Specific Contract 5 (SC5) proposal

(i) Feasibility and demonstration study of the potential use of National Forest Inventory data from Germany, Hungary, Italy, Latvia and Portugal to describe the tree species richness of the European forests

(ii) Pre study for the qualification of JRC forest Layers

"Framework contract for the provision of forest data and services in support to the European Forest Data Centre"
Reference: 2007/ S 194-235358 of 09/10/2007

Contents

1. The Framework context

The objective of the framework contract is to broaden and develop the knowledge base of the European Forest Data Centre (EFDAC) hosted by the Joint Research Centre (JRC) of the European Commission which has been established to supply European Union decision-makers with processed, quality checked and timely policy relevant forest data and information within the EU and territories where EU policies are operating.

The EFDAC is being developed and implemented as the single and central point for forest information at European level in support to relevant EU policies and as the basis of the European Forest Monitoring System proposed in the EU Forest Action Plan. The implementation of EFDAC will contribute to enhancing data harmonization and to streamlining data collection and reporting to international commitments such as the Ministerial Conference of the Protection of Forest in Europe (MCPFE), the FAO Global Forest Resources Assessment (GFRA) and the UN Convention on Biological Diversity (CBD). EFDAC is built on the basis of the information systems currently existing or under development and in compliance with the guidelines of the Infrastructure for Spatial Information in Europe (INSPIRE). In particular, these systems are the European Forest Fire Information System (EFFIS), the Forest Focus Data Platform, and the European Forest Information and Communication Platform (EFICP). New methods and tools developed for forest and natural hazards monitoring (forest fires, storms, etc) will decisively contribute to the further development and implementation of the Global Monitoring for Environment and Security (GMES) initiative.

Thus, the framework contract includes the provision of the following services or data at EU level:

- **technical assessments** such as reports, models, reviews, etc.
- **data** in the form of either statistics from forest inventory data (e.g. spatially aggregated plot data to provide harmonized estimates of selected indicators/attributes for given areas) or selected plot attributes derived from plot observation/measurements (e.g., forest type), to be used as validation or training fields for modeling.

This service provision needs to be organized around a dedicated platform. In order to provide the required services, the first two Specific Contracts under the Framework Contract concern the building of a platform called “EFDAC E-forest platform” (Figure 1). This platform will be useful for all consortium’s partners to upload required raw data in response to JRC request, harmonize them at an European level and transform them into aggregated data, spatial representation, maps, etc. In conclusion, this platform will become the central working area for the consortium’s members and will act as an intermediary actor between the data provider and the EFDAC.

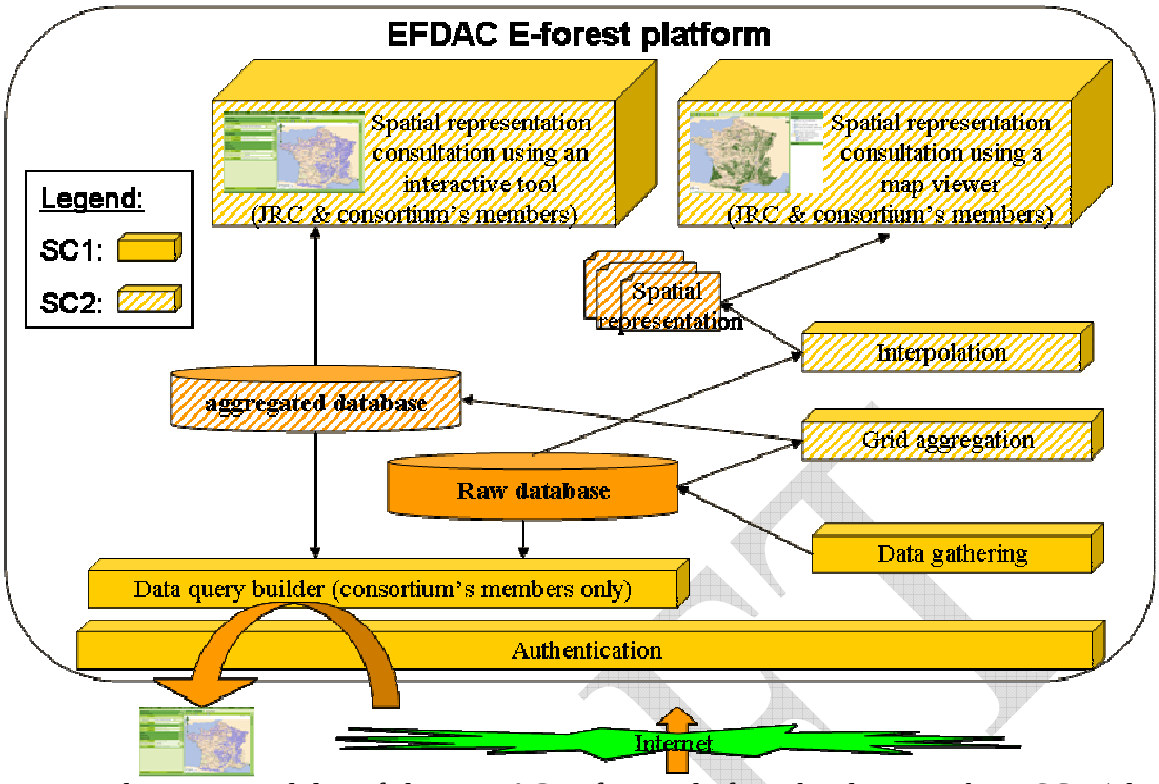


Figure 1. The main modules of the EFDAC E-forest platform by distinguishing SC1 (plain) and SC2 (hatched)

2. Objectives of Specific Contract 5 (SC5)

SC5 consists in a direct application of the data provided to the EFDAC E-forest platform in order to show the potential of this tool and also to emphasize the richness of data collected by the European Forest Inventories.

The main objective of SC5 is to demonstrate the feasibility of the elaboration of a spatial representation of "tree species" in 5 European countries: Germany (DE), Hungary (HU), Italy (IT), Latvia (LV), and Portugal (PT) in combination with all NFI data available in E-forest platform. The creation of this spatial representation will demonstrate the amount of information on European forests currently available from NFI.

Specific Contract 5 considers that the EFDAC E-forest platform as defined in the Specific Contract 1 is already developed. The SC1 was mainly dedicated to authentication, data gathering and data queries. The main purposes of the SC1 were to offer a user friendly interface to carry out these operations. The SC2 corresponds to an enrichment of the platform in order to carry out the main jobs for which the platform exists: providing to the JRC services or data at a European level.

The main goal of this project is to provide maps and aggregation results at the European level using NFI data from 5 European countries mentioned above in combination with all NFI data available in the E-forest platform (Figure 1).

National forest inventories

Forest information is collected in almost all countries of Europe through user-driven National Forest Inventories (NFIs). The main objectives of the National Forest Inventories are to acquire information on wood volume by tree species and diameter class, area estimates of forest land by type, stand size, ownership, site quality and stocking. Additional information is usually also included in the inventories like changes in the forest area, growth, mortality, timber removals and measures for successful regeneration.

This information is gathered from systematic assessments based on statistical sampling. The periodicity of the assessments of the national forest inventories may vary – but more and more continuous sample based inventories are applied.

Tree species

There is first a need to clearly define what is considered as a tree. The Cost Action E43 established that: "A tree, for NFI purposes, is a woody perennial of a species typically forming a single self supporting main stem and having a definite crown." (Gschwantner et al. 2009). This definition is used for trees in forest, but in this Specific Contract trees outside forest could have been assessed because no harmonization process is undertaken. Since tree species occurring in European countries are noticeably different depending on climatic and ecological conditions, so from one country to another, there is a need for specifying a list of tree species employed in the EFDAC E-forest platform.

3. Methodology

The repartition of work load between the data providers and the project team composed of thematic scientific officers and scientific managers proposed in the framework proposal will be defined. The project is subdivided into subtasks. For each subtask, the possible actors are identified among the data providers and/or the SC5 team and the deliverables are listed.
For data provision, the basal area by tree species per hectare will be assessed by each data provider who will input these values on the EFDAC E-forest platform. Then, the SC5 project team will produce maps or spatial representations using these data.

From a **data provider** point of view, the purpose of the study is to extend the basal area representation for Europe. This includes: providing data to the EFDAC E-forest platform as defined in SC1 and SC2 to give a thematic spatial representation of the variable "basal area".

From a **SC5 project team** point of view, the purpose of the study is to use and manage data provided by the SC5 partners using the EFDAC E-forest platform and to use and adapt some interactive tools to display spatial representation and also a map viewer to display static maps at the European level to show the potential of the European NFIs in response to a service required by the JRC.

From the **JRC** point of view, this study is expected to widen the possibility and feasibility of using data coming from data providers in order to produce a spatial representation at the European level. This spatial representation will show the JRC the richness of data collected by the European NFIs and also the capabilities of the EFDAC E-forest platform developed within Specific Contracts 1 and 2.

4. Tasks of SC5

4.1. Subtask: Data provision

This task is carried out by each data provider involved in the study.

Each consortium member will be in charge of the extraction of quality controlled raw data from the national forest inventory databases, the preparation of the data for the requested format (CSV file provided to each member of the consortium), the process of uploading to the EFDAC E-forest platform.

The E-forest administrator will have several tasks under this Specific Contract: the description of the metadata in the metadatabase for the variables needed for the study, testing the E-forest platform, assistance and coordination.

Since the JRC requires tree species maps using the 1x1 km INSPIRE grid, the plot location provided by the consortium members should be as accurate as possible. Depending on their data dissemination policy, the countries will choose one of the following solutions:

- If the country provides real plot coordinates, the E-forest platform will process these coordinates and determine the centre of the 1x1 km grid cell which contains the plot.
- If the country cannot (in case of clusters or for political reasons) provide the exact location of the plot, they should provide coordinates that correspond to the centre of the INSPIRE 1 km x 1 km grid for restitution at grid level.

In neither case will the JRC receive real plot locations, rather only coordinates that correspond to the centre of the 1x1 km INSPIRE grid cells.

The 1x1 km grid is only used for transformation of plot coordinates. It does not concern the data aggregation or spatial representation which are other subtasks in the SC5. Each grid cell does not have to contain data. If there is no plot in a cell, the cell is empty and thus, there is no line in the plot location file.

This Specific Contract will start to explore different evaluation approaches using data from the participating countries and elaborated by the single countries according to common guidelines. For each country, basal area by tree species per hectare will be assessed:

- according to a list of tree species previously defined
- at the plot level **OR** at least, if the country can't (in case of clusters) or won't provide the location of the plot, at the centre of the INSPIRE 1km x 1 km grid for restitution at grid level.

Each country, for which tree species assessed differ from the list used in the EFDAC E-forest platform, will adjust its data, i.e. each country will match its tree species with the one listed by the members and merge them if necessary.
Additional information for data providers are also available in the Guidance document on the E-forest website (http://efdac.ifn.fr/eforest).

Countries contributing with NFI data

The contributing countries for this subtask will be referred to as data providers and are: Germany (DE), Hungary (HU), Italy (IT), Latvia (LV) and Portugal (PT).

Outputs from data providers to the SC5 project team:

- Data uploaded using the EFDAC E-forest platform in accordance with the proposed format (CSV file). The country should also specify if it uses clusters/tracts. The data providers can refer to the CSV file specifications in Appendices for more details.
- Specification of a proposed list to match national tree species with those used in the EFDAC E-forest platform.

4.2. Subtask: Feasibility of mapping

This task is carried out by the SC5 project team.

The goal of this subtask is to explore options to produce spatial representations of data collected by the NFIs to show the potential of the European NFIs using some interactive graphic tools, or static maps of different main tree species at the European level using a web map viewer.

Mapping tree species can be done using three types of tools:

- An interactive tool to carry out requests by specifying columns and criteria to display. The results can be displayed dynamically in a table or in a map which is a "plot" distribution based on grid cell 1km × 1km.
- An interactive tool to aggregate the data. In this tool the end-user can choose the quantitative variable to display and the grid (50km × 50km, 100km × 100km). The result can be displayed dynamically in a table or in a map based on 50 km × 50 km grid cells.
- A web map tool or map viewer to display **maps** (static maps) (Figure 2).

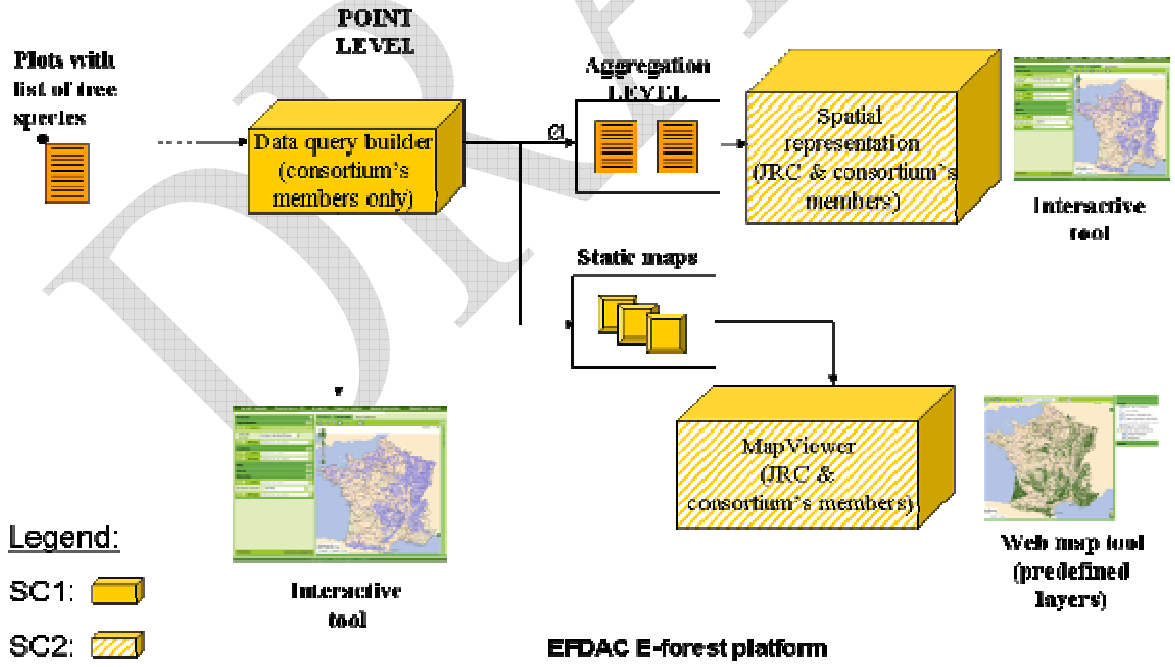


Figure 2. Process of mapping tree species.

4.2.1.Interactive tools

4.2.1.1. Data query builder

In the case of an interactive tool, the spatial representation corresponds to a qualitative variable of a particular tree species chosen by the user. This module consists in a user friendly interface to carry out requests and access the generated results based on 1kmx1km INSPIRE grid (spatial representations and tables) (Figure 3).

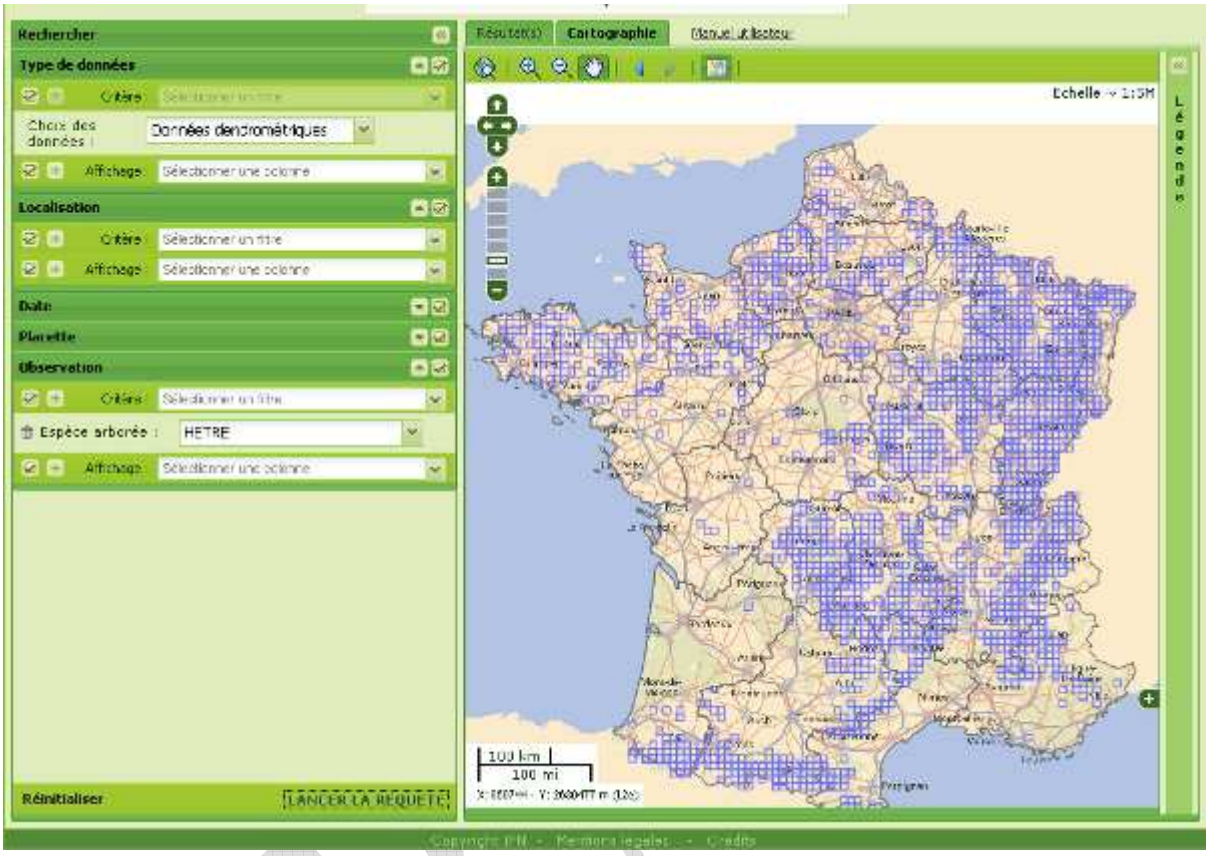


Figure 3. Example of a spatial representation: distribution of European Beech (*Fagus sylvatica*) in France.

As shown in the left part of Figure 3, the users of this interactive tool will have the possibility of displaying the representation they want according to different criteria. Using a pop-up list, they could choose the tree species to display, and next the qualitative data related to this tree species.

Occurrence of tree species

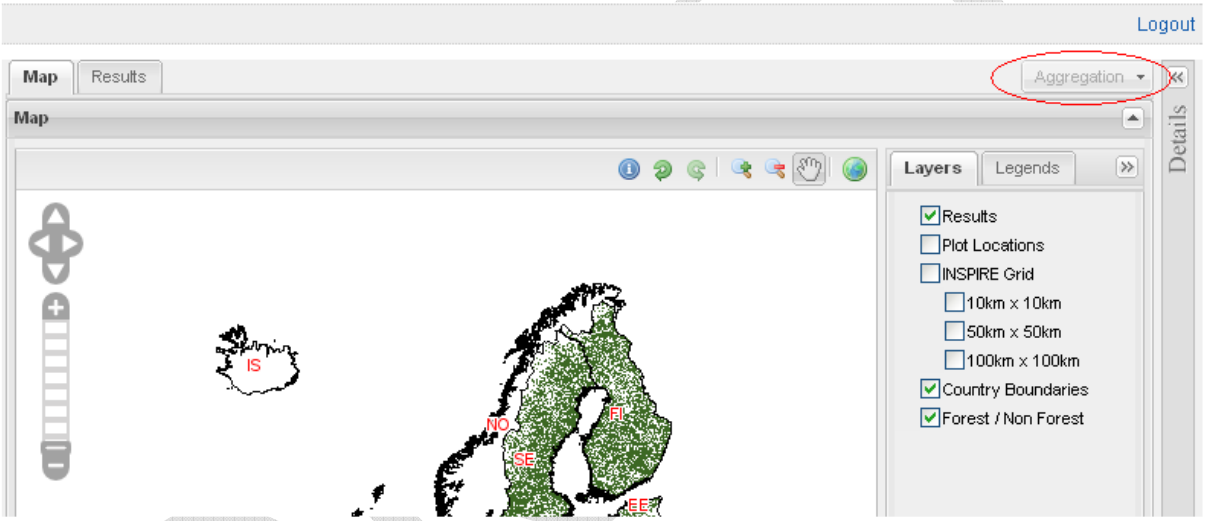
The spatial representation of occurrence (presence/absence) of tree species will be produced using this type of tool. The user of the interactive tool will choose the tree species they would like to display and generated results based on 1x1 km INSPIRE Grid would be available as spatial representations and as tables (Figure 3).
For the sake of showing the richness of plot data collected by the network of European Forest inventories, all the cells containing plot will be displayed in the spatial representations as a "plot" distribution. However, we will differentiate between cells which have data but does not contain a specific tree species and cells containing data related to the specific tree species chosen by the user. For example, this could be done using a background layer displaying all the grid cells containing data (in a light colour for example) and applying the grid cell including the tree species involved over it (in a dark colour).

The deliverables linked to this interactive tool will be exportable in CSV format. The coordinates of the 1x1 km INSPIRE Grid cells can be part of the CSV (if selected by the user)

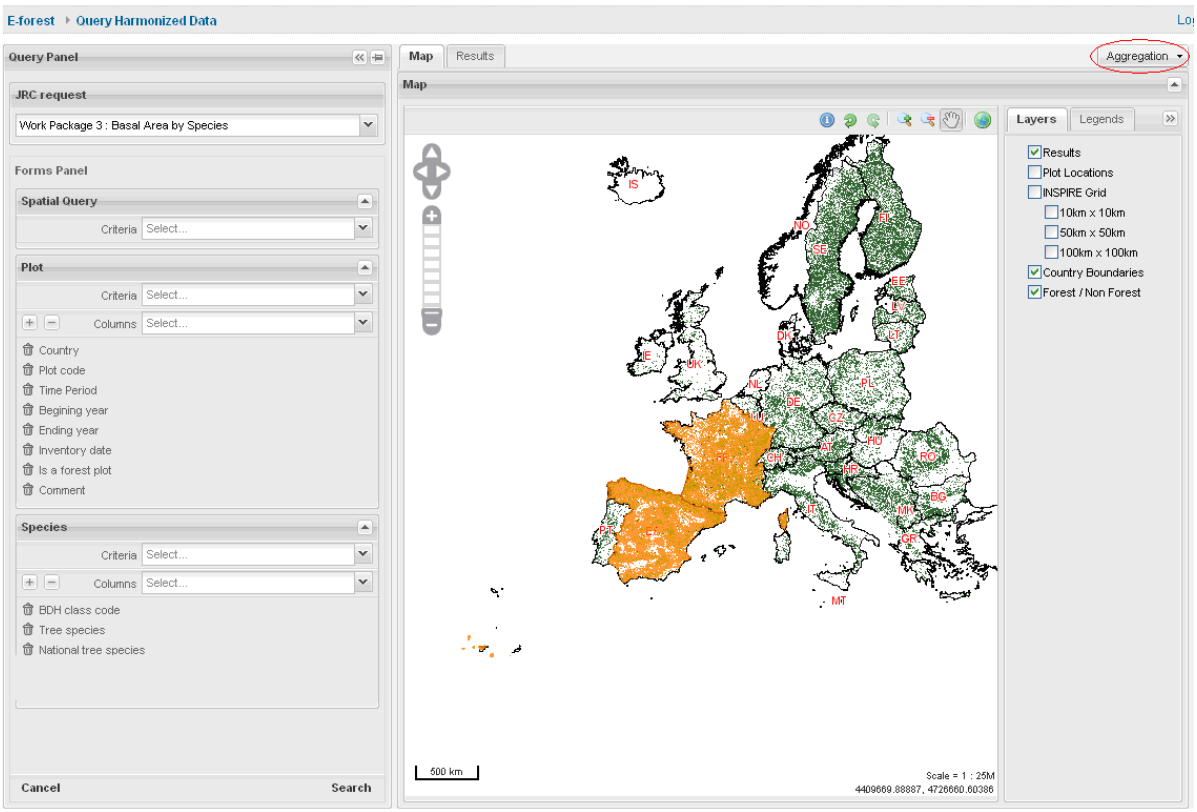
4.2.1.2.Aggregation tool

An interactive tool, hereafter referred as “interactive aggregation tool”, will also be used to demonstrate the usefulness of the EFDAC E-Forest platform in aggregating forest species basal area. The user of the interactive aggregation tool will have the possibility of displaying the representation they want according to at least one criterion: the tree species. Thus, for the selected tree species the data retrieval will be on demand.

The aggregation module will be seen as an extension of the Data query builder module. The user will first have to make a request to select some values before to be able to aggregate them.



When no value has been requested, the aggregation module is disabled.

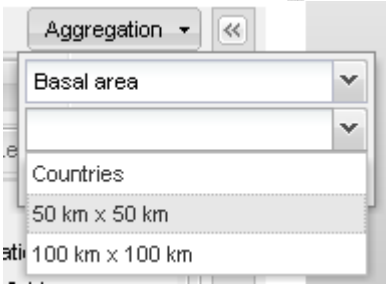


Once some results are selected, the aggregation module is available.

Selection of the variable to aggregate

When the user will click on the aggregation module, the list of available variables and the list of available grids will be displayed in the dataset.

In our case, only the basal area can be selected and the available grids are: 50 km × 50 km and 100 km × 100 km

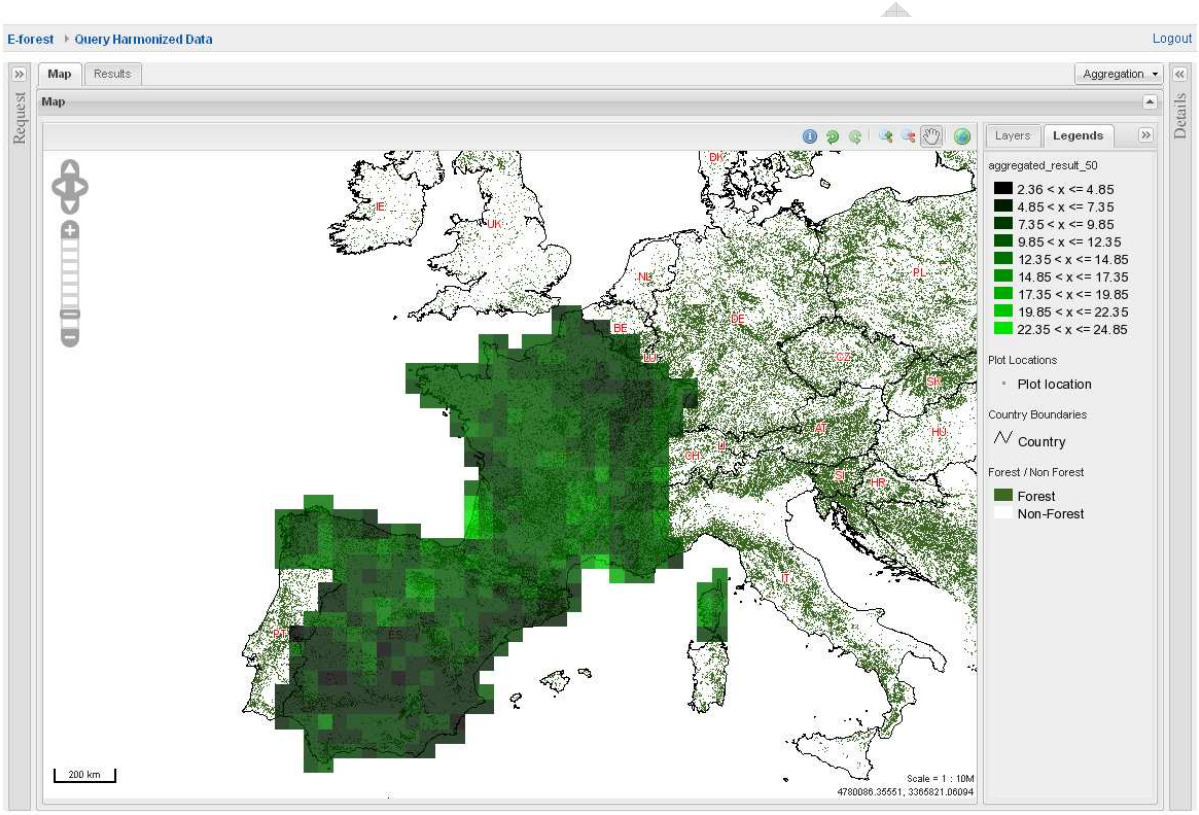


Calculation of the aggregated results

When the user clicks on the OK button, the selected plots are aggregated by cell and the quantitative value is averaged.

The result is composed of:

- The identifier of the cell or polygon
- The average of the quantitative value on the cell
- The count of aggregated elements



The deliverables linked to this interactive tool will be accessible in CSV format.

4.2.2.Map viewer

In the case of a map viewer, the first step is to define the number and the theme of the layers. Indeed, only a few numbers of maps will be provided and they need to be previously produced to be used as ready-built maps. Contrary to the interactive tool which enables users to carry out requests, with the map viewer the user will only access a limited number of maps (Figure 4).

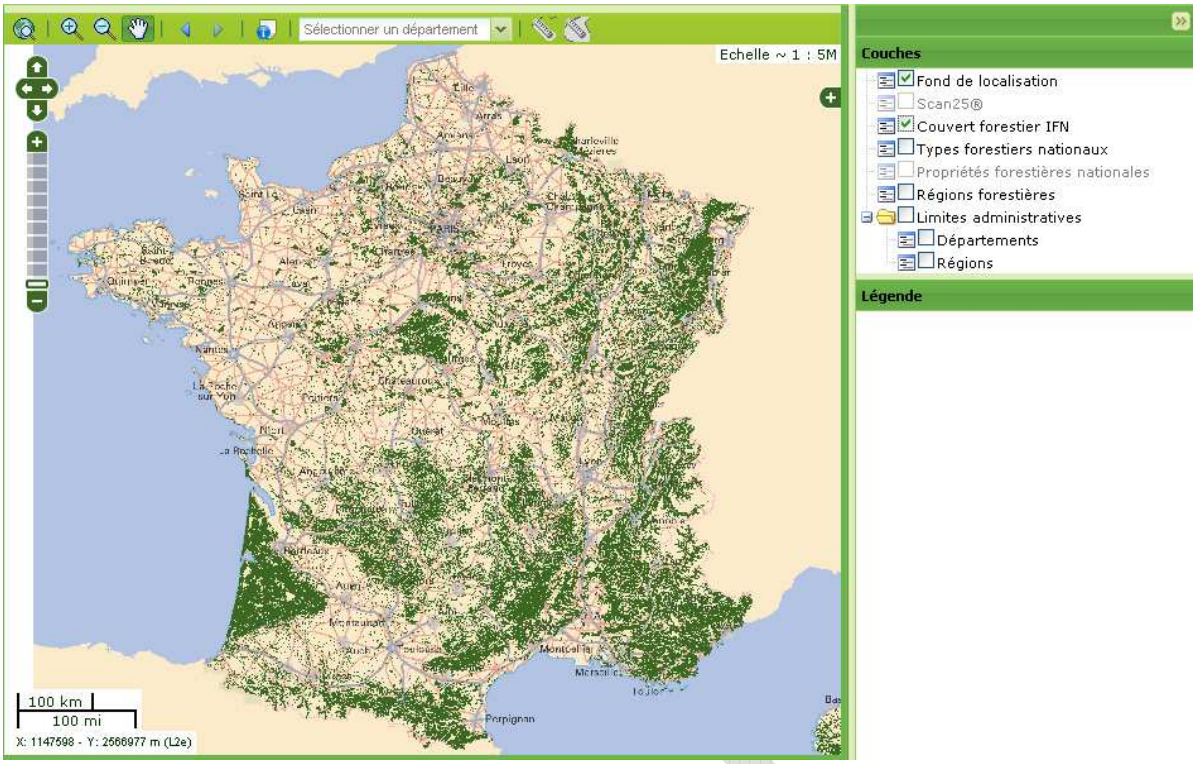


Figure 4. Example of a map viewer: distribution of forests in France.

Following a discussion among the EFDAC E-forest members and the JRC, the SC5 project team will produce 4 static maps derived from NFI observations by tree species and chosen by the JRC among many proposals. The agreed maps are:

- map of inventory "plot" distribution (to show the richness of NFI data) based on INSPIRE 1x1 km Grid.
- map of inventory forest and non-forest "plot" distribution based on INSPIRE 1x1 km Grid.
- map of tree stand global composition (majority of conifers or broadleaves) based on INSPIRE 1x1 km Grid. In this map only two classes are differentiated: conifers and broadleaves. To attribute one or the other value to a cell we will calculate the sum of the basal area for each class and the most representative class in term of basal area will determine the value of the cell.
- map of tree stand global composition (majority of conifers or broadleaves for harmonized dbh >=12 cm) based on INSPIRE 1x1 km Grid.

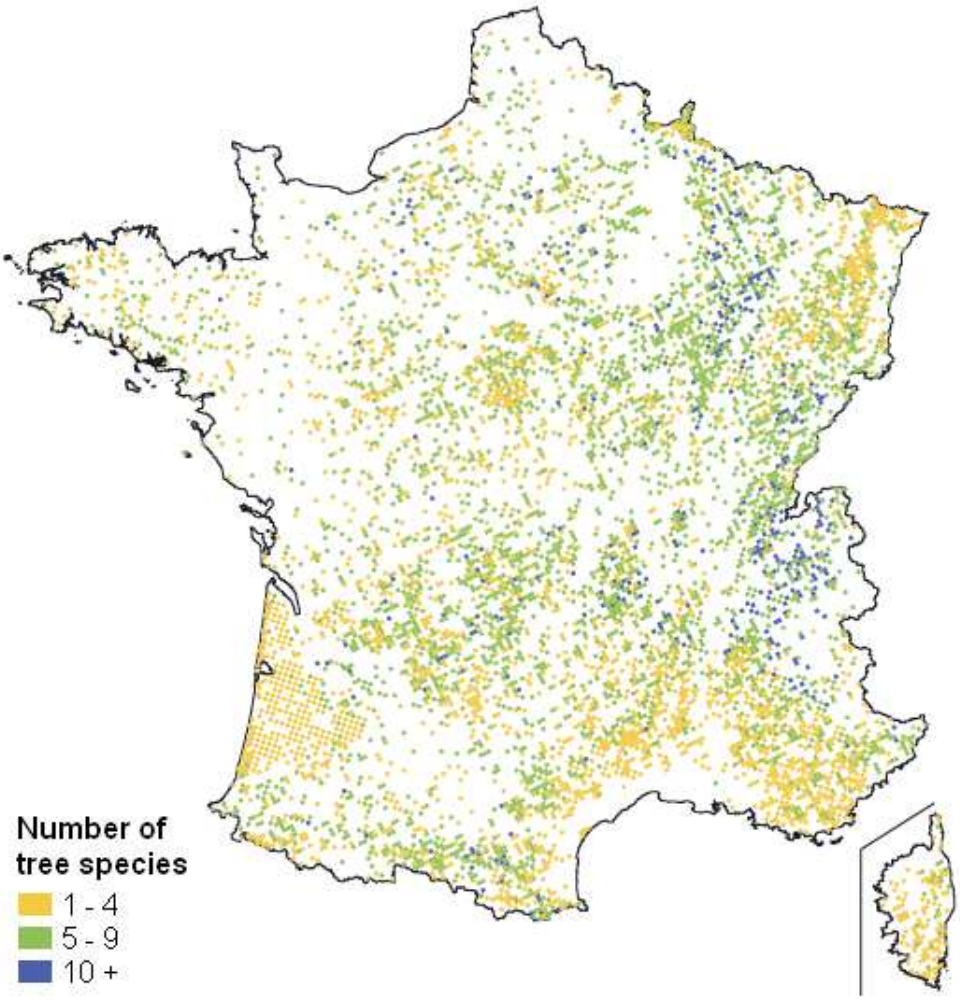


Figure 5. Number of different tree species per plot in France.

These spatial representation and map generations will be carried out in close cooperation with the SC2 team in order to use, whenever it is possible, the module developed in the EFDAC E-forest platform.

Note: the NFI data from 11 European countries have been collected and mapped within SC3. In order to map and combine data from all NFI available in E-forest platform and include the characteristics of each data provider some modifications in the mapping process will be needed during SC5. Therefore, to perform the subtask 4.2. “Feasibility on mapping tree species”, all data providers will be involved, namely:

Countries:

1. Austria: Austrian Federal Research and Training Centre for Forests, Natural Hazards and Landscapes (BFW)
2. Czech Republic: Forest Management Institute (Úhúl)
3. Denmark: Forest and Landscape - Faculty of Life Science - University of Copenhagen
4. Finland: Finnish Forest Research Institute (METLA)
5. France: French National Forest Inventory (NFI)
6. Great Britain: Forest Research
7. Norway: Norwegian Forest and Landscape Institute
8. Romania: Forest Research and Management Institute (ICAS)
9. Spain: Forest Technology Center of Catalunia (CFTC)
10. Sweden: Swedish National Forest Inventory (SLU)
11. Switzerland: Swiss Federal Institute for Forest, Snow and Landscape Research (WSL)
12. Germany: Johann Heinrich von Thünen Institute (vTI)
13. Hungary: Central Agricultural Office (CAO)
14. Italy: Agricultural Research Council (CRA)
15. Latvia: Latvian State Forest Research Institute (Silava)
16. Portugal: Instituto Superior de Agronomia (ISA)

4.2.3. Web services

In parallel with the data query builder, a WFS service is also provided. Thus, a map (cells distribution based on INSPIRE 1x1 km Grid) corresponding to the presence of **one** tree species can be dynamically produced. In that case, the user has to indicate the tree_species as a parameter in the URL. The tree species parameter has to be compliant with the tree species list. This web service is not directly linked to the interactive tool because there is not link between the result of the query and the result of the WFS. The WFS service can be considered as a map builder restricted to one tree species given as a parameter.

A specific program can load once a dedicated table with the result of the aggregation tool (basal area per species using the grid 50kmx50km). Based on this result table, a WFS web service is proposed. Thus, a map (cells distribution based on INSPIRE 50kmx50km Grid) corresponding to the basal area of **one** tree species can be dynamically produced. In that case, the user has to indicate the tree_species as a parameter in the URL. The tree species parameter has to be compliant with the tree species list. The WFS service can be considered as a map builder restricted to one tree species given as a parameter.

The 4 static maps available in the E-forest Mapviewer are also disseminated with web services. As these maps are cells distribution based on INSPIRE 1x1 km Grid, the web services available are WMS or WFS.

As these web services are only intented to be used by the EC and not the General Public, a secure access is needed. These web services will be limited to a few Internet addresses (IP range for instance) and the communication will be based on a secure channel (STunnel for instance).
Depending on the number of requests, it could be necessary to adapt the E-forest infrastructure hosted by the FNFI in France (new server, Internet connection).
These adaptations are not part of this proposal. Thus, there no engagement in term of response time.

4.2.4. Outputs

The task will demonstrate the use of national forest inventory data coming from national data providers and the use of the EFDAC E-forest platform and database using the mapping tools as proposed in the SC2. This exercise will permit to evaluate the availability of the information in 5 European countries and the potential use of National Forest Inventory data to describe richness of European forests including all NFI data available in E-forest platform.

With the use of a reference list and the basal area by tree species per hectare at each sample plot, the occurrence of tree species will be assessed. The process will also produce 4 static maps chosen by the JRC. As the E-Forest Consortium determined that the minimum grid size to compute basal area is 50 km × 50 km, this grid size is the one selected.

The task will test different approaches to assess basal area and calculate and map it, to test different aggregation levels and to evaluate the quality of a forest cover representation for Europe.

The JRC will not access raw data. The deliverables to the JRC are:

- Predefined datasets (static maps) related to tree species at the European level.
- Tree species qualitative datasets on a detailed 1 km x km grid.
- Aggregated forest species basal area datasets based on 50kmx50km grid.

Table 1. Deliverables to the JRC

Service	Display	Grid levels used	Description	Comments	Deliverable format/webservice
Qualitative variables					
Map viewer (Static Maps)	Inventory Plot Distribution	INSPIRE Grid 1x1 km	Display forest plots		WMS,WFS
	Inventory Plot Distribution	INSPIRE Grid 1x1 km	Display forest and non-forest plots	To show the richness of NFI data	WMS,WFS
	Tree Species Groups	INSPIRE Grid 1x1 km	Majority of conifers or broadleaves	2 classes: conifers and broadleaves. Sum of basal area for each class (comparison)	WMS,WFS
	Tree Species Groups	INSPIRE Grid 1x1 km	Majority of conifers or broadleaves for harmonized dbh >=12 cm	2 classes: conifers and broadleaves. Sum of basal area for each class (comparison)	WMS,WFS
Data query builder	Occurrence (presence/absence) of one tree species	INSPIRE Grid 1x1 km	Display all the plots + highlight those with the chosen tree species	Qualitative variables chosen by the user	CSV
Configurable Web Service	Occurrence (presence/absence) of one tree species	INSPIRE Grid 1x1 km	Plots where the tree species is present	WFS service with a tree_species parameter to fill (in accordance with the tree species nomenclature)	WFS&tree_species=
Quantitative variables					
Aggregation Tool	Basal Area	INSPIRE Grid 50x50 km	Data retrieval on demand for one tree species	The user chooses: - the tree species - the aggregation method	CSV
Configurable Web Service	Basal Area	INSPIRE Grid 50x50 km	Basal area where the tree species is present	WFS service with a tree_species parameter to fill (in accordance with the tree species nomenclature)	WFS&tree_species=

Data and deliverable provision

In one hand, within this contract, data providers provide raw data into the EFDAC E-forest platform. In the other hand, the JRC has access to the deliverables which don't correspond exactly to the data provided by the data providers, but which are derived from them.

At the end of the framework contract, the raw plot database will be destroyed. Thus, it is important to define what is available at the end of the SC5 contract and what will remain after the end of the framework contract.

Depending on the variable type, the level of restitution is not the same:

- For descriptive/qualitative data provision, the JRC has access to qualitative data using a location based on the 1km × 1km INSPIRE grid. This location is in fact the result of a shift of the plot location to the centre of the grid.
- For quantitative variable, the JRC will have access to statistical data aggregated using the 50km × 50km INSPIRE grid.

Thanks to SC2, the E-forest platform provides different interactive tools to the end-user (data query tool, aggregation tool, etc). Since some of these tools are linked to the raw database (for instance the aggregation module), these tools won't be available at the end of the Framework contract.
Thus, two strategies are proposed:

- For all variables (qualitative and quantitative variables), the E-forest platform provides a tool to build what is called the "harmonized database". This tool is foreseen to carry out harmonization work in the future. During this operation, the plot locations are shifted to the centre of the 1kmx1km grid cell. Then the raw database is no longer needed to feed the data query tools.
- For quantitative variables, a specific software is developed to load a dedicated table with the result of the aggregation tool (basal area per species using the 50km × 50km grid).

Then two web services (Web Feature Service) are proposed to disseminate these results (qualitative and quantitative). Both of these web services expect an input parameter which corresponds to the tree species.
The first web service provides the information about presence / absence for the selected tree species (input parameter) using the 1km × 1km grid.
The second web service provides the result of basal area aggregation of the selected tree species (input parameter) using the 50km × 50km grid.

These services will remain active after the end of the Framework contract if the E-forest platform is maintained.

4.3 .Prelimanry-study for validating JRC forest layers based on NFI data

The JRC plans to validate JRC forest layers by building up a validation database based on NFI plot information. During the proposed preliminary-study, the consortium (scientific officers) will test an implementation of the validation strategy proposed by the JRC using data coming from NFI (at least data from France, Denmark and Austria). The constraints of this

pre-study are (i) that the NFI plots are used with their real coordinates by ensuring that the real coordinates remain confidential and (ii) to guaranty that the methodology used for overlaying NFI plots and JRC forest layers is consistent for all the countries involved in this future contracts regarding the validation of European datasets.

This pre-study is composed of four steps:

a) A meeting with all the permanent members (at least Switzerland, Austria and France) of the consortium to propose a consensual implementation methodology.
b) A meeting will then be organised with all the countries involved in the framework contract.
c) Based on this methodology, a first version of a software is developed. The objective is that all the countries that may be concerned with the validation of European products such as the JRC forest layers will use this software at a national level (real coordinates remain at the NFI premises) in order to guaranty a consistent methodology. The software will provide a file compiling the information from both the JRC forest layers (exact location and 5 by 5 surrounding window) and the plot locations of NFI data. Thus all the files will be prepared to be uploaded into the E-forest platform (results without real coordinates).
d) A meeting will be organised at the JRC with the Coordinator of the E-Forest consortium to confirm the proposed methodology and check the first results obtained. As no task is proposed for preparing the data *(Crown Cover, tree height , etc.)*, the results will be mainly based on a small dataset with data that are already available in NFI databases.

The deliverable (M3) of this pre-study is :

- **Approved detailed implementation protocol of the validation strategy for 2006 and 1990.**

Depending on the results of this preliminary study, new contracts may be launched to validate the JRC pan-European forest layers 1990 and 2006

5. Work plan

The Specific Contract relies on an experienced group of partners having formerly taken part in European projects and having worked closely together under the COST Action E43 during the last 4½ years.

Work progress will be monitored according to the working plan (see below) and according to the general rules under the EFDAC E-forest quality plan and JRC Framework contract.

5.1. Staff description

5.1.1. Overall manager

Function (FNFI): DIRECTOR OF THE FRENCH NATIONAL FOREST INVENTORY
Name: Claude VIDAL
Task in the project: Project manager
Professional Experience: 33 years

Task in the project: Organisation, Plan, follow up, Meeting, Management, etc…

5.1.2. SC5 project team

Function (WSL): LEADER OF THE RESEARCH GROUP INVENTORY DESIGN AND PLANNING
Name: Adrian LANZ
Task in the project: thematic scientific officer
Professional Experience: 20 years
Task in the project: metadata and harmonisation tools
Function (BFW): HEAD OF THE DEPARTMENT OF FOREST INVENTORY
Name: Klemens SCHADAUER
Task in the project: scientific manager
Professional Experience: 20 years
Task in the project: statistical analysis, spatial analysis,

Function (F & L): SENIOR RESEARCHER AND PROJECT MANAGER AT THE DEPARTMENT OF FORESTRY AND WOOD PRODUCTS (DANISH NFI)
Name: Annemarie BASTRUP-BIRK
Task in the project: thematic scientific officer
Professional Experience: 22 years
Task in the project: biodiversity issues

Function (FNFI): HEAD OF THE INFORMATION SYSTEM DEPARTMENT
Name: Jean-Luc COUSIN
Professional Experience: 15 years
Task in the project: link between SC2/SC3

Function (FNFI): HEAD OF THE GIS DEPARTMENT OF THE FRENCH NFI
Name: Marianne Duprez
Professional Experience: 10 years
Task in the project: development of GIS tools, spatial representation and mapping

Function (FNFI): PROJECT MANAGER
Name: Benoit PESTY
Professional Experience: 10 years
Task in the project: participation in data aggregation and analysis

Function (FNFI): INTERNATIONAL OPERATION MANAGER
Name: Camille BONHOMME
Professional Experience: 1 year
Task in the project: participation in coordination and web site administration

5.1.3. Involved countries

Countries involved in subtask 4.1. “Data provision”:

1. Germany: Johann Heinrich von Thünen Institute (vTI)
2. Hungary: Central Agricultural Office (CAO)
3. Italy: Agricultural Research Council (CRA)
4. Latvia: Latvian State Forest Research Institute (Silava)
5. Portugal: Instituto Superior de Agronomia (ISA)

Countries involved in subtask 4.2. “Feasibility of mapping tree species” and subtask 4.3. “Pre-study for qualifying JRC forest layers”:

1. Austria: Austrian Federal Research and Training Centre for Forests, Natural Hazards and Landscapes (BFW)
2. Czech Republic: Forest Management Institute (Úhúl)
3. Denmark: Forest and Landscape - Faculty of Life Science - University of Copenhagen
4. Finland: Finnish Forest Research Institute (METLA)
5. France: French National Forest Inventory (NFI)
6. Great Britain: Forest Research
7. Norway: Norwegian Forest and Landscape Institute
8. Romania: Forest Research and Management Institute (ICAS)
9. Spain: Forest Technology Center of Catalunia (CFTC)
10. Sweden: Swedish National Forest Inventory (SLU)
11. Switzerland: Swiss Federal Institute for Forest, Snow and Landscape Research (WSL)
12. Germany: Johann Heinrich von Thünen Institute (vTI)
13. Hungary: Central Agricultural Office (CAO)
14. Italy: Agricultural Research Council (CRA)
15. Latvia: Latvian State Forest Research Institute (Silava)
16. Portugal: Instituto Superior de Agronomia (ISA)

5.2. Work repartition for the data provision and building the deliverable

Table 2. Specific Contracts Milestones

Milestone	Description	Partner	Sub-SC5	Month
M0	Contract notification			T_0
M1	Data preparation and provision	All (NFIs)	1	$T_0 + 5$
M2	Results of feasibility of mapping	All (Short team)[1]	2	$T_0 + 10$
M3	Results of pre-study for qualifying JRC Forest layers	All (NFIs)	1	$T_0 + 1.5$

[1] The short team has to be defined among the EFDAC E-forest members.

5.3. Financial proposal

SC5						
Price component	**Personnel type equivalence**	**Country**	**Staff**	**Price per day**	**Number of days**	**Total cost (€)**
Tasks assigned to data providers						
Data provision and data transformation	Thematic scientific officer and data analyst	5		750	10	37,500[2]
Subtotal data provider tasks (1)						37,500
Tasks assigned to SC5 team						
Animation, web site administration	Thematic Scientific Officer and data analyst	France	Camille Bonhomme	750	5	3,750[2]
Data aggregation	Scientific Manager and data analyst	France	Claude Vidal / Marianne Duprez / Benoit Pesty	750	6	4,500[2]
		Austria	Klemens Schadauer		6	4,500[2]
Spatial representation and mapping		Switzerland	Adrian Lanz		6	4,500[2]
	Thematic Scientific Officer and data analyst	Denmark	Anne-Marie Bastrup-Birk	750	3	2,250[2]
Subtotal SC5 team tasks (2)						19,500
Validation Meeting (data check and validation of the deliverables)						
Validation phase of data and deliverables[3]	NFIs and Thematic officer	16 NFIs + 3 Permanent Staff		750	1	14,250
Subtotal SC5 team tasks (3)						14,250
Qualification of JRC forest layers: pre-study						
Meeting of the permanent members		France(x3), Austria, Switzerland		750	1	3,750
Software modeling (First Draft)		France, Austria, Denmark Switzerland		750	5	3,750
Meeting at the JRC		France(x2),		750	2	3,000
Meeting for validation [3]		16 NFIs + 3 Permanent Staff		750	1	14,250
Subtotal data provider tasks (4)						27,750
TOTAL (1)+(2)+(3)+(4) = PRICE SC5						**96,000**

[2]As specified in the Framework Contract the cost of each Thematic Officer includes the potential travelling expenses.

[3] The two meetings are back to back to reduce the travel costs.

This proposal is valid until 30/04/2010

6. References

FAO. 2004. *Global Forest Resources Assessment Update (FRA 2005): Terms and definitions.* FRA Working Paper 83/E, FAO Forestry Department, Rome. 34 p. Available at: http://www.fao.org/forestry/media/7797/1/0/ [Cited 11 Feb 2009].

Gschwantner, T., Schadauer, K., Vidal, C., Lanz, A., Tomppo, E., di Cosmo, L., Robert, N., Englert Duursma, D., and Lawrence, M. 2009. *Common tree definitions for National Forest Inventories in Europe.* Silva Fennica.

Lanz et al. (2009). *Harmonising national forest inventories in Europe*. Report of the COST Action E43, pp. ~150.

Appendices

7.1. Appendix 1. CSV File Description – Strata Definition

E-forest
CSV File Description
Stratum Definition

"Framework contract for the provision of forest data and services in support to the European Forest Data Centre"
Reference: 2007/ S 194-235358 of 09/10/2007

File format

The file will contain information about the strata used in the country. Inside each stratum, the plot distribution should be homogenous.

Data types used are:

- **Integer:** Numeric value with no decimal.
- **Boolean:** Boolean value (represented as a 1 for true and a 0 for false).
- **Numeric:** Numeric value with decimals
  The decimal separator must be a dot, there is no precision limit.
  Value that is not measured should be left empty.
- **Code**: Code value, chosen in a list of valid codes given under the type of the data.
- **String:** alphanumeric value for free text
  Value must not contain special characters like the carriage return or the semi-colon.
- **Date:** Date value.
  The date format is YYYY-MM-DD.
- **Coordinate:** Coordinate value in numeric format
  The coordinate must be given in degrees minutes seconds using WGS84.
  The coordinate format is +/-DD.MM.SS.

Example:

```
//
// Strata
//
// STRATUM_CODE; TOTAL_STRATUM_AREA;COMMENT
FR_GENERIC;49000;This stratum contains plots based on a systematic stratification frame
FR_POPLAR;9123;
```

Description of fields

2.1. STRATUM_CODE

Description: This is the identifier of the stratum.
Condition: Mandatory
Example: FR_01
Type: String

2.2. TOTAL_STRATUM_AREA

Description: This is the total area (total land area including water zones) of the stratum in hectares.
Condition: Mandatory and >0
Example: 1234556.09
Type: Numeric

2.3. COMMENT

Description: This field is an optional comment field.
Condition: Optional
Example: This strata contains plots based on a systematic stratification frame
Type: String

7.2. Appendix 2. CSV File Description – Plot Location

E-forest
CSV File Description
Plot Location

“Framework contract for the provision of forest data and services in support to the European Forest Data Centre”
Reference: 2007/ S 194-235358 of 09/10/2007

File format

The file will contain information needed to identify a plot location (plot code) and its geographical coordinates.

Data types used are:

- **Integer:** Numeric value with no decimal.
- **Boolean:** Boolean value (represented as a 1 for true and a 0 for false).
- **Numeric:** Numeric value with decimals
  The decimal separator must be a dot, there is no precision limit.
  Value that is not measured should be left empty.
- **Code**: Code value, chosen in a list of valid codes given under the type of the data.
- **String:** alphanumeric value for free text
  Value must not contain special characters like the carriage return or the semi-colon.
- **Date:** Date value.
  The date format is YYYY-MM-DD.
- **Coordinate:** Coordinate value in numeric format
  The coordinate must be given in degrees minutes seconds using WGS84.
  The coordinate format is +/-DD.MM.SS.

Example:

```
//
// Plot Locations
//
// PLOT_CODE; CLUSTER_CODE; LATITUDE; LONGITUDE;
IS_PLOT_COORDINATES_DEGRADED;  COMMENT
1234;Cluster_test;+45.40.31;+03.45.40;1;Test
1235;Cluster_test;+45.41.31;+03.45.40;1;Test
1236;Cluster_test;+45.42.31;+03.45.40;1;Test
1237;Cluster_test;+45.40.31;+03.46.40;1;Test
1238;Cluster_test;+45.41.31;+03.46.40;1;Test
```

Description of fields

2.4. PLOT_CODE

Description: This is the identifier of the plot inside the country.
Type: String.
Condition: Mandatory
Example: A1234
Note: The plot code corresponds to a unique identifier used to identify the plot in all the files to upload.

2.5. CLUSTER_CODE

Description: This is the identifier of a group of plots. This field allow the country to group its plots in some clusters.
Condition: Mandatory
Example: 1234
Type: String.

2.6. LATITUDE

Description: This is the latitude of the plot, given in degrees minutes seconds using WGS84.
Condition: Mandatory
Example: +45.40.31
Type: Coordinate

2.7. LONGITUDE

Description: This is the longitude of the plot, given in degrees minutes seconds using WGS84.
Condition: Mandatory
Example: +03.45.40
Type: Coordinate

2.8. IS_PLOT_COORDINATES_DEGRADED

Description: This field indicate if the plot coordinates are degraded (in this case the value should be 1) or if the plot coordinates correspond to the real coordinates. (in this case the value should be 0).
If the plot doesn't belong to a cluster, the degradation means that the plot is snapped to the nearest centre of a grid cell of the INSPIRE grid of 1Kmx1Km. If the plot belongs to cluster, the country has to calculate the centre of the cluster then snap this centre to the nearest centre of the grid cell of the INSPIRE grid of 1Kmx1Km. Then, all the plots that belong to the cluster are translated using the same transformation.
Condition: Mandatory
Example: 1
Type: Boolean

2.9. COMMENT

Description: This field is an optional comment field.
Condition: Optional
Example: This plot is located in the mountain
Type: String

7.3.Appendix 3. CSV File Description – Plot Data

E-forest
CSV File Description
CS3 - Plot Data

“Framework contract for the provision of forest data and services in support to the European Forest Data Centre”
Reference: 2007/ S 194-235358 of 09/10/2007

File format

The file will contain information needed to submit data related to the plot in order to respond to the CS3 JRC Request.

Data types used are:

- **Integer:** Numeric value with no decimal.
- **Boolean:** Boolean value (represented as a 1 for true and a 0 for false).
- **Numeric:** Numeric value with decimals
  The decimal separator must be a dot, there is no precision limit.
  Value that is not measured should be left empty.
- **Code**: Code value, chosen in a list of valid codes given under the type of the data.
- **String:** alphanumeric value for free text
  Value must not contain special characters like the carriage return or the semi-colon.
- **Date:** Date value.
  The date format is YYYY-MM-DD.
- **Coordinate:** Coordinate value in numeric format
  The coordinate must be given in degrees minutes seconds using WGS84.
  The coordinate format is +/-DD.MM.SS.

Example:

```
//
// Plot Data
//
// STRATUM_CODE, PLOT_CODE, INV_DATE, TIME_PERIOD, REF_YEAR_BEGIN, REF_YEAR_END, STATISTICAL_WEIGHT;
CLUSTER_STATISTICAL_WEIGHTDOMAIN_BASAL_AREA; IS_FOREST_PLOT, COMMENT
FR01;1234;2006-01-26;1;2006;2009;0.5;1;1;1;1;test data plot
```

Description of fields

2.10. STRATUM_CODE

Description: This is an identifier for the stratum the plot belongs to. This code should correspond to the code given in the strata file.
Type: String
Condition: Mandatory
Example: FR_01

2.11. PLOT_CODE

Description: This is the identifier of the plot inside the country.
Type: String.
Condition: Mandatory
Example: A1234
Note: The plot code corresponds to a unique identifier used to identify the plot in all the files to upload. The plot code is a free code. It should be a unique and permanent identifier of the plot inside the country.

2.12. INV_DATE

Description: This is inventory date that means the date when the field plot has been assessed.
Type: Date
Condition: Mandatory
Example: 2006-01-26

2.13. TIME_PERIOD

Description: This is the cycle of inventory. It is the number of the ongoing cycle and not the duration of the cycle
Type: Integer
Condition: Mandatory
Example: 3

2.14. REF_YEAR_BEGIN

Description: This is the beginning reference year for the plot assessment.
Type: Integer
Condition: Mandatory
Example: 2006

2.15. REF_YEAR_END

Description: This is the ending reference year for the plot assessment
Type: Integer
Condition: Mandatory

Example: 2009
Note: set REF_YEAR_END=REF_YEAR_BEGIN if the reference year is a year and not a reference period.
This is the final year of the cycle, so the year of the plot assessment in general and not of the particular plot that you are registering. The measurement year of the plot corresponds to another code: INV_DATE.

2.16. STATISTICAL_WEIGHT

Description: This is the relative statistical weight of the plot when the sample inclusion probability is not equal for all plots in the stratum. If the same inclusion probability is used for all plots in the stratum, the STATISTICAL_WEIGHT is equal to 1.

Note on cluster sampling: Some countries (France) apply “false clusters” in the sense, that a random point generated by chance in a specific forest type generates additional plots (for instance a “cluster” of 4 plots in poplar plantations), while this is not the case in other forest types. All plots are considered independent. In this case plot weighting is needed (0.25 for a plot in a poplar plantation, 1 for other plots). The situation is different for a stratum with “true clusters”, i.e. clusters with the same geometric layout (but possibly with a varying number of plots located in the domain of study) for which independence of plot values within clusters can not be assumed. In this case, the random mechanism generates “anchor points” and the plot locations are given through a pre-defined set of vectors applied to all anchor points. Now, when the anchor points are drawn uniformly in the stratum, the plot weights are equal for all plots in the stratum (weight is 1). If, on the other hand, the sample inclusion probability is not equal for all anchor points, the relative statistical weight of the anchor point has to be given for all plots in the cluster. Plot weighting in the most complicated case of unequal inclusion probabilities of anchor points and varying cluster geometries within a single stratum is left as an exercise for those countries applying such a design!

Test with wj denoting the statistical weights of plots and yj denoting the observed (measured) target variable densities (per hectare) of plots; sum(wj x yj) / sum (wj), where the sums are over all plots in the domain, is expected to be an unbiased estimate of the true spatial density of the target variable in the domain.

Type: numeric
Condition: Mandatory
Example: 0.25
Note: This weight is a coefficient that doesn’t have any unit.

2.17. DOMAIN_BASAL_AREA

Description: indicates whether the plot belongs to the domain in which the basal area (basal_area) is defined (estimated). Note: For the target variable basal area, this domain comprises usually all forest plots. But there are exceptions in some countries: Austria, for instance, defines basal area on the domain “productive forest” (excluding forest roads, for instance). In this case the plot variable domain_basal_area is 1 for all plots falling into “productive forests” and 0 for all other plots in the stratum (non-forest plots, OWL plots, non-productive forest plots …). If the basal area is missing for some plot in the (productive forest) domain, the domain_basal_area variable must be set to -1 instead of 1 (missing value).
Type: Code
Condition: Mandatory
Example: 1
Code list: (refer to the codes above)

Code	Label
0	The plot is in a domain in which the variable is not defined
1	The plot is in the domain in which the variable is defined, the plot and

Code	Label
	the variable are assessed
-1	The plot is in the domain in which the variable is defined ,the plot or the variable is not assessed (missing value)

This domain refers to the basal area variable provided in the basal area file.
The plot refers to a terrestrial grid

2.18. DOMAIN_FOREST

Description: indicates whether the plot belongs to the domain in which the forest area (is_forest_plot) is defined (estimated). Note: For the target variable IS_FOREST_PLOT, which is used to estimate the forest area, this domain comprises usually all plots in the stratum, including all non-forest plots (thus, the default is to set domain_forest=1 for all plots in the sample, including non-forest plots). In some countries, and if the percentage of forest (forest cover) for some stratum should be given – to give an example - with respect to the land area (without inland water), the country may choose to declare plots located in inland water as not belonging to the domain for forest area estimation (domain_forest=0); but these cases should be rare. If the is_forest_plot variable is not available for some plot (missing information) and the plot is known to belong to the domain in which the percentage of forest should be calculated based on the is_forest_plot target variable, the domain_forest variable gets code -1 (missing). Note: the domain for the target variable basal_area is usually (roughly) forest, the domain for the target variable is_forest is usually (roughly) the whole stratum!
Type: Code
Condition: Mandatory
Example: 1
Code list: (refer to the codes above)

Code	Label
0	The plot is in a domain in which the variable is not defined
1	The plot is in the domain in which the variable is defined, the plot and the variable are assessed
-1	The plot is in the domain in which the variable is defined, the plot or the variable is not assessed (missing value)

This domain refers to the variable is_forest_plot variable provided in this file.

2.19. IS_FOREST_PLOT

Description: Tells if the plot corresponds to a forest plot or not (1 for true, 0 for false). Mid-point of plot decides.
Type: Boolean
Condition: Mandatory
Example: 1
Note: This variable is related to the “DOMAIN_FOREST” domain.

2.20. IS_PARTINIONNING_PLOT

Description: This field indicates whether the plot is a partitioned (or shared) plot between forest and non-forest land (OWL is considered non-forest land). More precisely, this variable indicates whether subplot transformation (=1) or not(=0), i.e. correction of sample inclusion probabilities for trees at the forest boundary, has been needed to calculate the local density of the basal area variable (basal area per ha). Depending on NFI, if there is a strict limit with land use or land cover detected on the plot inventoried area, subplots can be used to manage this situation. In that case, it is up to the country to

provide the information of the plot using the subplots. This field allows the country to indicate that subplots have been used. Note that this indicator variable is 0 for plots with mid-points outside forest, even for a partitioned plot between forest and non-forest.
Condition: Mandatory
Example: 1
Type: Boolean
Note:

2.21. COMMENT

Description: This field is an optional comment field.
Type: String
Condition: Optional
Example: This plot is a permanent plot

7.4.Appendix 4. CSV File Description – Species Data

E-forest
CSV File Description
CS3 - Species Data

"Framework contract for the provision of forest data and services in support to the European Forest Data Centre"
Reference: 2007/ S 194-235358 of 09/10/2007

File format

The file will contain information needed to submit data related to the species inside a plot in order to respond to the CS3 JRC Request.

Data types used are:

- **Integer:** Numeric value with no decimal.
- **Boolean:** Boolean value (represented as a 1 for true and a 0 for false).
- **Numeric:** Numeric value with decimals
  The decimal separator must be a dot, there is no precision limit.
  Value that is not measured should be left empty.
- **Code**: Code value, chosen in a list of valid codes given under the type of the data.
- **String:** alphanumeric value for free text
  Value must not contain special characters like the carriage return or the semi-colon.
- **Date:** Date value.
  The date format is YYYY-MM-DD.
- **Coordinate:** Coordinate value in numeric format
  The coordinate must be given in degrees minutes seconds using WGS84.
  The coordinate format is +/-DD.MM.SS.

Example:

```
//
// Species Data
//
// PLOT_CODE; TIME_PERIOD; DBH_CLASS, SPECIES_CODE;
NATIONAL_SPECIES_CODE;BASAL_AREA; COMMENT;
1234;1;1;031.001.041;253;157.6;test basal area
1234;1;1;036.004.011;256;65.4;test basal area
1235;1;2;036.004.011;300;48;test basal area
1235;1;1;036.004.011;245;356.3;test basal area
```

Description of fields

2.22. PLOT_CODE

Description: This is the identifier of the plot inside the country.
Type: String.
Condition: Mandatory
Example: A1234
Note: The plot code corresponds to a unique identifier used to identify the plot in all the files to upload.

2.23. TIME_PERIOD

Description: This is the cycle or the year of inventory. It is the number of the ongoing cycle and not the duration of the cycle.
Condition: Mandatory
Type: Integer
Example: 3

2.24. DBH_CLASS

Description: The **D**iameter **B**reast **H**eight represents the tree diameter at breast height 1,30m.
Condition: Mandatory
Type: Code
Example: 1
Note: This variable is related to the “DOMAIN_BASAL_AREA” domain
Code list: (refer to the dbh code above)

Code	Label
1	DBH is inferior to 12 centimeters
2	DBH is superior or equal to 12 centimeters

If different trees of the same species belong to the code 1 (dbh<12cm) and to the code 2 (dbh>=12), the two lines of this species has to be provided.

2.25. SPECIES_CODE

Description: This is the identifier of the species based on the Flora Europea. A standardized list of authorized species codes will be given.
Type: Code
Condition: Mandatory
Example: 77
Code list: (refer to the tree species list in annexe)

Code	Label
1	QUERCUS PEDUNCULATA OU SESSILIFLORA OU LANUGINOSA
2	QUERCUS PEDUNCULATA = ROBUR
3	QUERCUS SESSILIFLORA = PETRAEA
4	QUERCUS RUBRA
…	…

Note: if the species has been observed, only one line per PLOT_CODE, CYCLE and SPECIES_CODE is expected even if this species corresponds to more than one tree.

2.26. NATIONAL_SPECIES_CODE

Description: This is the national identifier of the species.
Type: String
Condition: Optional
Example: 1025

2.27. BASAL_AREA

Description: This is the sum of basal area per hectare forest of the given specie on the plot (in square meters per hectare).
Type: Numeric
Condition: Mandatory
Example: 123.4
Note:

- This basal area corresponds to the aggregation of the basal area per hectare forest of all the trees of the same species.
- This variable is related to the “DOMAIN_BASAL_AREA” domain

2.28. COMMENT

If available, add in the comment field the latin name of the species (genus, species, subspecies, …) and the country specific code for the specie.

Description: This field is an optional comment field.
Type: String
Condition: Optional
Example: Fagus Sylvatica