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Deliverable D2.1

Database of relevant phenotypic properties for the GenRes collection.

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Workpackage: 2

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CO Confidential, only for members of the consortium (including the Commission Services)	

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1 Summary

This deliverable D2.1 gathers the FORGENIUS WP2 phenotypic data collected in the field during the first two years of the project. The datasets provided as part of this deliverable have been summarised to make it easier to read and use as relevant datasets of phenotypic properties for the EUFGIS database.

This deliverable applies to four species: *Populus nigra* and *Pinus pinaster* (characterized in 2021) and *Fagus sylvatica* and *Pinus sylvestris* (characterized in 2022). The data for 2023 and 2024 (*Quercus robur*, *Picea abies*, *Abies alba*, *Malus sylvestris*, *Pinus halepensis* and *Pinus pinea*) are being analysed and will be provided once all analyses are completed.

Thus, more than 20,000 data points have been collected by the WP2 field team in the first two years of this project. This represents more than 600 people/day travelling or working in the field, often following long-distance travelling under challenging field conditions. The data collection was coordinated thanks to the help of the local partners to confirm the choice of relevant GCUs and identify the most suitable sampling areas. They provided an essential support to the WP2 field team.

The deliverable outputs are the datasets (§ 3.2) and the associated metadata (§ 3.1, 3.3 and 3.4). All the data are already available in the official FORGENIUS Repository (Microsoft Teams).

2 Introduction

This deliverable takes place in the context of task 1 of WP2: *Phenotypic characterisation and GenRes resilience to climatic extremes*. This task consists of characterizing environmental, site, stand and tree-level properties of a Functional Subset (FS) of Genetic Conservation Units (GCU), for which multi-trait phenotypic and genomic diversity will be determined. This deliverable aims at providing a database of relevant field phenotypic properties for the GenRes collection.

The data and samples collection are spread over a period of 4 years. This report (§. Results) focuses on the first 2 years of the field data collection. The second data package will be delivered at the end of the data collection.

The data provided in this D2.1 have been collected in the field by the WP2 mobile team composed of INRAE and CREAM personnel¹: Nicolas MARIOTTE⁽¹⁾ - Pierre-Jean DUMAS⁽¹⁾ - Joan PRUNERA⁽²⁾ - Ana HERNANDEZ⁽²⁾ - Didier BESOMBES⁽¹⁾ - Marianne CORREARD⁽¹⁾ - Marion PARIZAT⁽¹⁾ - Marti SOLE⁽²⁾ - Lucas ANTUNES⁽³⁾ and Florence JEAN⁽¹⁾ with the support of the FORGENIUS local partners in every country (§ 5). For the duration of the FORGENIUS project,

¹ (1) INRAE Avignon (France) - (2) CREAM Barcelone (Spain) - (3) INRAE Clermont-Ferrand (France).

Nicolas MARIOTTE, as technical reference, provided training courses in forestry measurement techniques and intercalibration for the whole team. Pierre-Jean DUMAS, Joan PRUNERA and Florence JEAN were responsible for organising and taking charge of the fieldwork in some GCUs. Florence JEAN was responsible of the logistic of this task: T2.1.

this WP2 team is charged with carrying out field measurements and sampling of biological material² on a subset of European Genetic Conservation Units: 10 species x up to 15 plots/species, as initially planned. The list of the 10 species³ and GCUs were preselected by the project's coordinator: Ivan SCOTTI in agreement with the WPs leaders. This list was partly amended because of technical difficulties encountered in the laboratory in measuring the vulnerability to cavitation (one type of hydraulic trait) of *Quercus robur*. This tree species has a particular wood anatomy characterized by very long vessels, which impedes the correct execution of our standard laboratory measurement protocol. For the same reason, *Fraxinus excelsior* and *Quercus ilex* (with the same wood anatomy characteristics) will be excluded and replaced by *Abies alba* and *Pinus halepensis* for the upcoming 2024 campaign (see table 1).

The number of GCUs initially planned was up to 15 per species. For logistical reasons (particularly increased costs, which had an impact on all other aspects of the planning: travel scheduling⁴, handling seasonality of sampling to avoid risks of cold weather in Nordic countries and severe water stress in Mediterranean countries, and risks of accidents linked to physical fatigue -climbing trees and long journeys), the number of GCU was slightly reduced, particularly in 2023.

Date of collection	Species	Number of GCUs
2021		
Spring	<i>Populus nigra</i>	15
Autumn	<i>Pinus pinaster</i>	12
2022		
Spring	<i>Fagus sylvatica</i>	15
Autumn	<i>Pinus sylvestris</i>	14
2023		
Spring	<i>Quercus robur</i>	13
Autumn	<i>Picea abies</i>	12
2024		
Spring	<i>Abies alba</i>	10
	<i>Malus sylvestris</i>	3
Autumn	<i>Pinus halepensis</i>	12
	<i>Pinus pinea</i>	6

Table 1 (See the annex 1 for the detailed list of WP2 GCUs)

² After collection, all biological samples were shipped to the different Forgenius laboratories for measurement of structural, physiological and biochemical traits of leaf and wood : economics, water relations traits (CREAF, INRAE Clermont-Ferrand), and hydraulics traits representing the resistance to severe water stresses (INRAE, Bordeaux). Wood samples were also shipped to INRAE-Orleans and CETEMAS-Madrid for additional micro-densitometry and infra-red spectroscopy analyses. Leaf samples were also shipped to CNR-Florence for sequencing and genotyping.

³ Grant Agreement number: 862221 — FORGENIUS — H2020-SFS-2018-2020 / H2020-SFS-2019-2 § 1.3.4, p 9.

⁴ See the WP2 fieldwork schedule in the official FORGENIUS Repository (Microsoft Teams).

For 2024, also note that the sampling in two species (*Malus sylvestris* and *Pinus pinea*) appears to be severely reduced but in fact reflects almost the entire span of available GCUs for these two species (the other GCUs being very close to those chosen).

In each GCU, field data were collected to document both the morphometric properties of individual trees (later sampled for biological material) as well as the environmental and biological conditions of the entire GCU:

- For individual trees:
 - All Phenotypic data and biological samples were collected on 10 trees representing a Functional Subset (FS) employed for morphological, physiological, and biochemical trait characterization.
 - Genomic samples were collected on 25 Genomic Subset (GS) trees. These include the 10 FS trees plus 15 additional trees, for which additional measurements (coordinates and tree circumferences) were also taken.
- At GCU level, two types of data were collected:
 - A forestry inventory was carried out inside a representative circular plot around one of the FS trees. These forestry inventory data were employed to determine measurements of stand density (species composition, number of trees, basal area per species and all species combined, and separately for live and dead standing trees),
 - A second forest inventory was carried out to describe various forest characteristics (forest stand structure, composition, evidence of regeneration, dieback) and obtain relevant environmental descriptors (for soil, topography and microtopography) in the same circular plot. Soil samples were taken across the plot to quantify soil structure and texture.

Field measurements and sampling were carried out using standardized methodologies developed jointly by INRAE/CREAF based on modified protocols from earlier projects (e.g., Gentree, H2020, European Union' Horizon 2020 project, B. Fady). Please see the WP2 guideline in Annex 2 and the WP2 protocol in the official FORGENIUS Repository (Microsoft Teams).

3 Results

3.1 The Read-me document

The README document⁵.

The documentation of a dataset should be sufficient to enable any user to understand and evaluate its quality. The README document provides complementary and accessible information that is not systematically provided through the dataset's metadata, and its file's metadata, and/or associated files.

This document contains the following information:

- General information on the dataset: title, contact email, DOI (if one exists).
- Methodological information: Environmental/experimental conditions, description of sources and methods used to collect and generate data, methods for processing the data, quality-assurance procedures performed on the data, other contextual information.
- Data & File overview: file naming convention, file hierarchy convention.
- Data-specific information with the dictionary of the dataset: variable/Column List, for each variable or column name, with full “human readable” name of the variable, description of the variable, unit of measurement if applicable, decimal separator, allowed values: list of values or range, or domain, format if applicable, e.g. date, missing data codes.
- Additional information: Any relevant information considered useful to better understand the file.

Please see the annex 2 for the detail of the readme_WP2_field_data_for_EUFGIS.txt document.

3.2 The datasets

The datasets have been summarized by species to provide relevant information of phenotypic properties for both the EUFGIS database and, simultaneously, for deliverable D2.1. Data are stored according to the Data management Plan in the project's data repository run by partner EFI.

⁵ This document is based on an INRAE reference document : <https://science-ouverte.inrae.fr/fr>

3.3 The dataset's metadata

The (conceptual) dictionary employed to define and explain the meaning of all the measured variables corresponds to the EUFGIS dataset contained in the online table: *characterization-descriptors.xls* constructed by the WP5 team (Milko Škofič and Marjana Westergren, WP5 leader).

This table gives information on each variable: name, description of the variable, unit of measurement if applicable, allowed values: list of values or typical range, format if applicable. The table aims at providing a (conceptual) dictionary to allow interpretation and use of the EUFGIS database (see WP5 and WP6).

3.4 The file's metadata or associated files

Additional information regarding WP2 protocols, traceability of the data and sample collection, traceability of data management, fieldwork schedules and list of WP2 GCUs, is stored in the documentation available on the project's data repository run by the coordinator.

4 Conclusions and prospects

These first two years of the project have been particularly demanding for WP2 in terms of:

- Ensuring data quality: we conducted yearly fieldwork training courses and regular intercalibration campaigns. An additional challenge has been to bring together the teams from two different institutions.
- Optimising fieldwork schedules, considering both biological, seasonality and logistical constraints.
- Ensuring post-sampling data documentation and sample collection traceability.

These difficulties were more accentuated during the first two years of the project, partly because of the need to adjust and synchronise all protocols, and partly because WP2 sites were then common to both WP3 (with samples collected, as mentioned above, for micro-densitometry and near-infra-red spectroscopy analyses) and WP4 (with samples collected for genomic analyses). This meant that particular attention had to be paid to the type and number of samples collected, the correct naming of the GCUs and the samples and to the overall organization of the fieldwork, sampling, and shipping to several laboratories.

5 Potential uses of the dataset

The dataset presented here serves multiple purposes. Firstly, it helps to characterise each of the sampled GCU by providing novel new information on the health state of a well-characterised sample plot within a typical area of the GCU, whose coordinates were recorded. This allows revisiting the area during future project to determine whether changes have taken place in the state of the area. Secondly, the information presented here will be used to populate the EUFGIS database allowing users to interrogate the database searching for particular forest conditions within the network of the sampled plots. Thirdly, the dataset presented here will be essential in informing all the scientific analyses conducted on the ensemble of the project dataset, both phenotypic and genomic. It will allow statistical analyses to consider the potential influence of both abiotic and biotic conditions on the diversity of phenotypic and genotypic traits measured. These data will also be a required input for all the process-based models carried out for various purposes by the Forgenius modelling teams, especially as part of the deliverables of WP1. The data presented here will also be employed for the analysis of genomic datasets and for the calculation of the multi-dimensional vulnerability indices developed as part of WP3.

It is foreseen that a data paper will be developed at the end of the project to make sure that the data contained in this deliverable are made publicly available.

6 Partners involved in the work.

INRA, CREAM, BFW, CNR, GIS, INCDS, Luke, TöGU, UKRI, FR, UMR

7 Annexes

7.1 Annex 1: list of WP2 GCUs performed in 2021 and 2022

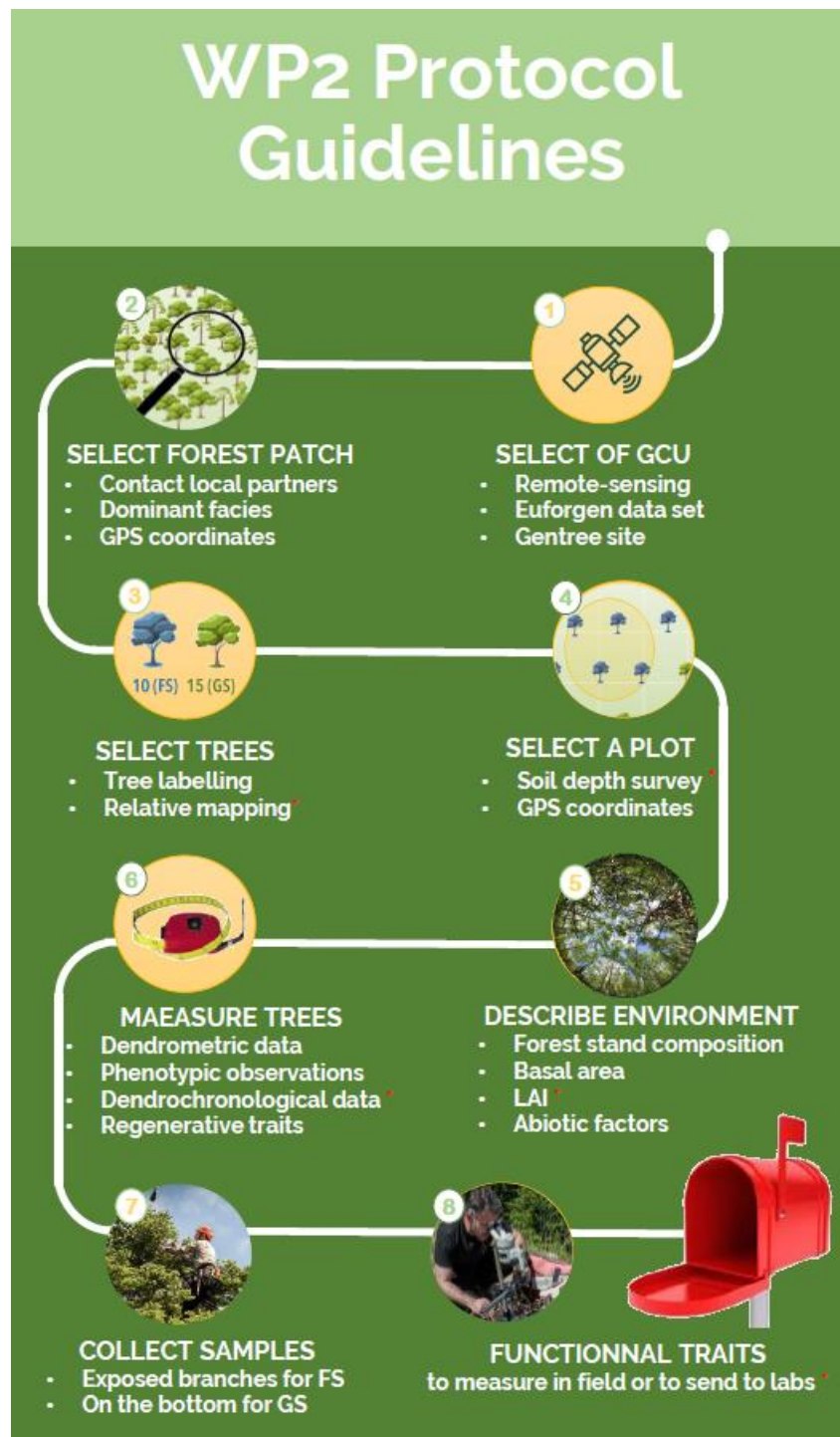
species	GCUCode	latitude	longitude	Unit Local name	GENSAE	comments
Populus nigra	AUT00284	48.132793024	16.620269	Nationalpark Donau-auen		<i>WP3 site (GCU in progress in 2021 = former code = AUP051)</i>
Populus nigra	DEU00140	48.0483333	12.795833	Doru	Cool and moist ? J	
Populus nigra	ESP00072	38.240006	-1.479076	Cieza	Warm and dry - L	
Populus nigra	ESP00073	38.279177	-1.73269	Moratalla	Warm and dry - L	
Populus nigra	ESP00141	40.391667	-4.720564	valuenga	Warm and moist - K	<i>replace ESP00201 removed not sustainable</i>
Populus nigra	ESP00360	42.181655	-1.758906	Alfaro	Warm and moist - K	<i>only 7 trees</i>
Populus nigra	ESP00395	41.584117	-0.762574	Pastriz	Warm and moist - K	
Populus nigra	FRA00073	44.7495068	4.91595269	R.N._des_Ramières	Warm and moist - K	
Populus nigra	FRA00074	46.436111111	3.33277777	R.N._du_Val_d'Allier	Cool and moist ? J	
Populus nigra	FRA00096	46.4018694	6.51726944	Reserve_du_delta_de_la_Dranse	Cool and moist ? J	
Populus nigra	FRA00102	44.8939798	3.91808851	Goudet	Cool and dry - HI	<i>replace FRA00072 close to FRA00074</i>
Populus nigra	ITA00045	45.2091666	9.05833333	Integrate_tural_biogenetic_reserve_of_Sir o_Negri	Warm and moist - K	
Populus nigra	ROU00189	43.9996693	26.2132618	Gostinu	Cool and dry - HI	
Populus nigra	ROU00337	43.7052215	24.7453417	Prundu_Lung	Cool and dry - HI	

Populus nigra	SVN00043	46.6061111	16.1408333	Saparyevo	Cool and moist ? J	
Pinus pinaster	ESP00050	36.565385	-5.401339	Cortes de la Frontera	Warm and moist - K	
Pinus pinaster	ESP00089	38.969765	-0.360241	Quatretonda	Warm and dry - L	
Pinus pinaster	ESP00112	40.029711	-0.643612	Pi de Montalgrao	Cool and moist ? J	
Pinus pinaster	ESP00120	40.000387	-5.622922	Talayuela	Warm and dry - L	
Pinus pinaster	ESP00128	40.331166	-4.351077	San Martin de Valdeiglesias	Cool and dry - HI	
Pinus pinaster	ESP00129	40.192927	-5.121748	Guisando	Warm and moist - K	
Pinus pinaster	ESP00186	41.334603	-4.248697	Cuéllar	Cool and dry - HI	
Pinus pinaster	FRA00048	44.0491111	-1.302361	F.D._de_Lit_et_Mixe	Warm and moist - K	
Pinus pinaster	FRA00051	44.9635	-1.1649722	F.D._de_Lacau	Warm and moist - K	
Pinus pinaster	FRA00105	44.41	-1.24	Fontfroide	Warm and moist - K	
Pinus pinaster	ITA00019	43.13	11.25	Tocchi,_Poggio_Tagliato	Warm and moist - K	<i>ITA00019 and not ITA00172</i>
Pinus pinaster	ITA00267	43.8230556	7.7075	Seborga	Warm and moist - K	<i>replace ITA00060</i>
Fagus sylvatica	AUT00207	47.5536111	14.8441666	N^rdl. des Urwirtsgraben; n^rdl. Anschluß an EE 1a - Abtlg. 9 R,P,Q,X	Cold and moist ? EG	<i>replaced AUT00206</i>
Fagus sylvatica	DEU00071	51.7225	9.67416666	Hilwartshausen	Cold and moist ? EG	
Fagus sylvatica	ESP00179	41.232179	-3.351306	Cantalojas	Cool and dry - HI	
Fagus sylvatica	ESP00225	42.635059	-7.14431	Folgosos do Courel (Galicia)	Warm and moist - K	
Fagus sylvatica	ESP00263	43.046771	-1.876888	Larraun	Cool and moist ? J	<i>ESP00220 removed because close to ESP00263 replaced by ESP00225</i>

Fagus sylvatica	FRA00029	41.85	9.1166666	FD_de_Coscione	Cold and moist ? EG	
Fagus sylvatica	FRA00042	46.1330994	-0.3733635	FD_de_Chizé	Warm and moist - K	
Fagus sylvatica	FRA00045	44.900	5.233	FD de Léoncel	Cold and moist ? EG	<i>replace FRA00032 Valbonne and then Aigoual WP3 site</i>
Fagus sylvatica	FRA00046	49.416666	0.7166666	FD de Brotonne	Cool and moist ? J	<i>replace the pending UK GCU</i>
Fagus sylvatica	ITA00178	39.3833333	16.1	Cinquemiglia,_Piano_d'Albero, Serra Nicolino	Warm and moist - K	
Fagus sylvatica	NOR00005	59.1958	10.0497222	Larvik, Brånakollene	Cold and moist ? EG	<i>replace the pending UK GCU</i>
Fagus sylvatica	ROU00077	45.980	23.012	Certej-Varmaga	Cool and dry - HI	<i>replaced ROU00470 too fragmented</i>
Fagus sylvatica	ROU00467	45.9376531	22.4552944	Valea_Seaca	Cool and moist ? J	
Fagus sylvatica	SVN00047	46.4317	13.61587	Planina Mangart (Bovec)	?	<i>replaced SVN00007</i>
Fagus sylvatica	TUR00264	41.7658333	27.6616666	KURUDERE	Cool and dry - HI	
Pinus sylvestris	AUT00032	46.65	13.7	Rot- u. Weißlahna; bis zur oberen Forststraße - Abtg. 8/5 bis 8/28	Cool and moist ? J	<i>this GCU common with Picea abies GCU</i>
Pinus sylvestris	DEU00011	52.9747222	13.6711111	Kienhorst	Cool and dry - HI	
Pinus sylvestris	ESP00113	40.127278	-1.008501	Camare de la Sierra	Cool and dry - HI	<i>ESP00135 close to ESP00113 ESP00135 removed</i>
Pinus sylvestris	ESP00170	40.994933	-3.823402	Aldealengua de Pedraza	Cold and moist ? EG	
Pinus sylvestris	ESP00393	37.082059	-3.467762	La Cortijuela (Monachil)	Cool and moist ? J	
Pinus sylvestris	FIN00001	61.8611166	29.3816833	Patasalo	Cold and moist ? EG	
Pinus sylvestris	FRA00097	43.35	5.865	FD_de_Mazaugues	Warm and moist - K	
Pinus sylvestris	FRA00101	45.402138	3.696701	Forêt_Syndicale_SMGF_d'Arlanc	Cool and moist ? J	

Pinus sylvestris	GBR00001	57.6047222	-5.3119444	Beinn_Eighe_NNR	Cool and moist ? J	<i>Initially 3 sites selected in GBR but still pending GCU in autumn_ one of this site replaced by ITA00155</i>
Pinus sylvestris	ITA00155	44.5	10.5	Crostolo, Casina,	Cool and moist ? J	
Pinus sylvestris	ITA00198	46.55	11.533333333	Landro,_Gemark_Cimabanche	Cool and dry - HI	
Pinus sylvestris	ROU00415	47.3305078	25.3737762	Tinovul_Mare	Cold and moist ? EG	<i>Pinus sylvestris GCU common with Picea abies GCU</i>
Pinus sylvestris	TUR00027	40.7916666	31.55	BOLU	Cool and dry - HI	
Pinus sylvestris	TUR00179	38.7280555	36.2263888	Pinarbasi	Cool and dry - HI	

7.2 Annex 2: WP2 protocol guidelines



7.3 Annex 3: readme_WP2_field_data.txt

readme_WP2_field_data_for_EUFGIS.txt Version: V1

This README file was generated on 2023-12-08 by Florence JEAN

Last updated: 2023-12-08

GENERAL INFORMATION

Dataset title: EUFGIS_WP2_field_data_species.xls

Contact email: m.mencuccini@creaf.uab.cat (WP2 leader) / florence.jean@inrae.fr (T2.1 leader)

METHODOLOGICAL INFORMATION

Environmental/experimental conditions:

These data have been collected by the WP2 mobile team composed of both INRAE and CREAM people: Nicolas MARIOTTE (1) - Pierre-Jean DUMAS (1) - Joan PRUNERA (2) - Ana HERNANDEZ (2) - Didier BESOMBES (1) - Marianne CORREARD (1) - Marion PARIZAT (1) - Marti SOLE (2) - Sonia HERNANDO (2) - Lucas ANTUNES (3) and Florence JEAN (1) with the support of the FORGENIUS local partners in every country.

This team carried out all the field measurements and sampling of biological material on a subset of European Genetic Conservation Units (GCU) (10 species x up to 15 plots/species).

(1) INRAE Avignon (France)

(2) CREAM Barcelone (Spain)

(3) INRAE Clermont-Ferrand (France)

In each GCU, field data were collected at either individual or GCU level.

At individual level:

- All the Phenotypic data and biological samples were collected on the 10 Functional Subset (FS) trees for physiologic trait characterization,
- Some measurements (coordinates and tree circumference) and genomic samples were collected on the 25 Genomic Subset (GS) trees (the 10 FS trees + additional 15 trees).

At GCU level, two types of data were collected:

- one corresponding to the forestry inventory (carried out in a circular plot around one of the FS trees) from which the basal area was calculated (per species or all species combined),
- and another one with general stand forest descriptions (forest stand structure and composition) and environmental descriptions (soil descriptors, aspect, microtopography) described in the same circular plot.

Description of sources and methods used to collect and generate data:

The field measurements and sampling were carried out using standardized methodologies developed jointly by INRAE/CREAF and based on a modified Gentree protocol (H2020, European Union' Horizon 2020 project, B. Fady).

Please see the WP2 protocol in the FORGENIUS Repository (Microsoft Teams).

Methods for processing the data: step by step

The datasets are structured in a simple flat-file format (.xls or .csv).

The raw data collected in the field are uploaded in a specific folder in the official FORGENIUS Repository (Microsoft Teams).

These "raw data" were subsequently formatted into "curated data" using a specific format (.xls) and a common dictionary for the names and the description of the variables.

These curated data were uploaded in a specific folder in the official FORGENIUS Repository (Microsoft Teams).

For these respective folders: Raw_data and Curated_data, several subfolders were created for each of the traits, or the object measured:

So that, the subfolder names pertaining to the WP2 field data are:

- "FS_trees" for the data at individual level (see § ## Environmental/experimental conditions)
- "Plot" for the data at GCU level

The data were subsequently cleaned (data consistency and graphical error checking) using R basic routines available in the official FORGENIUS Repository (Microsoft Teams).

All these data were compiled by species in a single Excel spreadsheet with several sheet tabs, to serve as a dataset for the analyses and scientific objectives of WP2 workgroup (see the § # DATA & FILE OVERVIEW) and for the other WPs.

They are available in the official FORGENIUS Repository (Microsoft Teams) in the specific folder WP2\Total_field_data_per_species

This dataset was simplified to provide a relevant dataset of phenotypic properties for the EUFGIS database and by the same way for the deliverable: D2.1.

See the official FORGENIUS Repository (Microsoft Teams) and the specific folder WP2\Deliverables\D2.1

Quality -assurance procedures performed on the data:

An initial workshop was carried out at the start of the project in 2021:

- to ensure homogeneity in the field data and sampling collection (intercalibration of measurements within the WP2 mobile team)
- to be in accordance with the laboratory measurements
- to meet scientific purposes.

The WP2 protocol was tested and calibrated yearly by the WP2 mobile team together with Maurizio MENCUCCINI (WP2 leader) at the start of each field measurement campaign in spring or autumn (in 2021 and 2022) for each species.

Other contextual information:

Relevant comments or remarks are available inside each file for more information on the data.

DATA & FILE OVERVIEW

File format and file naming convention

(see § ## Methods for processing the data: step by step)

-> Regarding the dataset for the deliverable: D2.1

See the official FORGENIUS Repository (Microsoft Teams) and the specific folder WP2\Deliverables\ D2.1

The file format available is in a single Excel spreadsheet format (.xls) with 6 sheet tabs.

The file naming convention for:

The single Excel spreadsheet is: "EUFGIS_WP2_field_data_species.xlsx" (ex: EUFGIS_WP2_field_data_Fagus_sylvatica.xlsx).

The sheet tabs are at either GCU (plot) or individual level (trees).

The sheet tabs pertaining to this spreadsheet are:

- "EUFGIS_WP2_GCU_level_env_data" for the dataset of synthetic environmental and forest stand descriptors at GCU level
- "EUFGIS_WP2_GCU_level_env_metadata" for the metadata in the previous dataset
- "EUFGIS_WP2_GCU_level_inv_data" for the synthetic forestry inventory data
- "EUFGIS_WP2_GCU_level_inv_metadata" for the metadata in the previous dataset
- "EUFGIS_WP2_ind_level_data" for the synthetic phenotypic data at individual level (FS/GS trees)
- "EUFGIS_WP2_ind_level_metadata" for the metadata in the previous dataset

DATA-SPECIFIC INFORMATION

The dictionary of the EUFGIS dataset corresponds to the table: characterization-descriptors.xls created by the WP5 team (Milko Škofič and Marjana Westergren, WP5 leader) is available in the official FORGENIUS Repository (Microsoft Teams).

Missing data code:

The code used to indicate missing data is blank cell.

Decimal separator:

Point is used.

Additional information:

For more information on the FORGENIUS project (an H2020 project, funded by the EU):

Please see the FORGENIUS project on the website: <https://www.forgenius.eu/>

Please see the contractual documents with The Grant Agreement (GA) in the official FORGENIUS Repository (Microsoft Teams).

7.4 Annex 4: Correspondence of the variable names for WP2/WP5 datasets

WP2 variables	WP5 variables	Subject of data measurements
species	<i>species</i>	Individual level data (tree)
GCUCode	<i>gcu_id_number</i>	Individual level data (tree)
TreeCode	<i>chr_tree_code</i>	Individual level data (tree)
cbh	<i>chr_CircBreastHeight</i>	Individual level data (tree)
ht	<i>chr_Htot</i>	Individual level data (tree)
hbc	<i>chr_CrownHeight</i>	Individual level data (tree)
CrownArea	<i>chr_CrownArea</i>	Individual level data (tree)
dieback	<i>chr_Dieback</i>	Individual level data (tree)
dead_trees	<i>chr_DeadTrees</i>	Individual level data (tree)
rege	<i>chr_NaturalRegeneration</i>	Individual level data (tree)
age	<i>chr_age</i>	Individual level data (tree)
GCUCode	<i>gcu_id_number</i>	GCU level (Plot inventory)
species	<i>species</i>	GCU level (Plot inventory)
dead	<i>chr_Dead</i>	GCU level (Plot inventory)
g_ha	<i>chr_PlotBasalArea</i>	GCU level (Plot inventory)
GCUCode	<i>gcu_id_number</i>	GCU level (Environmental descriptors)
species	<i>species</i>	GCU level (Environmental descriptors)
date	<i>std_date</i>	GCU level (Environmental descriptors)
TreeCode	<i>chr_tree_code</i>	GCU level (Environmental descriptors)
LatPlot	<i>chr_measured_LatPlot</i>	GCU level (Environmental descriptors)
LongPlot	<i>chr_measured_LongPlot</i>	GCU level (Environmental descriptors)
ElevationPlot	<i>chr_measured_Elevation</i>	GCU level (Environmental descriptors)
structure	<i>chr_ForestStructure</i>	GCU level (Environmental descriptors)
composition	<i>chr_ForestComposition</i>	GCU level (Environmental descriptors)
LAI	<i>chr_LeafAreaIndex</i>	GCU level (Environmental descriptors)
slope	<i>chr_measured_Slope</i>	GCU level (Environmental descriptors)
aspect	<i>chr_measured_Aspect</i>	GCU level (Environmental descriptors)
topography	<i>chr_MicroTopography</i>	GCU level (Environmental descriptors)
Dsoil	<i>chr_Dsoil</i>	GCU level (Environmental descriptors)
Rooting_depth	<i>chr_Droot</i>	GCU level (Environmental descriptors)
percent_Coarse_element	<i>chr_PercentCoarseElement</i>	GCU level (Environmental descriptors)
methods	<i>soil_method</i>	GCU level (Environmental descriptors)