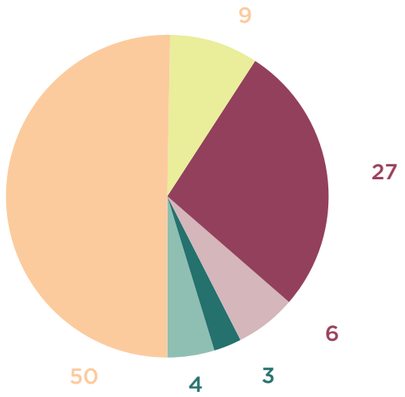


Figure 81 - Restoration potential per class in % of the total restoration potential

Table 53 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	0	0	0	0	1
in use areas		1	2	0	0	4
abandoned areas	%	6	9	4	0	20
in use areas		27	50	3	0	80

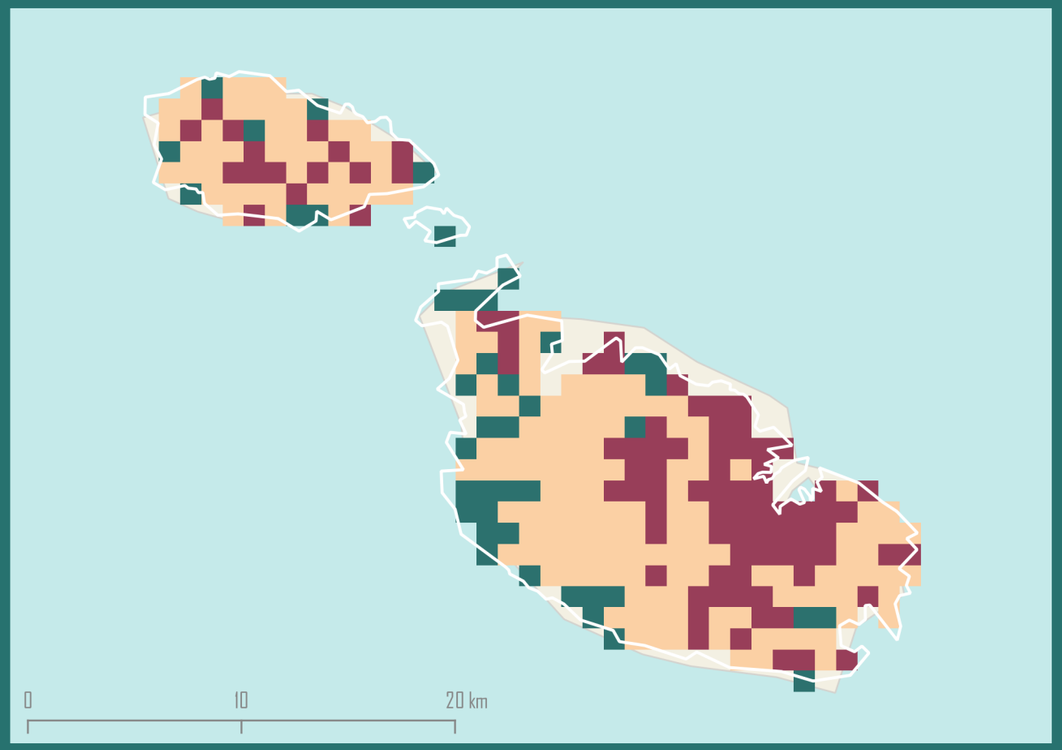


Figure 82 - Map showing the distribution of CORINE Land Cover classes at country level.

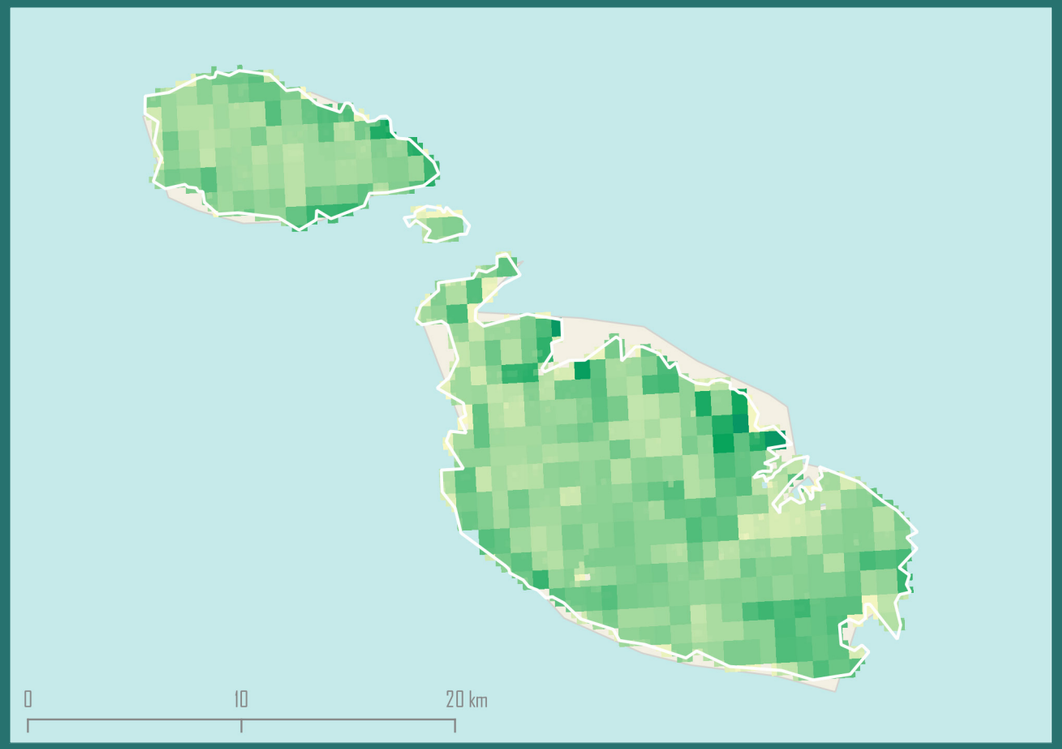


Figure 83 - Map showing the natural tree restoration potential.

Table 54 - Natural canopy restoration potential outside Natura 2000 protected areas in Malta.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	0	0	0	0	0	1	0	NA
	Discontinuous urban fabric	1	5	0	4	0	1	23	1	0
	Industrial or commercial units	0	0	0	1	0	0	1	0	0
	Road and rail networks and associated land	0	0	0	0	0	0	0	0	NA
	Port areas	0	0	0	0	0	0	0	0	NA
	Airports	0	0	0	0	0	0	2	0	NA
	Mineral extraction sites	0	0	0	0	0	0	1	0	NA
	Dump sites	0	0	0	0	0	0	0	0	NA
	Construction sites	0	0	0	0	0	0	0	0	NA
	Green urban areas	0	0	0	0	0	0	1	0	NA
	Sport and leisure facilities	0	0	0	0	0	0	0	0	NA
Artificial surfaces	All sub-classes	1	6	0	6	0	1	27	0	1
Agricultural areas	Non-irrigated arable land	0	1	0	0	0	0	2	0	NA
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	0	0	0	0	0	0	0	0	NA
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	0	0	0	0	0	0	0	0	NA
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	0	1	0	0	0	0	5	0	0
	Agriculture associated with natural vegetation	2	9	0	8	0	2	43	2	1
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	2	10	0	9	0	2	50	0	1
Forest and semi natural areas	Broad-leaved forest	0	0	0	0	0	0	0	0	NA
	Coniferous forest	0	0	0	0	0	0	1	0	NA
	Mixed forest	0	0	0	0	0	0	1	0	NA
	Natural grasslands	0	0	0	0	0	0	0	0	NA
	Moors and heathland	0	0	0	0	0	0	0	0	NA
	Sclerophyllous vegetation	1	1	0	4	0	0	2	0	0
	Transitional woodland-shrub	0	0	0	0	0	0	0	0	NA
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	1	1	0	4	0	0	3	0	0
Wetlands	Inland marshes	0	0	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	0	0	0	0	0	0	0	0	NA
All classes	All sub-classes	4	16	1	20	1	4	80	3	1

NETHERLANDS

RESTORATION POTENTIAL OUTSIDE NATURA 2000

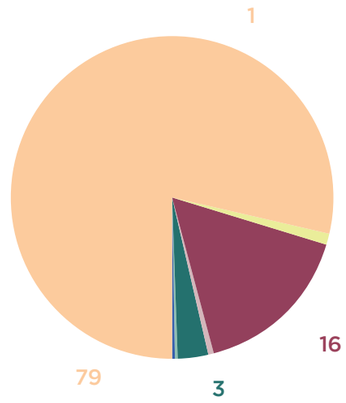


Figure 84 - Restoration potential per class in % of the total restoration potential

Table 55 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	2	5	9	0	8
in use areas	kha	64	309	12	0	385
abandoned areas	%	1	1	0	0	2
in use areas	%	16	79	3	0	98

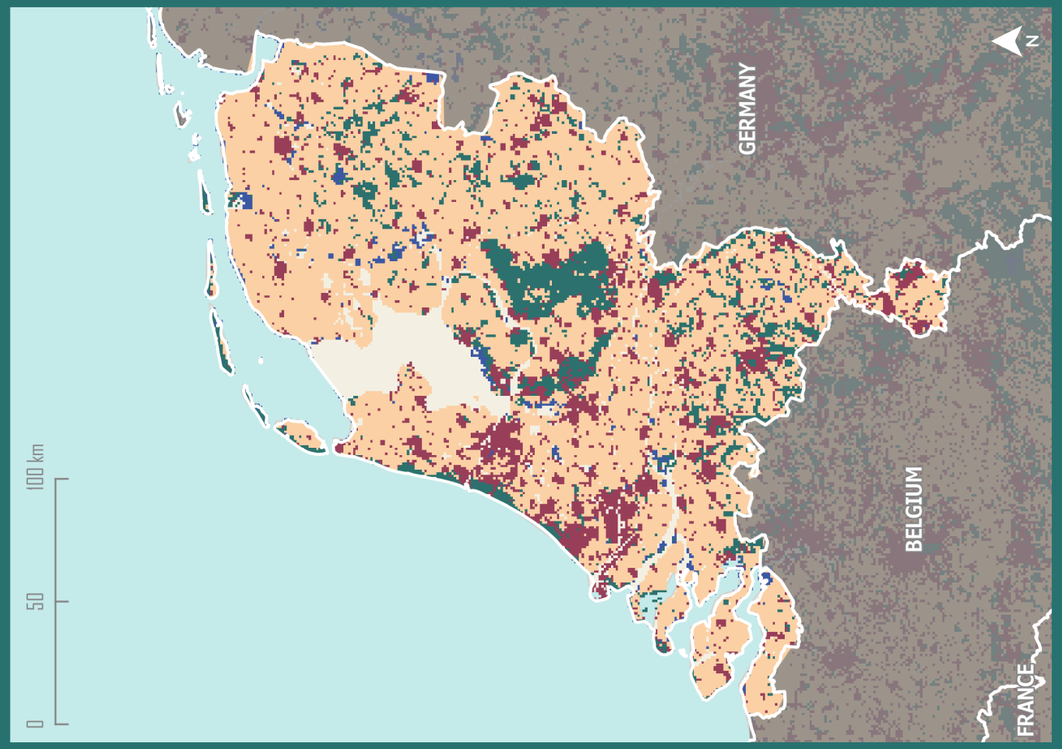


Figure 85 - Map showing the distribution of CORINE Land Cover classes at country level.

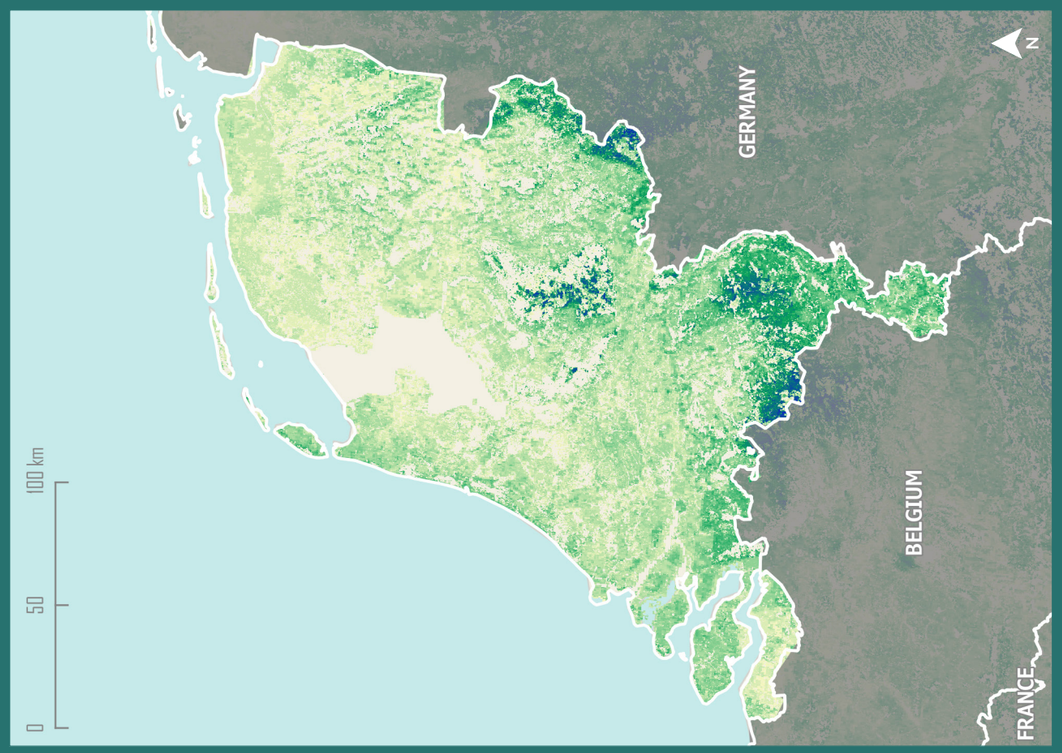


Figure 86 - Map showing the natural tree restoration potential.

Table 56 - Natural canopy restoration potential outside Natura 2000 protected areas in Netherlands.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	0	0	0	0	0	0	0	NA
	Discontinuous urban fabric	8	303	1	0	1	43	11	21	2
	Industrial or commercial units	2	66	0	0	0	12	3	6	1
	Road and rail networks and associated land	0	7	0	0	0	1	0	0	0
	Port areas	0	12	0	0	0	2	0	1	0
	Airports	0	6	0	0	0	1	0	1	0
	Mineral extraction sites	0	1	0	0	0	0	0	0	0
	Dump sites	1	1	0	0	0	0	0	0	1
	Construction sites	0	6	0	0	0	1	0	0	0
	Green urban areas	1	10	0	0	0	1	0	0	1
	Sport and leisure facilities	1	35	0	0	0	3	1	2	1
Artificial surfaces	All sub-classes	12	447	2	1	0	64	16	0	3
Agricultural areas	Non-irrigated arable land	9	683	2	0	1	92	24	45	2
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	0	6	0	0	0	1	0	0	0
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	19	895	2	0	1	97	25	47	4
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	12	483	1	0	1	108	27	52	3
	Agriculture associated with natural vegetation	4	99	1	0	0	12	3	6	2
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	42	2,168	5	1	0	309	79	0	5
Forest and semi natural areas	Broad-leaved forest	4	30	0	0	0	1	0	0	1
	Coniferous forest	3	71	0	0	0	7	2	3	1
	Mixed forest	4	49	0	0	0	3	1	2	2
	Natural grasslands	2	7	0	0	0	1	0	0	1
	Moors and heathland	3	5	0	0	0	1	0	0	1
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	0	2	0	0	0	0	0	0	0
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	0
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	17	164	1	0	0	12	3	0	3
Wetlands	Inland marshes	5	4	0	0	0	0	0	0	1
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	0
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	5	5	0	0	0	0	0	0	1
All classes	All sub-classes	83	2,778	9	2	4	385	98	187	7

POLAND

RESTORATION POTENTIAL OUTSIDE NATURA 2000

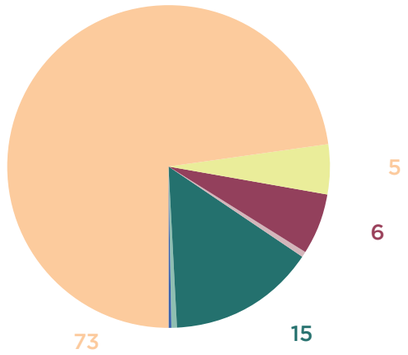


Figure 87 - Restoration potential per class in % of the total restoration potential

Table 57 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	25	266	37	2	331
in use areas	kha	326	3,834	772	3	4,935
abandoned areas	%	0	5	1	0	6
in use areas	%	6	73	15	0	94

Figure 88 - Map showing the distribution of CORINE Land Cover classes at country level.

Figure 89 - Map showing the natural tree restoration potential.

Table 58 - Natural canopy restoration potential outside Natura 2000 protected areas in Poland.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	1	6	0	0	0	2	0	1	1
	Discontinuous urban fabric	73	1,035	18	0	9	271	5	130	7
	Industrial or commercial units	13	99	3	0	1	22	0	11	3
	Road and rail networks and associated land	3	17	1	0	0	4	0	2	1
	Port areas	0	2	0	0	0	0	0	0	NA
	Airports	1	18	0	0	0	5	0	2	1
	Mineral extraction sites	0	43	0	0	0	11	0	5	0
	Dump sites	2	6	1	0	1	1	0	1	2
	Construction sites	1	7	0	0	0	2	0	1	1
	Green urban areas	2	10	0	0	0	2	0	1	1
	Sport and leisure facilities	8	35	2	0	1	7	0	4	2
Artificial surfaces	All sub-classes	105	1,279	25	0	0	326	6	0	9
Agricultural areas	Non-irrigated arable land	476	12,133	122	2	59	3,098	59	1,498	24
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	10	164	2	0	1	44	1	21	4
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	313	1,354	93	2	45	400	8	193	18
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	39	429	12	0	5	117	2	55	5
	Agriculture associated with natural vegetation	123	641	35	1	17	179	3	85	11
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	985	14,698	266	5	0	3,834	73	0	34
Forest and semi natural areas	Broad-leaved forest	40	734	6	0	3	83	2	39	7
	Coniferous forest	53	3,445	11	0	6	458	9	222	8
	Mixed forest	56	1,471	8	0	4	173	3	83	9
	Natural grasslands	1	4	0	0	0	2	0	1	1
	Moors and heathland	0	0	0	0	0	0	0	0	NA
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	37	255	11	0	5	54	1	26	6
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	2	0	0	0	1	0	1	0
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	192	5,906	37	1	0	772	15	0	16
Wetlands	Inland marshes	10	11	2	0	1	3	0	1	2
	Peat bogs	0	3	0	0	0	1	0	0	0
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	9	14	2	0	0	3	0	0	2
All classes	All sub-classes	1,338	21,850	338	6	163	4,928	94	2,376	39

PORTUGAL

RESTORATION POTENTIAL OUTSIDE NATURA 2000

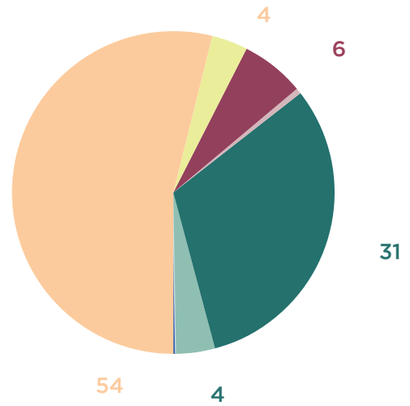


Figure 90 - Restoration potential per class in % of the total restoration potential

Table 59 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	6	51	54	0	112
in use areas	kha	86	728	424	0	1,238
abandoned areas	%	0	4	4	0	8
in use areas	%	6	54	31	0	92

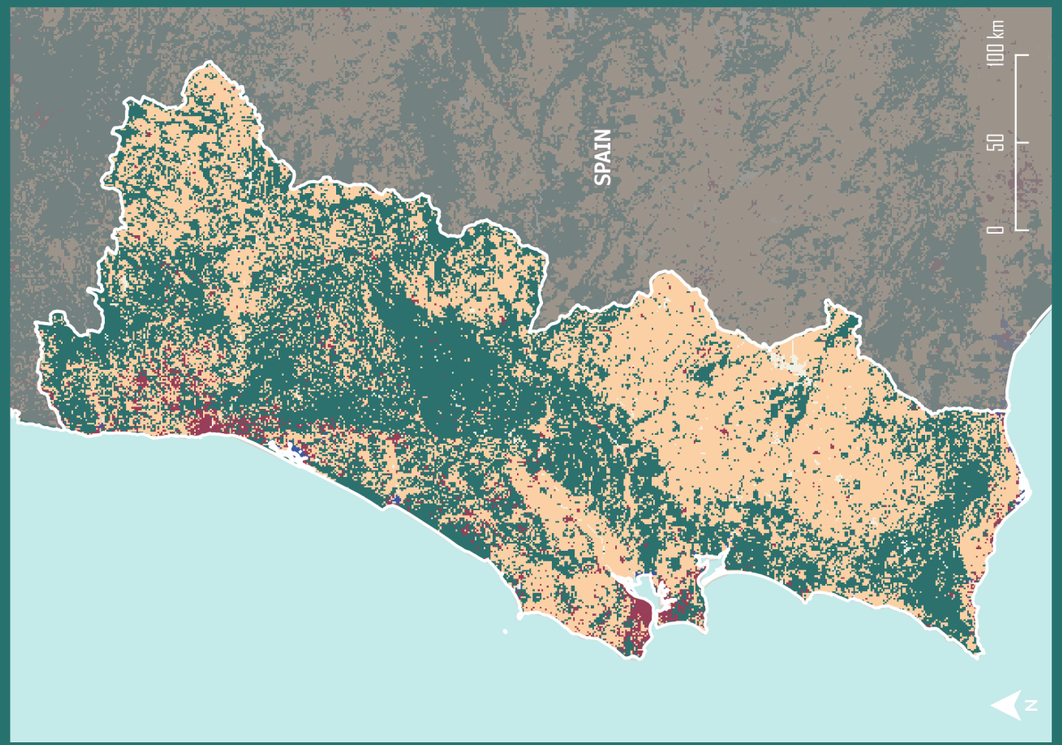


Figure 91 - Map showing the distribution of CORINE Land Cover classes at country level.

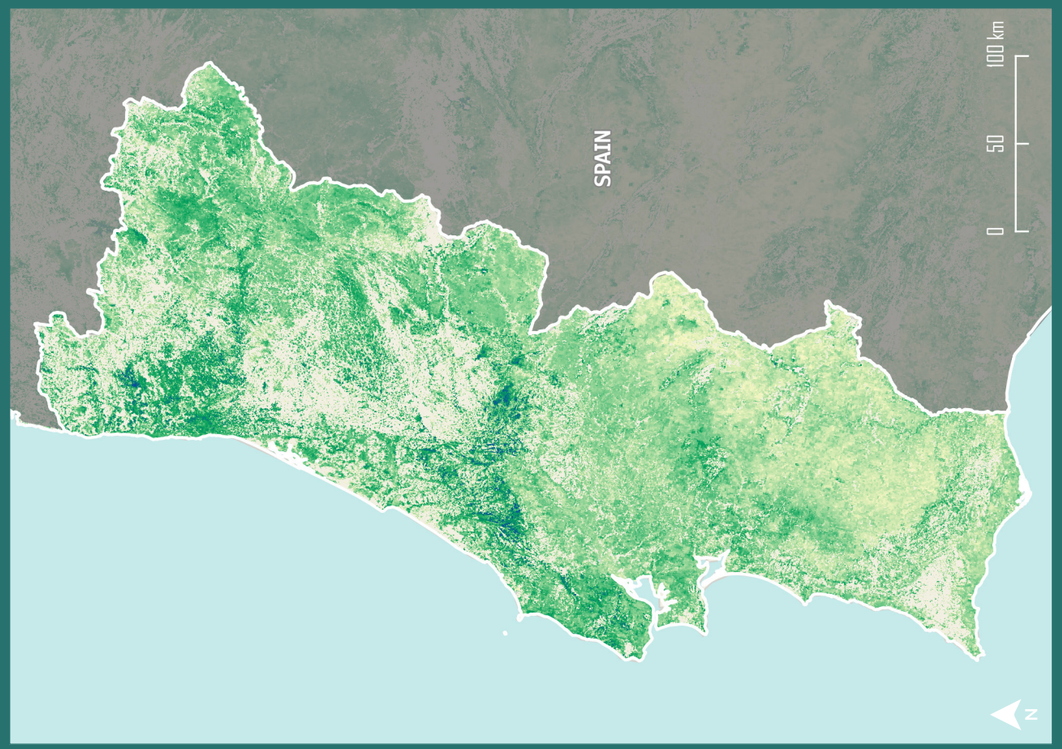


Figure 92 - Map showing the natural tree restoration potential.

Table 60 - Natural canopy restoration potential outside Natura 2000 protected areas in Portugal.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	1	32	0	0	0	10	1	8	1
	Discontinuous urban fabric	9	172	4	0	3	58	4	37	3
	Industrial or commercial units	3	33	1	0	1	9	1	7	2
	Road and rail networks and associated land	1	6	0	0	0	1	0	1	1
	Port areas	0	1	0	0	0	0	0	0	NA
	Airports	0	5	0	0	0	1	0	1	0
	Mineral extraction sites	2	7	0	0	0	2	0	1	1
	Dump sites	0	1	0	0	0	0	0	0	NA
	Construction sites	0	1	0	0	0	0	0	0	NA
	Green urban areas	0	3	0	0	0	1	0	1	0
	Sport and leisure facilities	0	12	0	0	0	3	0	2	0
Artificial surfaces	All sub-classes	17	271	6	0	0	86	6	0	4
Agricultural areas	Non-irrigated arable land	16	453	4	0	3	88	7	75	4
	Permanently irrigated land	8	196	3	0	2	43	3	33	3
	Rice fields	0	36	0	0	0	5	0	4	0
	Vineyards	20	180	7	0	6	49	4	41	5
	Fruit trees and berry plantations	7	70	2	0	1	16	1	14	3
	Olive groves	22	262	5	0	4	50	4	44	6
	Pastures	7	204	3	0	2	59	4	39	3
	Annual crops associated with permanent crops	24	210	4	0	3	52	4	35	5
	Complex cultivation patterns	30	519	8	1	6	136	10	109	6
	Agriculture associated with natural vegetation	73	495	17	1	14	120	9	90	9
	Agro-forestry areas	18	587	2	0	2	108	8	95	4
Agricultural areas	All sub-classes	216	3,224	51	4	0	728	54	0	16
Forest and semi natural areas	Broad-leaved forest	14	604	3	0	3	92	7	74	4
	Coniferous forest	11	305	1	0	1	38	3	30	3
	Mixed forest	18	399	3	0	2	53	4	39	4
	Natural grasslands	15	19	5	0	3	7	1	5	4
	Moors and heathland	163	121	33	2	23	20	1	15	15
	Sclerophyllous vegetation	55	55	8	1	7	9	1	8	7
	Transitional woodland-shrub	137	1,113	22	2	17	172	13	139	13
	Beaches, dunes, sands	1	0	0	0	0	0	0	0	0
	Bare rocks	0	1	0	0	0	0	0	0	NA
	Sparsely vegetated areas	12	2	2	0	1	1	0	1	2
	Burnt areas	5	65	2	0	1	7	1	6	3
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	302	2,817	54	4	0	424	31	0	18
Wetlands	Inland marshes	0	0	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	1	0	0	0	0	0	0	NA
	Salines	0	1	0	0	0	0	0	0	0
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	1	2	0	0	0	0	0	0	1
All classes	All sub-classes	536	6,313	112	8	87	1,238	92	974	24

ROMANIA

RESTORATION POTENTIAL OUTSIDE NATURA 2000

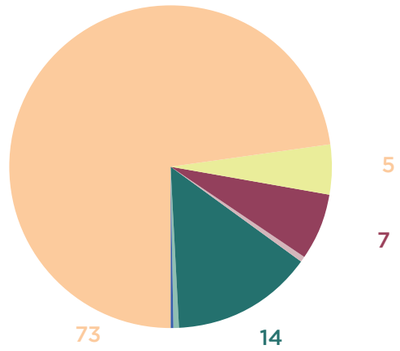


Figure 93 - Restoration potential per class in % of the total restoration potential

Table 61 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	13	166	25	1	204
in use areas	kha	234	2,479	481	2	3,197
abandoned areas	%	0	5	1	0	6
in use areas	%	7	73	14	0	94

Figure 94 - Map showing the distribution of CORINE Land Cover classes at country level.

Figure 95 - Map showing the natural tree restoration potential.

Table 62 - Natural canopy restoration potential outside Natura 2000 protected areas in Romania.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	1	12	0	0	0	2	0	1	1
	Discontinuous urban fabric	23	825	5	0	2	210	6	99	4
	Industrial or commercial units	12	66	3	0	2	13	0	6	2
	Road and rail networks and associated land	0	4	0	0	0	1	0	0	0
	Port areas	0	2	0	0	0	0	0	0	NA
	Airports	0	3	0	0	0	0	0	0	0
	Mineral extraction sites	3	22	1	0	0	6	0	3	2
	Dump sites	1	2	0	0	0	1	0	0	1
	Construction sites	2	6	0	0	0	1	0	1	1
	Green urban areas	0	3	0	0	0	1	0	0	0
	Sport and leisure facilities	0	2	0	0	0	0	0	0	0
Artificial surfaces	All sub-classes	51	941	13	0	0	234	7	0	6
Agricultural areas	Non-irrigated arable land	277	7,397	67	2	32	1,604	47	742	18
	Permanently irrigated land	0	2	0	0	0	1	0	0	0
	Rice fields	4	29	1	0	0	5	0	2	2
	Vineyards	18	171	4	0	2	41	1	20	4
	Fruit trees and berry plantations	21	218	6	0	3	56	2	27	5
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	166	1,591	50	1	24	462	14	216	12
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	48	568	13	0	6	162	5	76	7
	Agriculture associated with natural vegetation	70	548	21	1	10	153	4	72	8
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	639	10,490	166	5	0	2,479	73	0	26
Forest and semi natural areas	Broad-leaved forest	79	3,018	12	0	6	291	9	135	14
	Coniferous forest	11	577	1	0	0	51	1	22	4
	Mixed forest	11	554	1	0	0	37	1	16	4
	Natural grasslands	23	210	7	0	3	71	2	31	5
	Moors and heathland	0	4	0	0	0	1	0	0	0
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	16	181	3	0	2	30	1	13	4
	Beaches, dunes, sands	0	2	0	0	0	1	0	0	0
	Bare rocks	0	1	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	159	4,528	25	1	0	481	14	0	18
Wetlands	Inland marshes	6	12	1	0	1	2	0	1	2
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	6	12	1	0	0	2	0	0	2
All classes	All sub-classes	928	15,898	212	6	99	3,189	94	1,478	33

SLOVAKIA

RESTORATION POTENTIAL OUTSIDE NATURA 2000

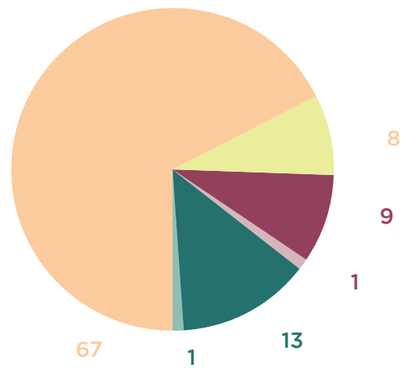


Figure 96 - Restoration potential per class in % of the total restoration potential

Table 63 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	8	53	7.15	0	67
in use areas	kha	57	434	85	0	575
abandoned areas	%	1	8	1	0	10
in use areas	%	9	67	13	0	90

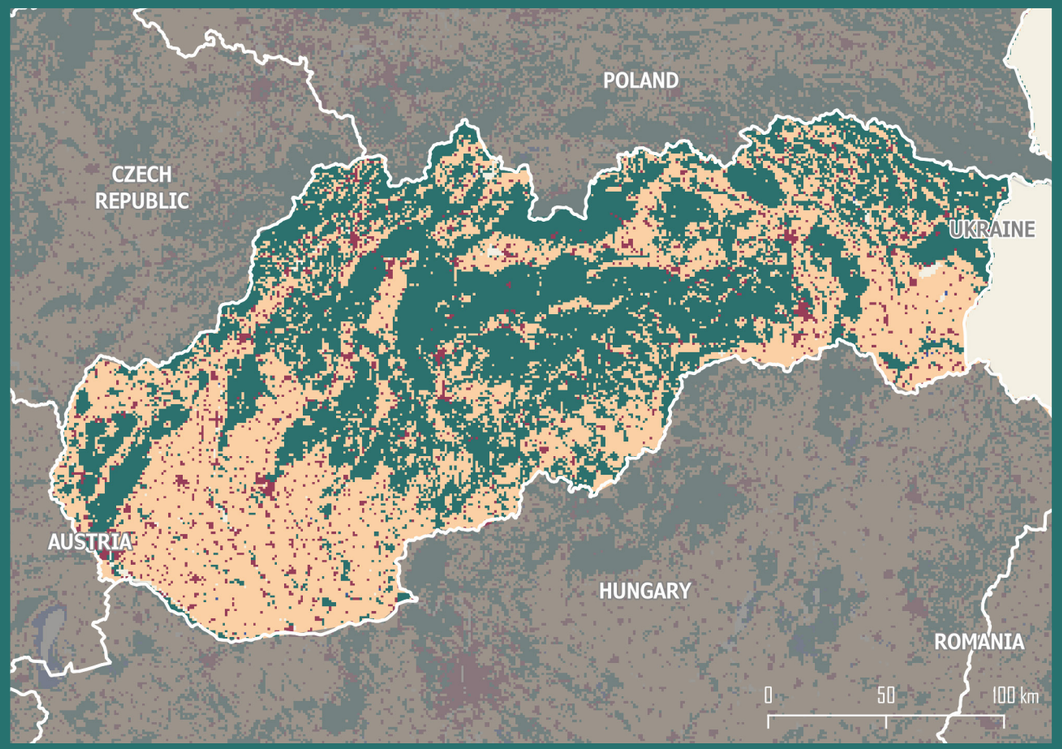


Figure 97 - Map showing the distribution of CORINE Land Cover classes at country level.

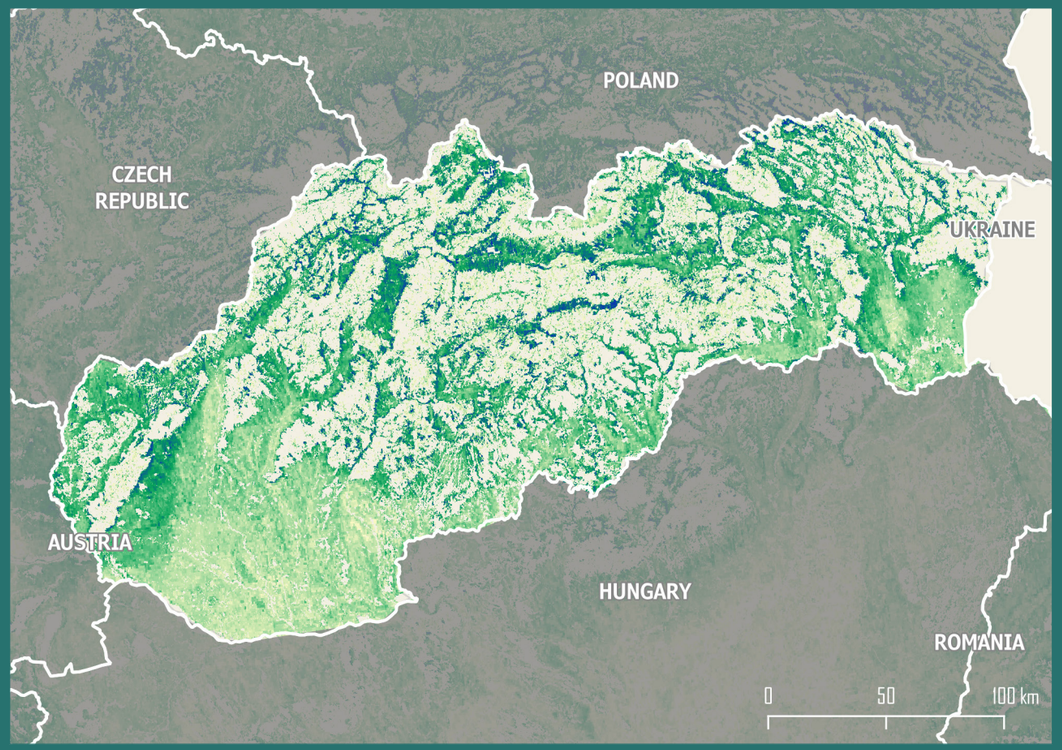


Figure 98 - Map showing the natural tree restoration potential.

Table 64 - Natural canopy restoration potential outside Natura 2000 protected areas in Slovakia.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	1	0	0	0	0	0	0	NA
	Discontinuous urban fabric	20	141	6	1	3	46	7	21	4
	Industrial or commercial units	3	21	1	0	0	7	1	3	2
	Road and rail networks and associated land	1	1	0	0	0	0	0	0	1
	Port areas	0	0	0	0	0	0	0	0	NA
	Airports	0	1	0	0	0	0	0	0	NA
	Mineral extraction sites	0	2	0	0	0	1	0	0	0
	Dump sites	0	1	0	0	0	0	0	0	NA
	Construction sites	0	0	0	0	0	0	0	0	NA
	Green urban areas	0	1	0	0	0	0	0	0	NA
	Sport and leisure facilities	0	6	0	0	0	1	0	1	0
Artificial surfaces	All sub-classes	24	174	8	1	0	57	9	0	4
Agricultural areas	Non-irrigated arable land	90	1,238	24	4	12	338	53	160	12
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	4	9	1	0	1	2	0	1	2
	Fruit trees and berry plantations	2	6	0	0	0	2	0	1	2
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	17	137	4	1	2	47	7	21	5
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	5	38	2	0	1	10	2	5	2
	Agriculture associated with natural vegetation	49	154	15	2	7	40	6	19	6
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	188	1,561	53	8	0	434	67	0	16
Forest and semi natural areas	Broad-leaved forest	30	519	4	1	2	36	6	17	7
	Coniferous forest	3	217	2	0	1	21	3	9	2
	Mixed forest	11	209	1	0	1	20	3	9	4
	Natural grasslands	0	5	0	0	0	2	0	1	0
	Moors and heathland	0	0	0	0	0	0	0	0	NA
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	2	52	1	0	0	5	1	2	2
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	1	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	44	1,006	7	1	0	85	13	0	8
Wetlands	Inland marshes	0	0	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	0	0	0	0	0	0	0	0	NA
All classes	All sub-classes	265	2,733	68	11	32	575	89	269	19

SLOVENIA

RESTORATION POTENTIAL OUTSIDE NATURA 2000

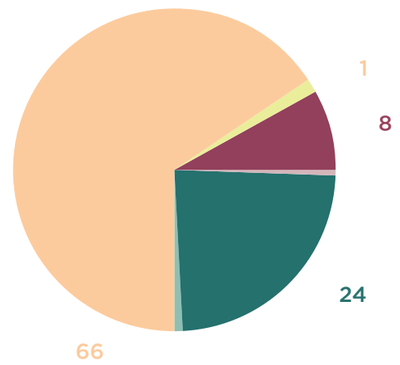


Figure 99 - Restoration potential per class in % of the total restoration potential

Table 65 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	1	3	2	0	5
in use areas	kha	17	133	48	0	197
abandoned areas	%	0	1	1	0	2
in use areas	%	8	66	24	0	98

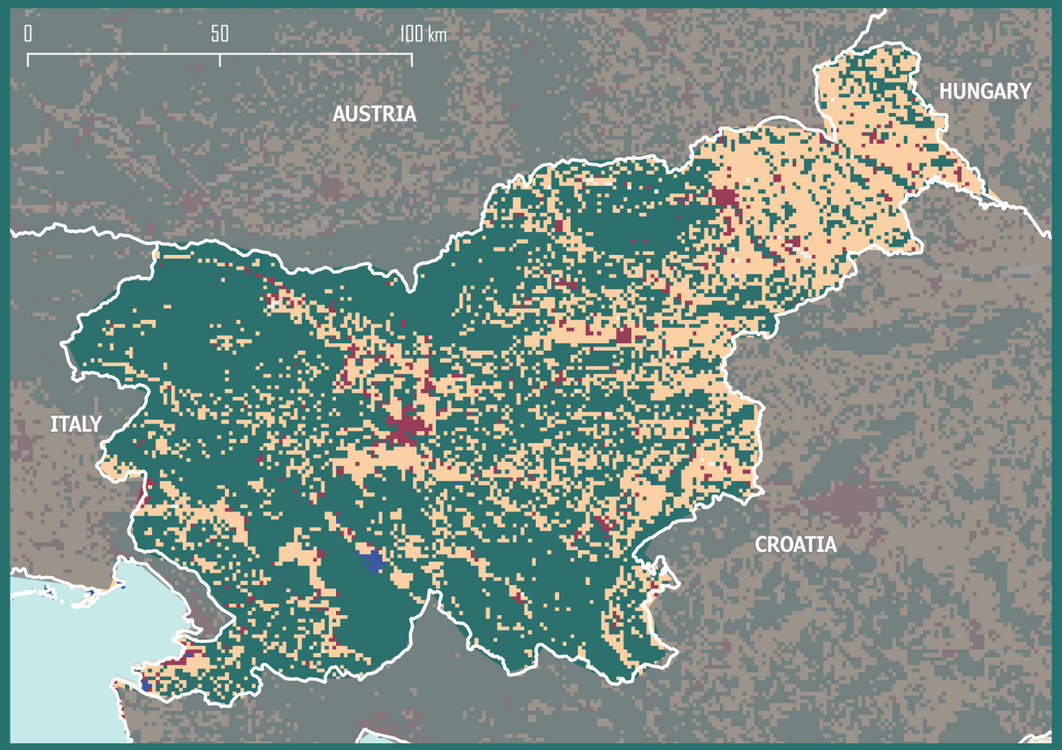


Figure 100 - Map showing the distribution of CORINE Land Cover classes at country level.

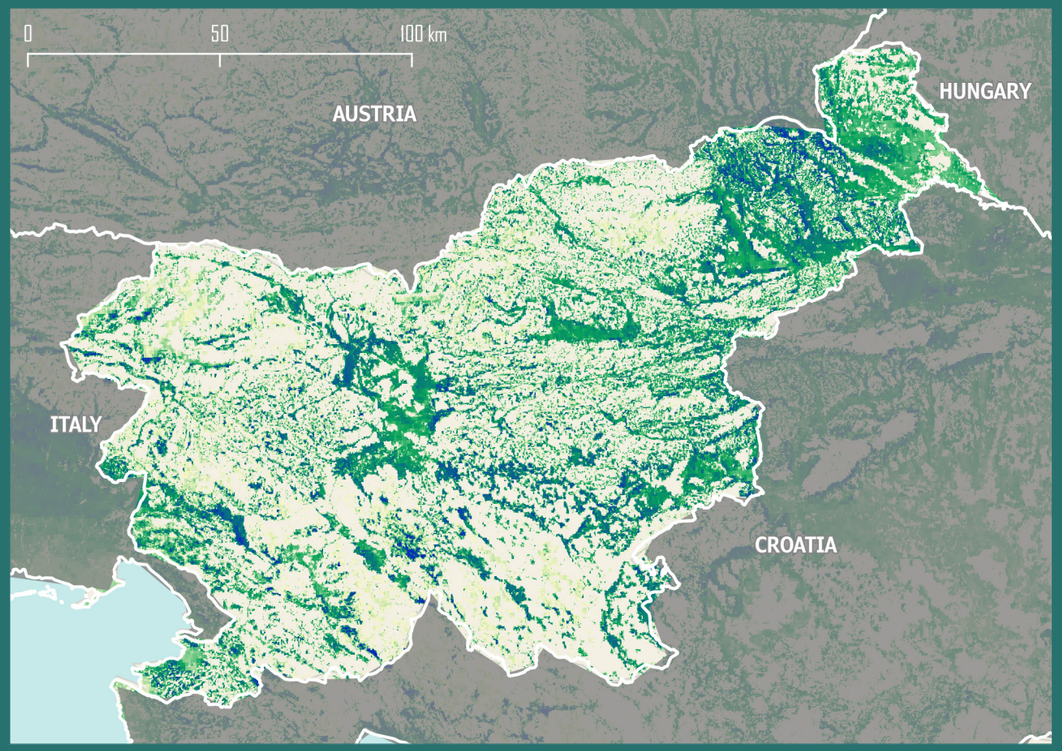


Figure 101 - Map showing the natural tree restoration potential.

Table 66 - Natural canopy restoration potential outside Natura 2000 protected areas in Slovenia.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	0	0	0	0	0	0	0	NA
	Discontinuous urban fabric	1	29	0	0	0	13	6	6	1
	Industrial or commercial units	0	6	0	0	0	2	1	1	0
	Road and rail networks and associated land	0	2	0	0	0	1	0	0	0
	Port areas	0	0	0	0	0	0	0	0	NA
	Airports	0	1	0	0	0	0	0	0	NA
	Mineral extraction sites	0	1	0	0	0	0	0	0	0
	Dump sites	0	0	0	0	0	0	0	0	NA
	Construction sites	0	0	0	0	0	0	0	0	NA
	Green urban areas	0	0	0	0	0	0	0	0	NA
	Sport and leisure facilities	0	1	0	0	0	0	0	0	0
Artificial surfaces	All sub-classes	3	39	1	0	0	17	8	0	1
Agricultural areas	Non-irrigated arable land	0	78	0	0	0	37	18	18	0
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	18	0	0	0	7	4	4	0
	Fruit trees and berry plantations	0	4	0	0	0	2	1	1	0
	Olive groves	0	1	0	0	0	0	0	0	0
	Pastures	2	46	1	0	0	11	5	5	1
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	5	157	2	1	1	54	27	27	2
	Agriculture associated with natural vegetation	1	89	0	0	0	21	10	10	1
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	7	393	3	1	0	133	66	0	2
Forest and semi natural areas	Broad-leaved forest	9	194	1	1	1	17	8	9	4
	Coniferous forest	3	93	0	0	0	7	4	3	2
	Mixed forest	5	207	0	0	0	22	11	11	2
	Natural grasslands	0	1	0	0	0	0	0	0	0
	Moors and heathland	0	0	0	0	0	0	0	0	NA
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	2	6	0	0	0	1	0	0	1
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	NA
	Bare rocks	0	0	0	0	0	0	0	0	NA
	Sparsely vegetated areas	0	0	0	0	0	0	0	0	NA
	Burnt areas	0	0	0	0	0	0	0	0	NA
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	18	503	2	1	0	48	24	0	4
Wetlands	Inland marshes	0	0	0	0	0	0	0	0	NA
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	0	0	0	0	0	0	0	0	NA
All classes	All sub-classes	28	936	5	3	3	197	97	97	5

SPAIN

RESTORATION POTENTIAL OUTSIDE NATURA 2000

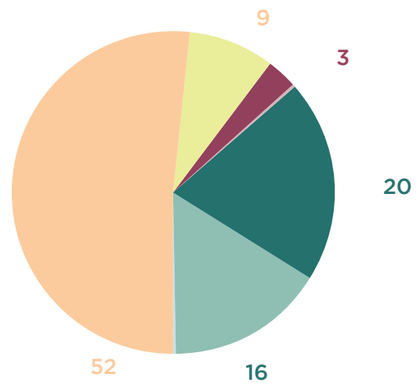


Figure 102 - Restoration potential per class in % of the total restoration potential

Table 67 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	19	421	783	1	1,224
in use areas	kha	145	2,552	995	0	3,692
abandoned areas	%	0	9	16	0	25
in use areas	%	3	52	20	0	75

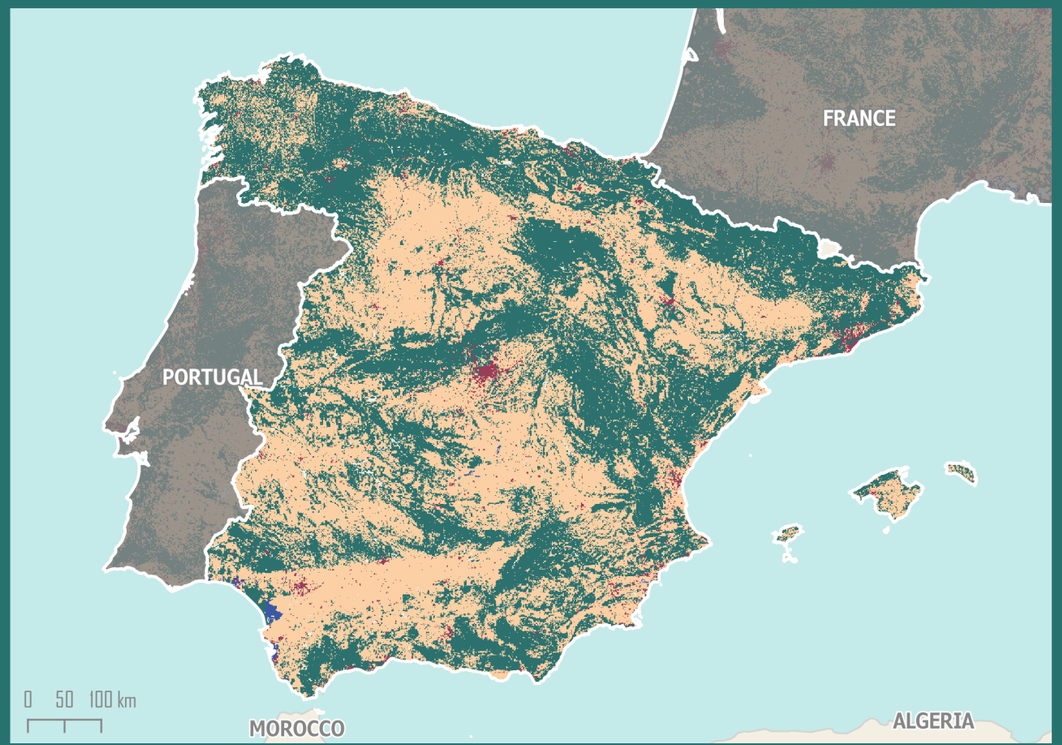


Figure 103 - Map showing the distribution of CORINE Land Cover classes at country level.

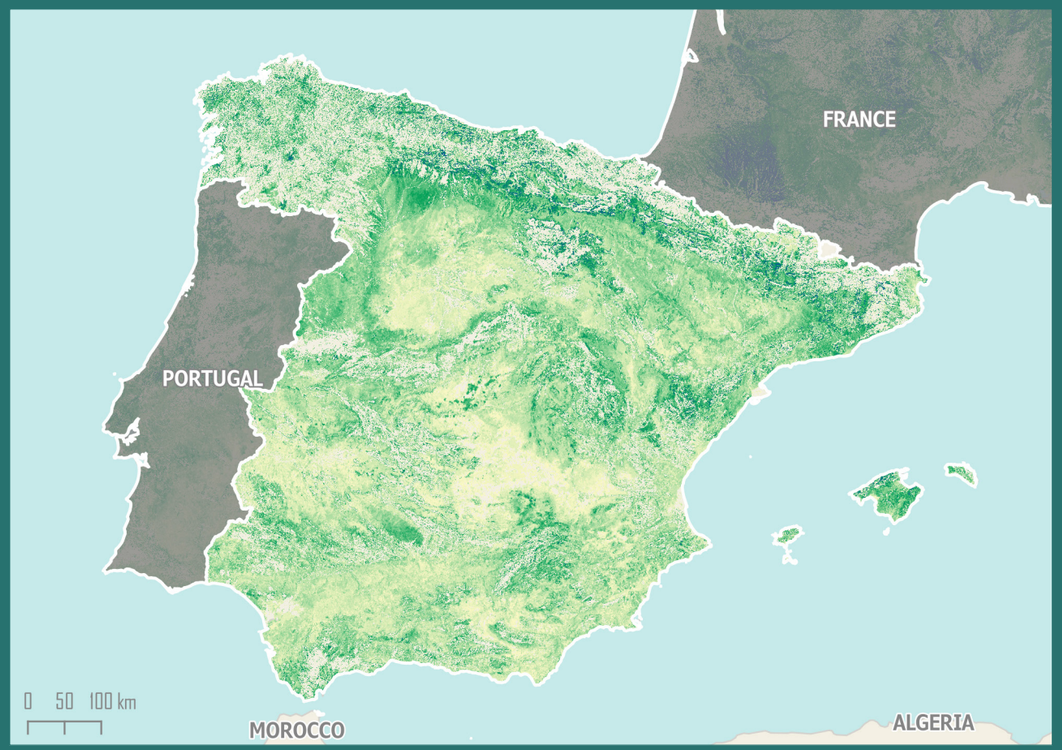


Figure 104 - Map showing the natural tree restoration potential.

Table 68 - Natural canopy restoration potential outside Natura 2000 protected areas in Spain.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
				Abandoned area			Area in use			
		Abandoned area In kha	Area in use In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	14	154	2	0	2	26	1	21	3
	Discontinuous urban fabric	40	338	7	0	6	66	1	51	4
	Industrial or commercial units	30	177	5	0	4	30	1	23	4
	Road and rail networks and associated land	8	15	2	0	2	2	0	2	2
	Port areas	0	2	0	0	0	0	0	0	0
	Airports	2	17	0	0	0	3	0	2	1
	Mineral extraction sites	15	40	2	0	2	8	0	6	3
	Dump sites	2	6	0	0	0	1	0	1	2
	Construction sites	6	13	1	0	1	2	0	1	2
	Green urban areas	1	12	0	0	0	2	0	1	1
	Sport and leisure facilities	3	29	1	0	1	5	0	4	2
Artificial surfaces	All sub-classes	115	807	19	0	0	145	3	0	8
Agricultural areas	Non-irrigated arable land	770	7,286	132	3	113	1,119	23	953	27
	Permanently irrigated land	174	2,162	28	1	24	298	6	260	12
	Rice fields	5	75	1	0	1	3	0	3	2
	Vineyards	169	779	19	0	17	73	1	64	16
	Fruit trees and berry plantations	291	722	43	1	38	103	2	91	17
	Olive groves	580	1,453	76	2	66	186	4	164	36
	Pastures	126	703	25	1	21	147	3	105	10
	Annual crops associated with permanent crops	5	7	1	0	1	1	0	1	2
	Complex cultivation patterns	278	1,311	43	1	36	226	5	150	14
	Agriculture associated with natural vegetation	326	615	57	1	50	115	2	90	13
	Agro-forestry areas	85	1,490	14	0	13	262	5	231	12
Agricultural areas	All sub-classes	2,630	16,781	421	9	0	2,552	52	0	51
Forest and semi natural areas	Broad-leaved forest	677	1,887	93	2	72	212	4	159	19
	Coniferous forest	481	1,790	64	1	55	174	4	138	17
	Mixed forest	231	461	35	1	29	57	1	45	10
	Natural grasslands	923	865	167	3	143	162	3	136	21
	Moors and heathland	510	464	76	2	47	66	1	36	16
	Sclerophyllous vegetation	1,573	882	284	6	247	152	3	132	23
	Transitional woodland-shrub	439	805	67	1	57	121	2	100	16
	Beaches, dunes, sands	1	2	0	0	0	0	0	0	0
	Bare rocks	22	14	4	0	3	2	0	1	4
	Sparsely vegetated areas	165	99	29	1	23	12	0	10	12
	Burnt areas	8	6	1	0	1	1	0	1	2
	Glaciers and perpetual snow	0	0	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	4,731	7,575	783	16	0	995	20	0	50
Wetlands	Inland marshes	3	1	0	0	0	0	0	0	1
	Peat bogs	0	0	0	0	0	0	0	0	NA
	Salt marshes	3	0	0	0	0	0	0	0	0
	Salines	1	1	0	0	0	0	0	0	1
	Intertidal flats	0	1	0	0	0	0	0	0	NA
Wetlands	All sub-classes	7	2	1	0	0	0	0	0	1
All classes	All sub-classes	7,948	24,700	1,264	26	1,074	3,652	74	2,981	77

SWEDEN

RESTORATION POTENTIAL OUTSIDE NATURA 2000

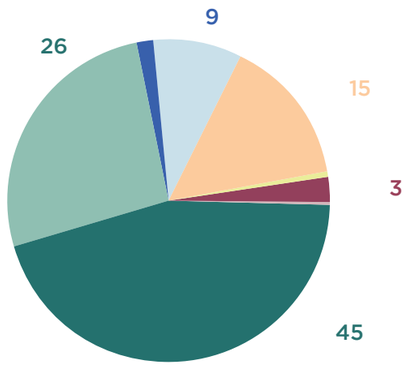


Figure 105 - Restoration potential per class in % of the total restoration potential

Table 69 - Restoration potential per class in % of the total restoration potential and absolute value, kha.

RESTORATION POTENTIAL		ARTIFICIAL AREAS	AGRICULTURAL AREAS	FOREST SEMINATURAL	WETLANDS	TOTAL
abandoned areas	kha	7	22	1,101	369	1,507
in use areas	kha	107	631	1,902	74	2,715
abandoned areas	%	0	1	26	9	36
in use areas	%	3	15	45	2	64

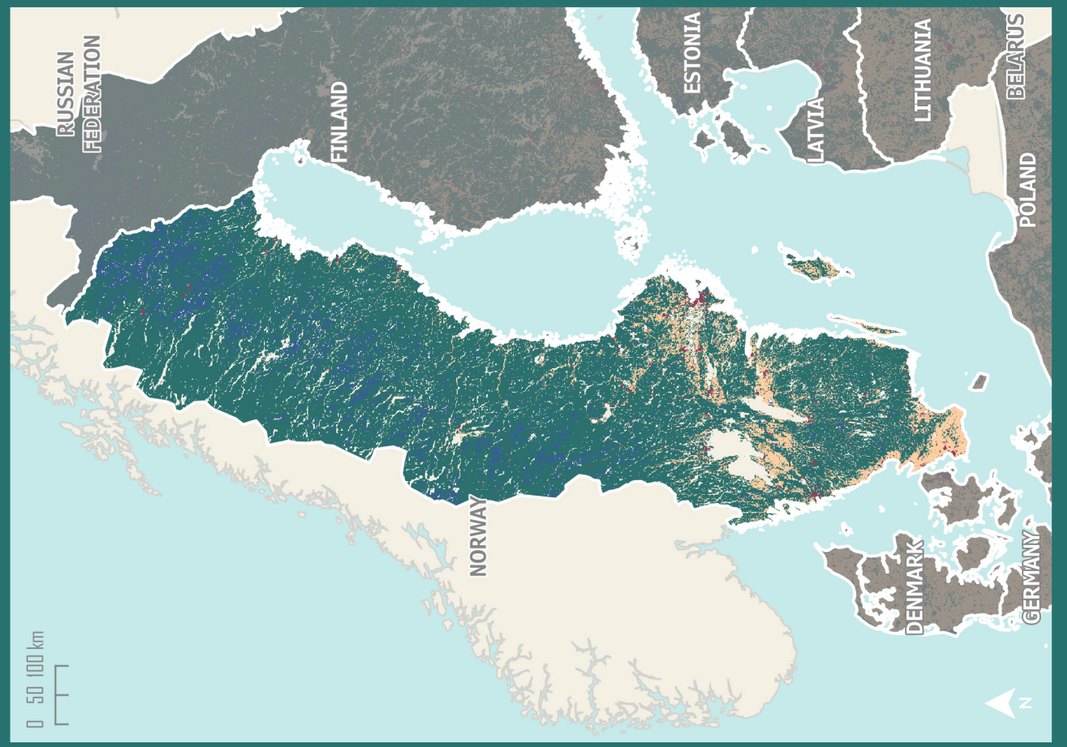


Figure 106 - Map showing the distribution of CORINE Land Cover classes at country level.

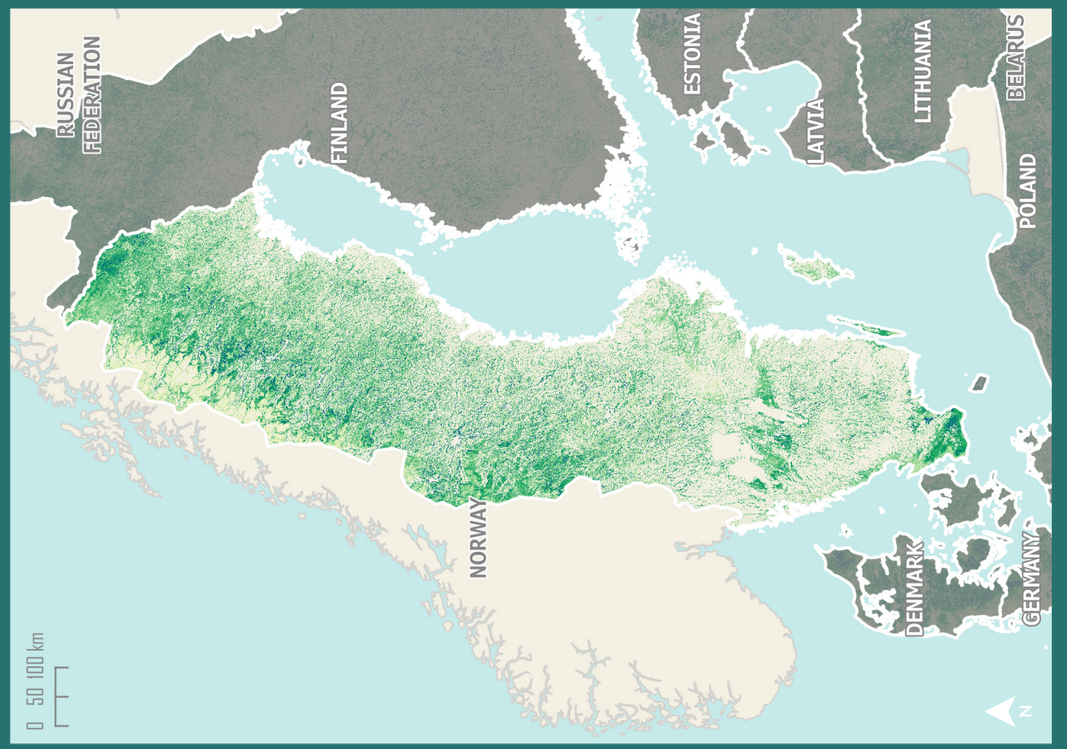


Figure 107 - Map showing the natural tree restoration potential.

Table 43 - Natural canopy restoration potential outside Natura 2000 protected areas in Sweden.

Land cover class	Land cover sub-class	Area		Natural canopy restoration potential						Standard deviation of the estimations in abandoned areas In kha
		Abandoned area	Area in use	Abandoned area			Area in use			
		In kha	In kha	In kha	In % of total	In million trees	In kha	In % of total	In million trees	
Artificial surfaces	Continuous urban fabric	0	3	0	0	0	1	0	1	0
	Discontinuous urban fabric	25	381	4	0	3	73	2	47	4
	Industrial or commercial units	3	62	0	0	0	14	0	8	1
	Road and rail networks and associated land	0	3	0	0	0	1	0	0	0
	Port areas	0	2	0	0	0	0	0	0	0
	Airports	3	10	1	0	0	3	0	2	1
	Mineral extraction sites	1	10	0	0	0	3	0	2	1
	Dump sites	0	9	0	0	0	3	0	3	0
	Construction sites	0	1	0	0	0	0	0	0	0
	Green urban areas	3	17	1	0	1	2	0	1	1
	Sport and leisure facilities	3	40	0	0	0	7	0	5	1
Artificial surfaces	All sub-classes	37	541	7	0	0	107	3	0	5
Agricultural areas	Non-irrigated arable land	88	2,793	14	0	8	558	13	303	7
	Permanently irrigated land	0	0	0	0	0	0	0	0	NA
	Rice fields	0	0	0	0	0	0	0	0	NA
	Vineyards	0	0	0	0	0	0	0	0	NA
	Fruit trees and berry plantations	0	1	0	0	0	0	0	0	0
	Olive groves	0	0	0	0	0	0	0	0	NA
	Pastures	14	133	2	0	2	22	1	13	2
	Annual crops associated with permanent crops	0	0	0	0	0	0	0	0	NA
	Complex cultivation patterns	5	74	0	0	0	11	0	8	2
	Agriculture associated with natural vegetation	42	376	4	0	3	40	1	25	5
	Agro-forestry areas	0	0	0	0	0	0	0	0	NA
Agricultural areas	All sub-classes	153	3,373	22	1	0	631	15	0	9
Forest and semi natural areas	Broad-leaved forest	305	709	73	2	73	69	2	60	15
	Coniferous forest	2,195	18,793	428	10	403	1,486	35	1,363	60
	Mixed forest	257	1,581	47	1	46	143	3	132	19
	Natural grasslands	68	11	6	0	6	3	0	2	6
	Moors and heathland	1,166	261	289	7	300	73	2	69	18
	Sclerophyllous vegetation	0	0	0	0	0	0	0	0	NA
	Transitional woodland-shrub	325	1,891	99	2	91	256	6	249	23
	Beaches, dunes, sands	0	0	0	0	0	0	0	0	0
	Bare rocks	180	33	11	0	10	1	0	1	22
	Sparsely vegetated areas	277	101	19	0	21	9	0	7	20
	Burnt areas	3	11	0	0	0	1	0	0	2
	Glaciers and perpetual snow	0	6	0	0	0	0	0	0	NA
Forest and semi natural areas	All sub-classes	4,738	23,437	1,110	26	0	1,902	45	0	84
Wetlands	Inland marshes	22	12	3	0	3	2	0	1	2
	Peat bogs	1,550	370	366	9	352	73	2	71	21
	Salt marshes	0	0	0	0	0	0	0	0	NA
	Salines	0	0	0	0	0	0	0	0	NA
	Intertidal flats	0	0	0	0	0	0	0	0	NA
Wetlands	All sub-classes	1,567	386	369	9	0	74	2	0	22
All classes	All sub-classes	5,938	28,295	1,169	28	1,163	3,053	72	2,534	83

ABSTRACT

In July 2019 the Crowther Lab at ETH-Zurich and the Food and Agriculture Organization of the United Nations published a report on “the global tree restoration potential” which provided the first quantitative assessment of the earth’s current and future carrying capacity to host trees.

The report was published in Science and since its publication it has been at the center of the scientific and international debate on nature-based solutions to tackle climate change. Today it is considered as one of the scientific reports in environmental sciences with one of the largest impacts on society.

Inspired by the report and the European Union’s new Green Deal, the European Commission Directorate General for Environment requested the FAO Climate and Biodiversity Department to prepare a detailed report for the potential of land restoration in the European Union.

The expected outputs include:

• **Output 1**: The preparation and publication of a report on “Tree restoration potential in the European Union countries” (this report);

• **Output 2:** Participation in the International Conference on Forests, Biodiversity and Climate Change and present the preliminary results of the report;

• **Output 3:** Sharing preliminary data and results of the EU specific report on tree restoration potential through a pre-agreed platform and open-data policy for country evaluation and feedback.

Food and Agriculture Organization of the United Nations

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