Manual for the use of the public EUFGIS portal.

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1. INTRODUCTION

This manual for the use of the public portal to the European Information System on Forest Genetic Resources (EUFGIS), provides guidelines on how to navigate through the portal in the most direct way and how to download reports and data. It provides guidelines on how to refer to the outcome of this portal when using it for publication. Viewing the portal does not need logging in, but for uploading and downloading data, it is required to registrate to the manager of the portal.

The portal has been designed in a logic and self-explaining way, making it possible to navigate through it without much guidance. Part of the guidance in this manual is also integrated in the portal itself. Definitions of the most important terminologies used in the Information System are given in a glossary. All indicators and specific terminology are explained in the portal through pop-up boxes that appear when clicking the buttons. Some links to main pages of the portal ℹ have been made interactive in the manual. These links are marked blue like **THIS**.

For those GCUs where part of the information is restricted, i.e. the coordinates of the site, the portal will show only the public information. Some of the data that has been produced by the FORGENIUS project will be under embargo. This data will become publicly available as soon as the embargo ends, latest 30.6.2027. This data will become publicly available from EUFGIS as soon as the embargo ends.

A feedback button in the upper right corner of every page of the portal brings you to a form to provide any kind of comments or suggestions. Clicking this button allows the user to comment directly on that specific page. This button will be active for some time after the new EUFGIS has been launched but will be removed later. Then feedback can be given by sending an email to euforgen@efi.int.

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2. GLOSSARY

- **Genetic Conservation Unit (GCU)**: a forest area that is formally designated to the protection of forest genetic resources (FGR) of one or more forest tree species. It is established to allow the full cycle of natural processes to occur with the conservation objective of dynamically conserving the evolutionary potential of the population
- **Dynamic conservation**: genetic conservation that emphasizes the maintenance of evolutionary processes within tree populations to safeguard their potential for continuous adaptation.
- **Target tree species:** The species within a GCU that are the goal for conservation and for which the management efforts for the purpose of genetic conservation are being carried out.
- **Population (within EUFGIS):** All the trees of the target species growing within the borders of a GCU.
- **Indicator**: A measurement or value that helps to describe the status of a GCU or its target population.
- **Remote sensing**: Obtaining information by the scanning of the earth by satellite or high-flying aircraft.
- **National Focal Point**: national authority who has the responsibility to compile data on dynamic genetic conservation units in their country and to provide the data to the information system.
- **Geo-referenced data**: data containing information on the location of the collected data.
- **Forest Genetic Resources**: the heritable materials within and among tree species and other woody plants (FAO, 2014a)
- **Vulnerability** (tag): The tag vulnerability states if an indicator is of relevance for estimating if a GCU or population is under a risk to be affected by biotic or abiotic threats.
- **Diversity** (tag): The tag diversity states if an indicator is of relevance for estimating the genetic or phenotypic diversity of a population.
- **Distinctiveness** (tag): The tag distinctiveness states if an indicator is of relevance for estimating in how unique a GCU or population is compared to other GCUs or populations from the same species.
- **Phenotypic**: the set of observable characteristics of an individual tree, such as height, form, etc., resulting from the interaction of its genotype with the environment.
- **Polygon**: The shape of a GCU based on the border line.

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- **Modelled**: Indicators that are the result of modelling with data available from either on site or remote sensing or a combination.
- ***In-situ***: When the GCU is located and managed at their natural sites within the environment to which the target populations are adapted to.
- ***Ex-situ***: When the GCU is artificially established and includes transplanted tree populations located outside the original source location of the population, within or outside of the natural distribution range of the target species.

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3. ACCESS AND REGISTRATION

The EUFGIS portal is open for everyone to browse and to view information on the individual GCUs and their target populations and to download graphs and reports. Registration is required for uploading and downloading reports and data. Uploading data is limited to the National Focal Points of each country, some FORGENIUS partners and the system managers. Downloading reports and data requires registration to ensure that the users of the data will agree with the conditions for using it, including making reference to EUFGIS when publishing results based on the data, as well as them being aware of any disclaimers concerning the data. In order to register the user should first click the green **REGISTER** button (see figure 1) on the top right of the homepage, which opens the sign-up page with a form to create a new user-profile.

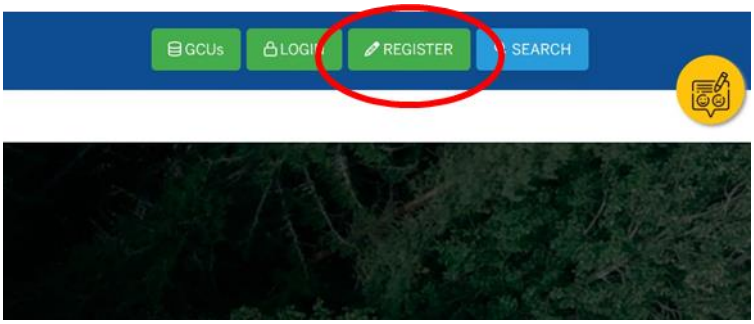

Figure 1.

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PRIVACY POLICY

This privacy notice informs about the information we collect when one registers to the EUFGIS Portal:

We are the European Forest Institute (EFI), and we are the data controller. Our address is Yliopistokatu 6 B | 80100 Joensuu | Finland. email EUFORGEN@efi.int.

When you submit the registration form to create a profile and to have access to the EUFGIS Information System, we ask you for the following information: Your name, surname, email address, affiliation, position and country. You will also create a password for logins. We use this information to know who is accessing EUFGIS and which actions are taken in the system, as well as to provide us with statistics on use. The information is stored on our database which is hosted in European Union.

The grounds for processing is that it is necessary for the purposes of the legitimate interests pursued by EFI. You can delete your profile at any time, but we will continue to process information related to your activities in the system for a period of 5 years. You can ask what information we hold about you and to correct it if it is inaccurate. Please address any enquiries and requests regarding data protection to dataprotection@efi.int

Data protection at EFI is regulated by the EFI Data Protection Rules (https://efi.int/data-protection).

After filling the registration form the user will receive an email with personal credentials to login into the system. Once registered a user can use the **LOGIN** button (see figure 2) to enter the system for every new session, using your email address and password.

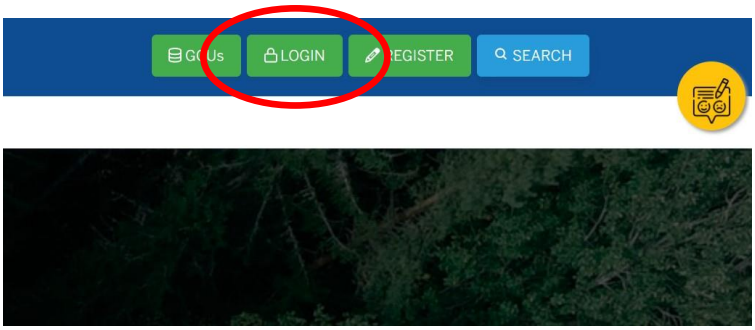

Figure 2.

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4. DISCLAIMER

By accessing the EUFGIS portal, you acknowledge and agree to the following:

- Each participating country retains full ownership of its respective national data.
- The availability and use of data are governed by a Data Sharing Agreement (DSA) between the contributing countries and the European Forest Institute (EFI), which hosts the EUFGIS portal.
- To download data or access project-specific visualizations, you must register with the EUFGIS portal and consent to the terms outlined in our Privacy Policy (see chapter 3).
- The EUFGIS portal is provided for informational and scientific purposes only. EFI and participating countries do not guarantee the completeness, accuracy, or currency of the data presented.
- Any use of the data should acknowledge EUFGIS and the original data providers in accordance with the applicable citation guidelines.
- Unauthorized commercial use, redistribution, or modification of the data is not permitted without prior written consent from the data owners.
- EFI reserves the right to update the content, access conditions, or terms of use of the portal at any time without prior notice.

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5. HOW TO GET STARTED

From the homepage **HOME** the user can go forward in different ways. At the top of the page there is a bar with different options to choose from (see figure 3).

Figure 3.

- **ABOUT** gives access to information on an overview of EUFGIS, the development of EUFGIS, Genetic Conservation Units and Data Standards.
- **DATA SOURCES** gives access to information on National Data Providers, Research Projects and Other Data Sources.
- **DATA** gives access to information on either the GCUs or the indicators. From both options one can continue select for specific GCUs or indicators. A third choice is comparison from where one can compare between different GCUs for several selected descriptors.
- **LINKED IS** gives access to pages with information on the link between EUFGIS and either FOREMATIS or GD^2.
- **STATUS OF CONSERVATION** provides access to the Forest Europe Indicator 4.6 reports. The user can choose to get reports on either country or species level.
- **GUIDE** gives access to the manual as well as to the protocols on making assessments and sampling within GCUs.

The homepage includes an interactive map of Europe showing every Genetic Conservation Unit (GCU) in the EUFGIS database. Clicking the mouse onto one of the dots opens a box with the code and name of the GCU. When continuing by clicking the VIEW button, the user will be directed to a page with the basic information for this particular GCU (see figure 4).

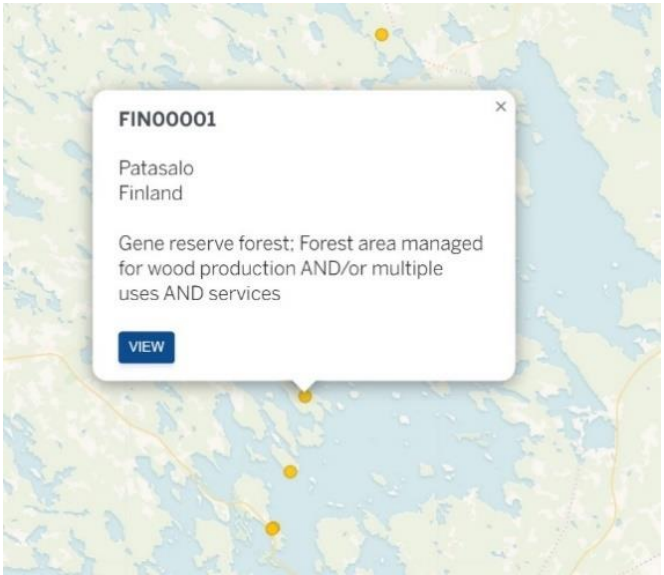

Figure 4.

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At the bottom of the homepage there are links to the five domains of characterization indicators that EUFGIS includes (see figure 5).

Figure 5.

It should be noted that most indicators are available only for a limited number of species and GCUs per species.

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6. SEARCHING FOR SPECIFIC GCUs

When looking for information on some specific GCU, there are three ways to go ahead from the **HOME** page (see figure 6):

- Clicking **TREE SPECIES** brings the user to the complete list of tree species that are included in EUFGIS. By choosing one species a list will appear with all the GCUs for which the selected species is marked as target species. From here one can also choose to show the GCUs for the selected species on a map, which shows besides the GCUs also the distribution area of the species.
- Clicking **COUNTRIES** brings the user to the complete list of countries that are included in EUFGIS. By choosing one country a list will appear with all the GCUs registered in that country. From here one can also choose to show the GCUs for the chosen country on an interactive map (see figure 7).
- Clicking the **SEARCH** button opens a list with criteria to select one or more GCU's the user is looking for.

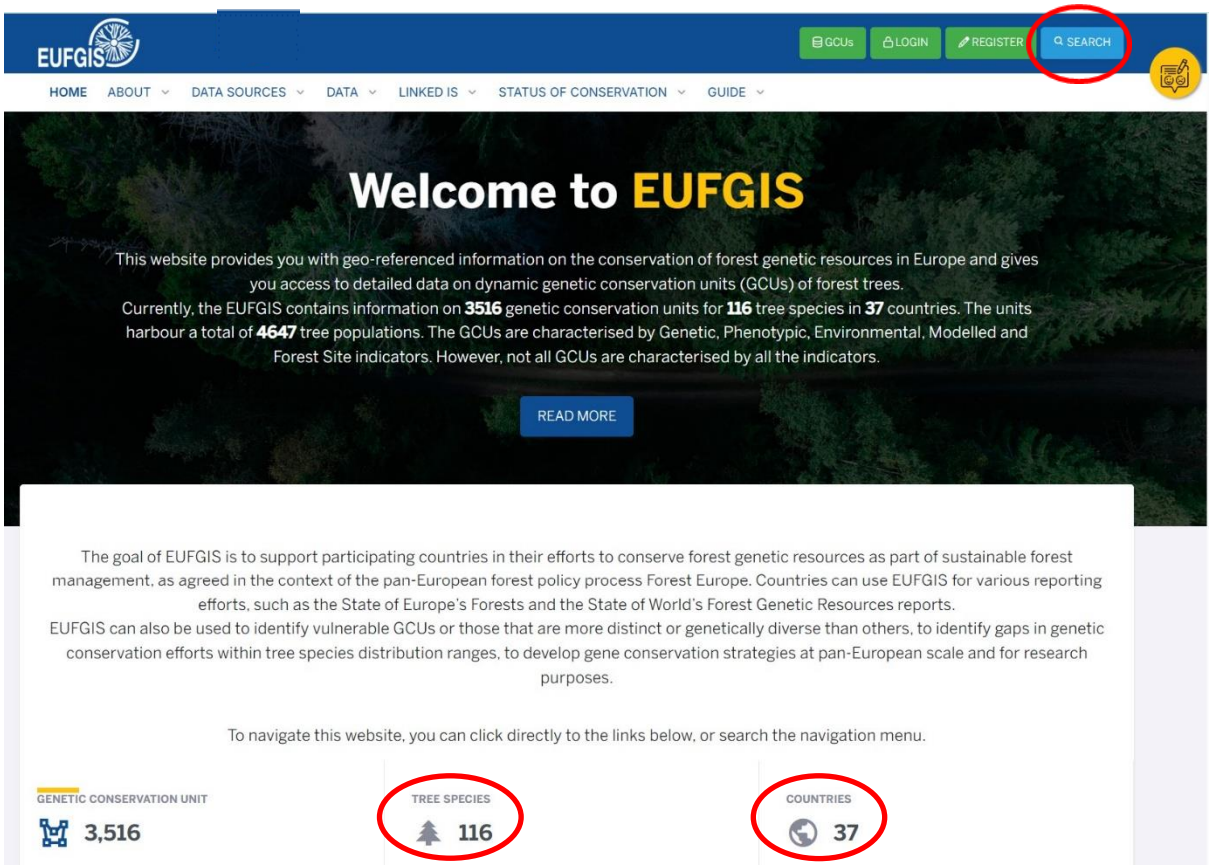

Figure 6.

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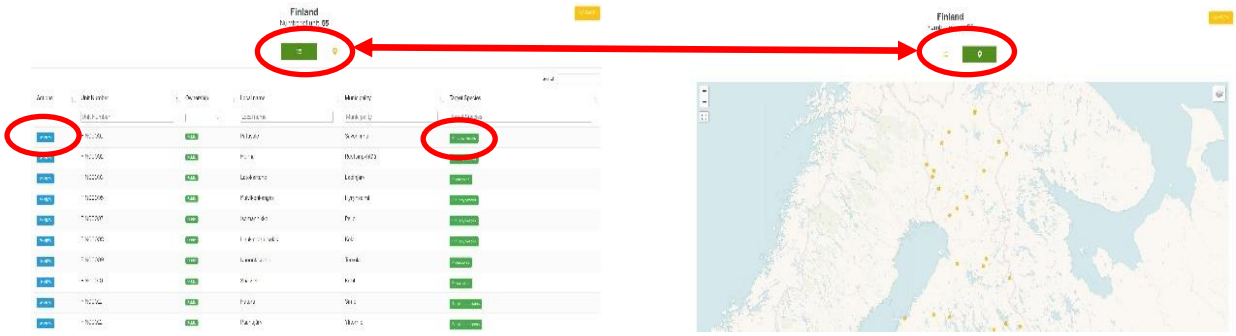

Figure 7.

When one selects a GCU by clicking **VIEW** from the country list, or by clicking on a GCU on the map (see figure 4), a page opens with the basic information on the GCU that has been provided by the National Focal Points (NFP) on the location of the GCU, the tree species included and GCU type (see figure 8).

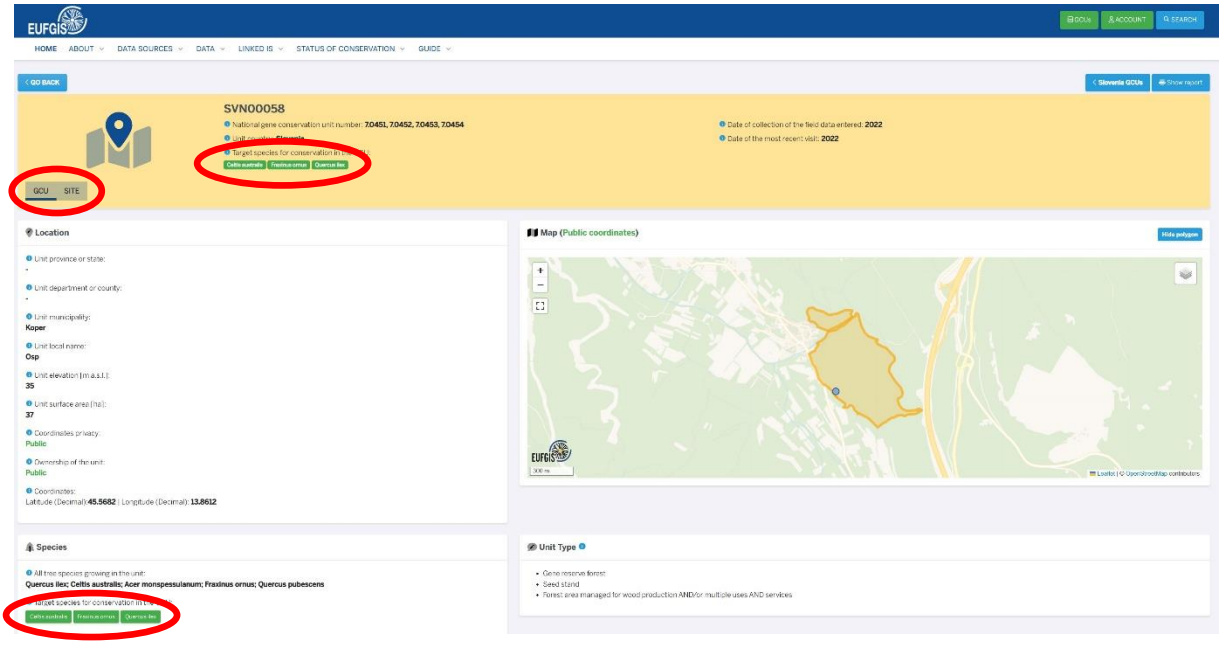

Figure 8.

This page also includes a map giving the location of the GCU and the polygon of the site, if publicly available. From this map the user can choose to either show or hide the polygon and choose the GCU location to be shown on a map or on a satellite image.

From the GCU page one can continue by selecting **SITE**. The SITE page provides more detailed information on the conditions of the site through **CLIMATE DATA, SURFACE DATA** and **ENVIRONMENTAL INFORMATION ON THE GCU**. The contents of the first two categories is obtained from external databases (see chapter 9), the contents of the third category is obtained from the FORGENIUS H2020 project. In this category one can choose between two datasets for respectively monthly and yearly values.

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By selecting one of the target species (see figure 8) two additional links are added to choose from (see figure 9): **POPULATION**, which directs to a page with the basic information on the target species provided by the NFPs, and **INDICATORS** which directs to a page from where one can choose a different group of indicators for the target population, namely **GENETIC, MODELLED, PHENOTYPIC, FOREST** and **ENVIRONMENTAL** (see chapter 7).

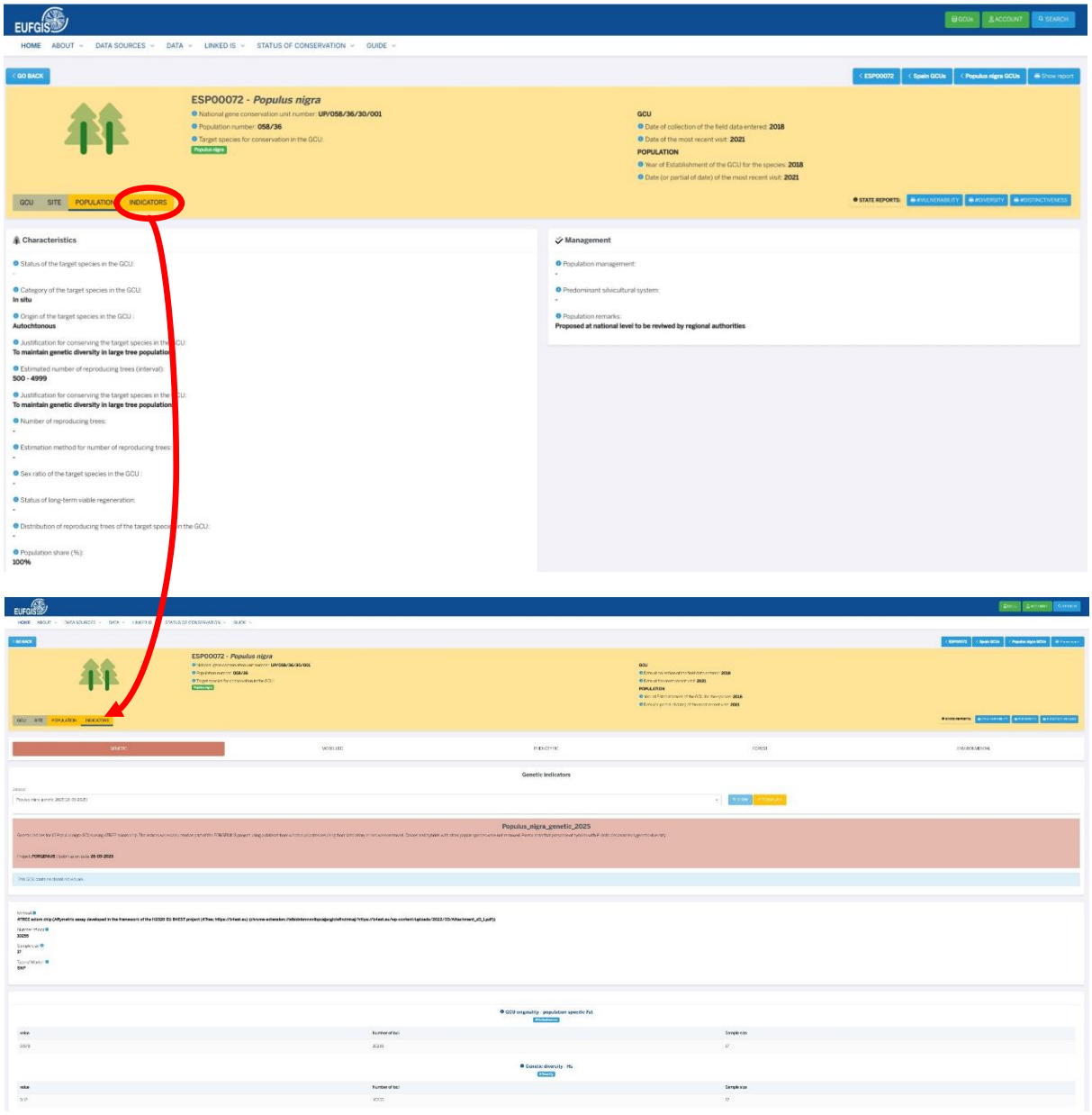

Figure 9

Guidelines on how to get reports on the basic information of a GCU and its target species can be found in chapter 11.

When one selects a GCU via the species list, or by clicking on a target species on the country list (see figure 10), the page including the links to the **POPULATION** and **INDICATORS** opens directly. These two different ways are needed because a GCU may cover more than one target species.

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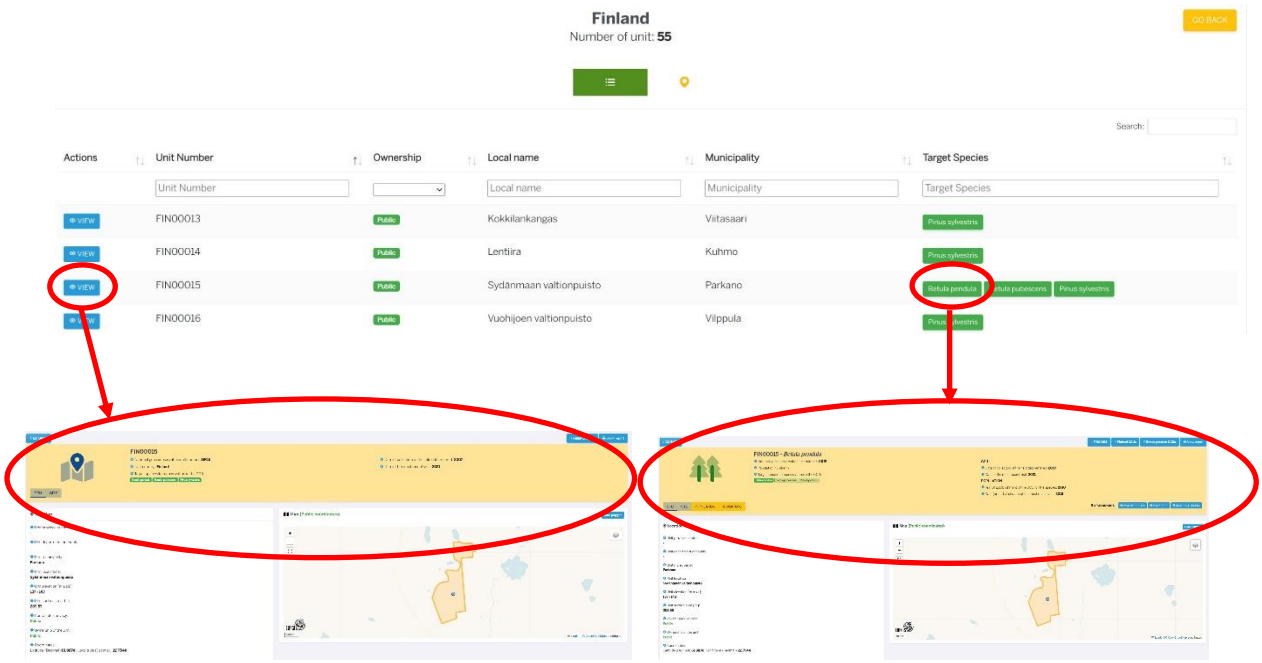

Figure 10.

The **POPULATION** page shows the basic information of the chosen target population in that specific GCU as it was provided by the NFPs on a number of characteristics and management type.

The **INDICATORS** page shows five groups of characterization indicators, **GENETIC, MODELLED, PHENOTYPIC, FOREST** and **ENVIRONMENTAL**. These indicators are available only for those species and GCUs per species that were assessed within the FORGENIUS project. Some additional data has been provided by national NFPs and obtained by national projects using the FORGENIUS protocols to ensure comparability of the data.

From the GCU pages there are several buttons for going back to different pages, avoiding having to go through a series of steps (see figure 11).

Figure 11.

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6.1. SEARCH BY COUNTRY

When one selects GCUs by country, either by clicking on COUNTRIES at the bottom of the home page or by clicking via the main menu on DATA>GCU, a page opens that shows a list with all the GCUs in the selected country. From this list one can easily refine the search by using the search terms on the top of the list for Unit Number, Type of Ownership, Local name, Municipality and/or Target Species. One can also use a free search term on the top left of the list. One can copy the final result list or download it as an Excel, CSV or PDF file (see figure 12).

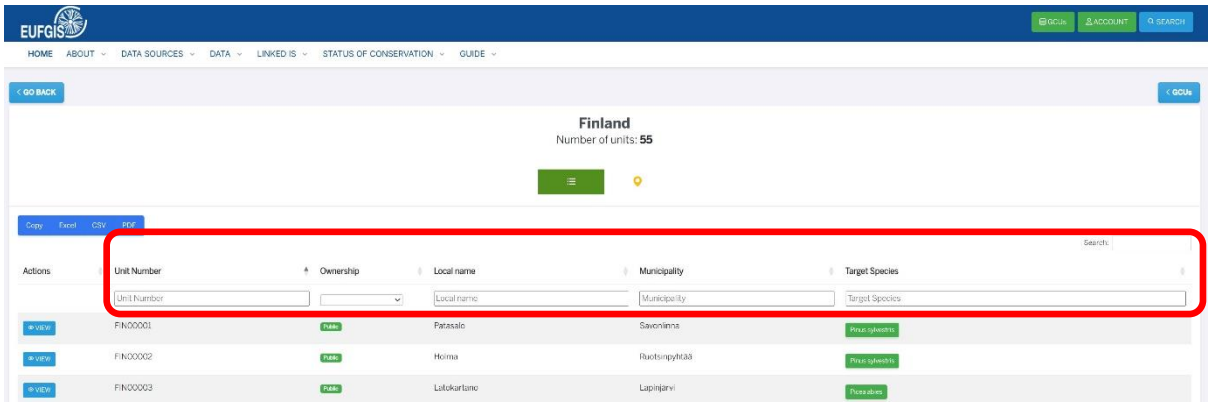

Figure 12.

6.2. SEARCH BY SPECIES

When on selects GCUs by species, either by clicking on SPECIES at the bottom of the home page or by clicking via the main menu on DATA>GCU, a page opens that shows a list with all the GCUs that have the selected tree species a target species. From this list one can easily refine the search by using the search terms on the top of the list. When using the term Unit Number one can also write only the country abbreviation, e.g. ESP for Spain, to get a list with all the GCUs for the species in Spain. One can also select GCUs for the selected species that have values for one or more of the five groups of indicators. One can copy the final result list or download it as an Excel, CSV or PDF file. (see figure 13).

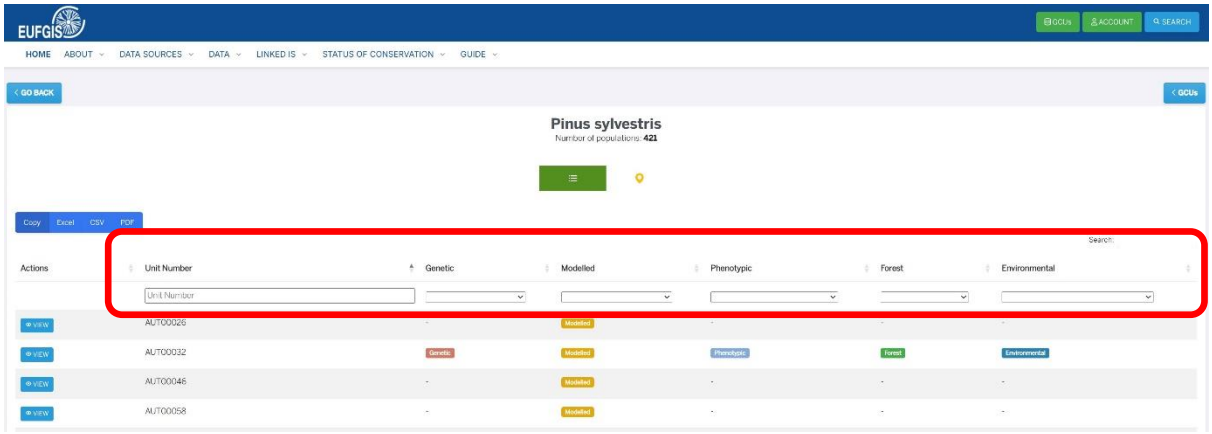

Figure 13.

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7. SEARCH BY INDICATORS AND/OR TAGS

The GCUs and/or the target populations are described on the basis of a list of indicators. All indicators are described extensively in a Data Dictionary. A summary list of all indicators with a short description, their domain and whenever applicable their unit and tags, can be found in Appendix 1 of this manual.

A list of all the indicators can also be found from the main menu **ABOUT > DATA STANDARDS**. Here the indicators are divided over 7 domains: **GCU, POPULATION, GENETIC, MODELLED, PHENOTYPIC, FOREST** and **ENVIRONMENT**. The domains **GCU** and **POPULATION** contain the indicators on the basic characteristics of a GCU site and the target population and are provided by the National Focal Points.

The other 5 domains cover the indicators provided by the FORGENIUS project or from external databases. When choosing one domain a list of indicators opens that provides for each indicator its Global Identifier, an Alias, a short description, the Data type and the Level of the indicator. Under the short description it also shows the tag(s) of the indicator. When a more extensive description of the indicator is available, it opens when clicking **More**. This same extensive description pops up when checking the values for certain indicators for a certain GCU or its target species by clicking on the ⓘ button for the indicator (see figure 14). One can search directly for indicators from the main menu **DATA > INDICATORS**.

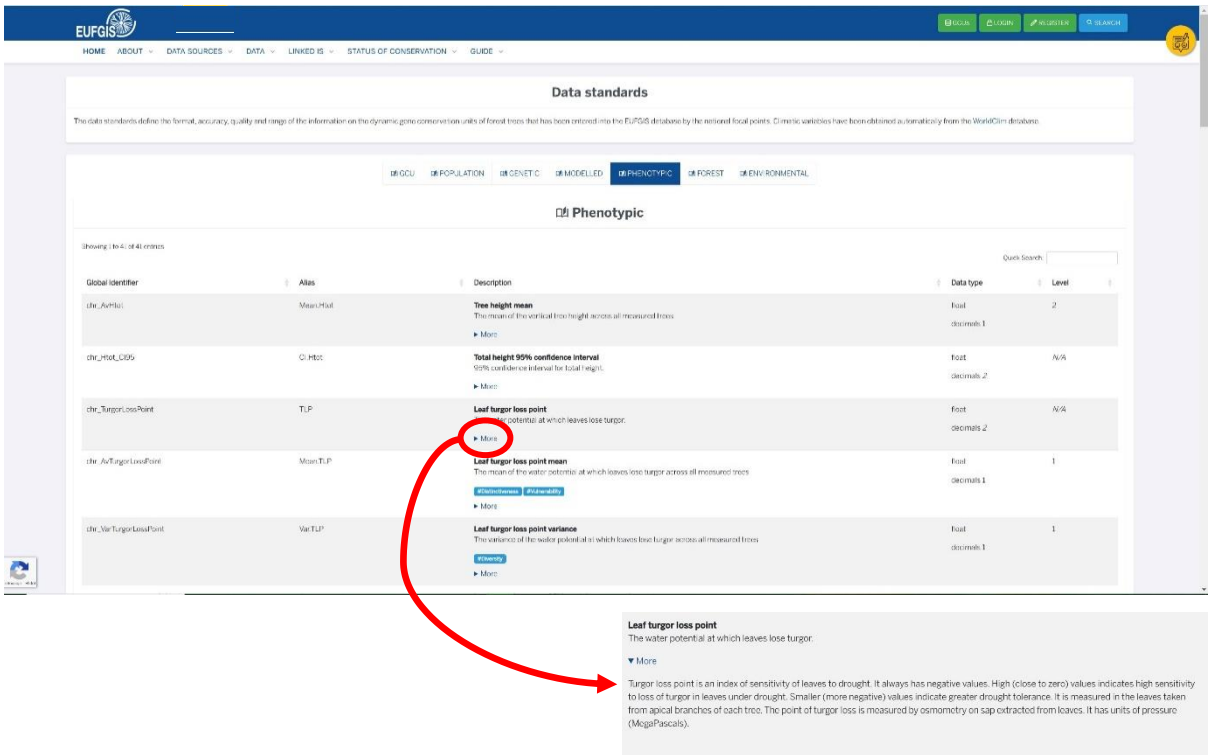

Figure 14.

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7.1. TAGS

Several indicators have been identified as being relevant to estimate the condition of the GCU or its target species in connection to **DIVERSITY, DISTINCTIVENESS** and/or **VULNERABILITY**. These indicators have been given a corresponding tag:

- **DIVERSITY** indicators show the genetic or phenotypic diversity of a population.
- **DISTINCTIVENESS** indicators show in how unique a GCU or population is compared to other GCUs or populations i.e. within a species or within a country.
- **VULNERABILITY** indicators show if a GCU or population is of risk to be affected by biotic or abiotic threats.

When selecting a GCU and one of its target species in the upper box three buttons appear:

STATUS REPORTS: **#VULNERABILITY, #DIVERSITY** and **#DISTINCTIVENESS**. When clicking on one of these buttons a new window opens showing a report with the basic information of the GCU as well as the values for those indicators that have been provide with the respective tag. This report can be printed or saved as a PDF-file. In case no indicators with a certain tag are available for a selected GCU and target population, the respective button is shown as disabled (blue text on transparent background).

7.2. TWO LEVELS OF INFORMATION

The information that is provided on the individual GCUs and target species, including indices, is presented in two levels. Both levels are open for everyone. The first level provides the general information and is very well explained in laymen's language and thus understandable for a wide audience. From the first level one can continue to the second level by clicking on the **+ SHOW MORE** button. This second level includes more specific information that often requires some background knowledge of the substance it concerns. This information is targeted to certain end users, such as researchers, and may therefore be somewhat less accessible for the general public. The information in the second level is presented only as data, not as graphs.

7.3. SEARCH BY INDICATOR

When starting by selecting from the main menu **DATA > INDICATORS** a page opens with some statistical information about five different groups of indicators and their availability: **ENVIRONMENTAL, PHENOTYPIC, GENETIC, MODELLED** and **FOREST**. By clicking VIEW for one of the groups a page opens with a list of the indicators that have been used so far (see figure 15). From the list one can select the indicator one is looking for by selecting **VIEW** again. A page opens with a description of the indicators, a list with all the GCUs for which this indicator is available, the value of the indicator and the target species for which the indicator is assessed as well as a list of tree species for which the indicator is available. By selecting a GCU, one goes to the page with the basic information on the site (see chapter 6). By selecting a species (see figure 15), a page opens with a map showing all the GCUs for that species in Europe. For those GCUs the indicator has been assessed the colour of the dot gives information on the value of the indicator for that GCU. As a default the values for the indicator are divided into five classes. However, one can adjust this by

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adding **&theNumSteps=x** to the URL (where x is the desired number of classes). For example: **https://beta.portal.eufgis.org/data/indicators/indicator?key=chr_Divergence&species=Abies%20alba&theNumSteps=10**. The map can be either saved or printed.

The page also has a table with the value for the indicator for all GCUs it has been assessed from. This table can be downloaded as an Excel sheet by clicking on the **Download data** button in the yellow heading of the page. The table can be filtered using the search option, for example by giving a country code, the list narrows down to the GCUs from that country only.

From the list of indicators one can also click on the number of species (see figure 15), and subsequently select a species from the list that appears in a pop-up box. This way one reaches directly the page with the map and list of values for that species.

The page that opens when selecting from the main menu **DATA > INDICATORS** also shows three boxes, one for each of the tags (see figure 16). When choosing **VIEW** from one of these boxes a page opens that lists the indicators available for this particular tag. By choosing **VIEW** again from here for one of the indicators listed, a page opens with a table showing the values for that indicator for all GCU where it is available from. This table can be downloaded as an Excel-file. From the list of indicators one can also see for how many species this indicator is available. After clicking on the number (green button) a pop-up box appears that lists the species, as well as the number of GCUs that has been assessed for that indicator. After choosing a species the same page with the map and list opens.

7.4. SEARCH BY TAG

The page that opens when selecting from the main menu **DATA > INDICATORS** also provides the opportunity to select indicators based on their tags. At the bottom of this page there are three boxes, one for each tag: **#DISTINCTIVENESS, #DIVERSITY** and **#VULNERABILITY** (see figure 16). By choosing **VIEW** from one of these boxes a list opens with indicators having this tag (see figure 16). Similar like for searching by indicators, by choosing **VIEW** again from here for one of the indicators listed, a page opens with a table showing the values for that indicator for all GCU where it is available from. This table can be downloaded as an Excel-file. From the list of indicators one can also see for how many species this indicator is available. After clicking on the number (green button) a pop-up box appears that lists the species, as well as the number of GCUs that has been assessed for that indicator. After choosing a species the same page with the map and list opens (see figure 16).

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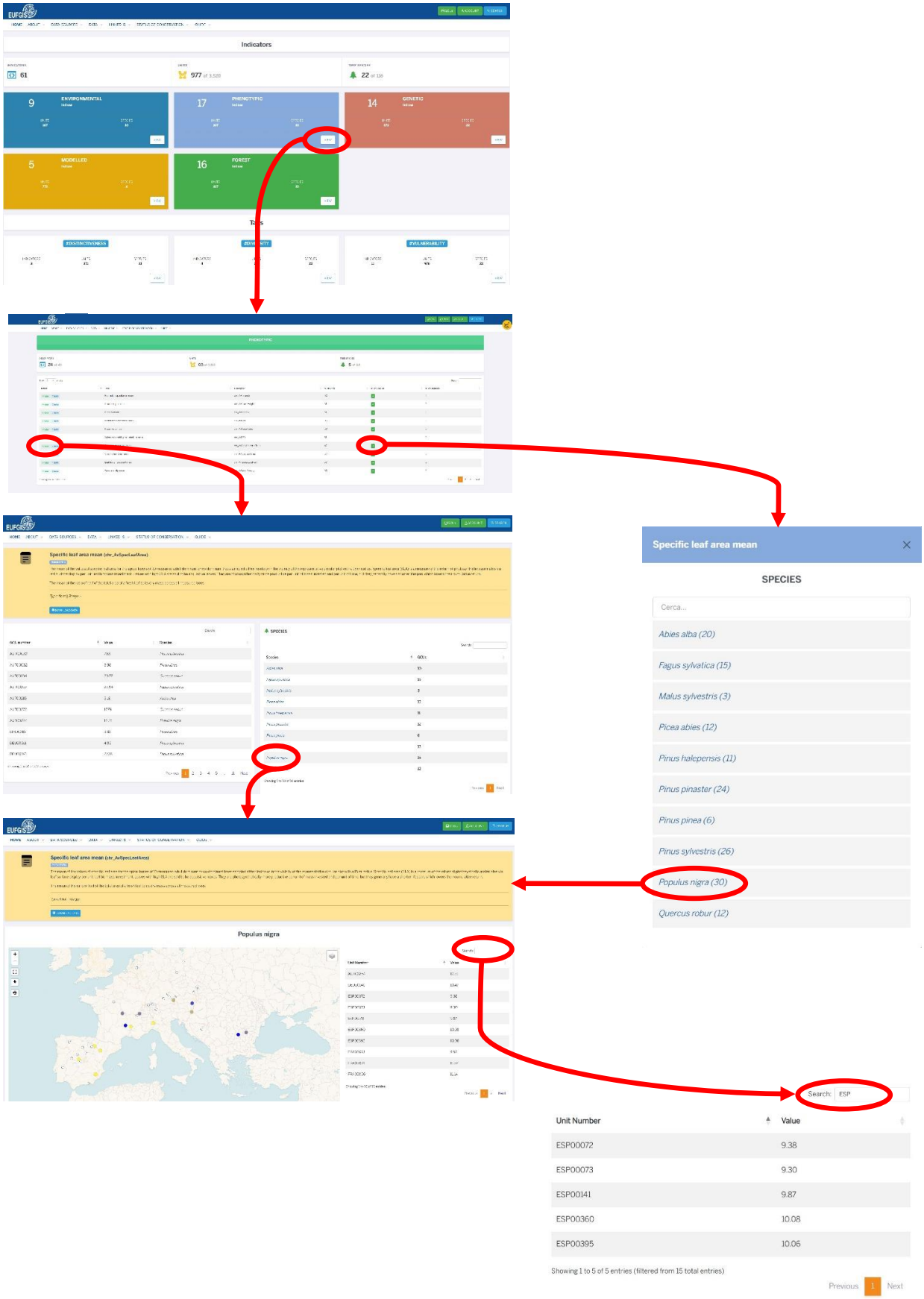

Figure 15.

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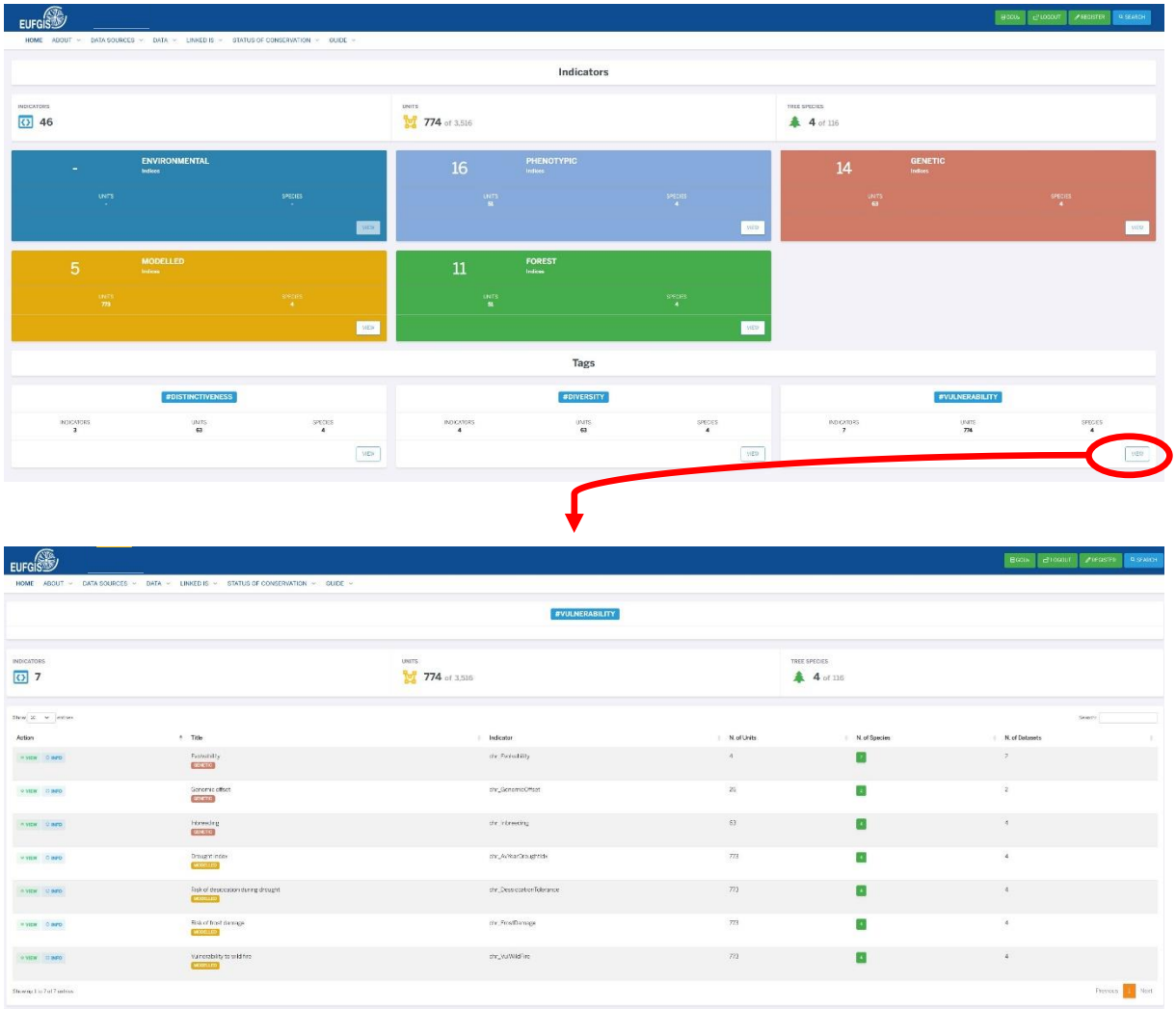

Figure 16.

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8. SEARCH OPTION: data filtering

The search option allows one to use multiple selection criteria to filter for GCUs with specific properties and/or location. Some of the criteria have multiple choice options, like country and target species, where others, like latitude and longitude, have open fields.

After having defined the criteria of the GCUs that one wants to be shown, the user will receive a list of GCUs that fit the criteria set by clicking on **SEARCH**. If the user selects more than one possibility for a certain criterion, for example two target species, the portal will show all GCUs that have either one of the species as target species as well as those having both. From the list shown the user can select one specific GCU by clicking on **VIEW**, which will bring one to the page with the general information of the GCU site. Alternatively, one can choose the target species of that GCU to go directly to the page with information on both the GCU and the target species population.

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9. LINKS TO OTHER DATABASES AND INFORMATION SYSTEMS

9.1. LINKED IS

9.1.1. FOREMATIS

EUFGIS is linked to the information system of the European Commission of forest reproductive material FOREMATIS. This link is found from the main bar under **LINKED IS > FOREMATIS**. This makes it possible to view the FOREMATIS Seed stands (only those for which the coordinates are included in FOREMATIS) mapped with the GCUs for all available species. It is possible to filter the seed stands by country, species as well as its distance from the nearest GCU (radius) (see figure 17).

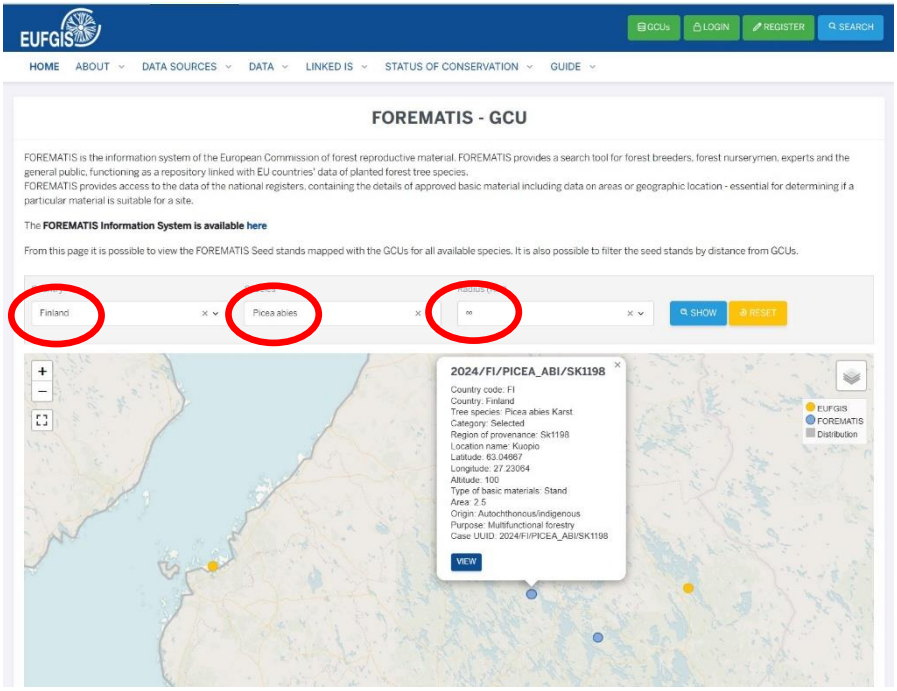

Figure 17.

The preparation of this manual has been supported by the FORGENIUS project, that received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 862221.21

9.1.2. GD²

EUFGIS is linked to the GD² database (Georeferenced Database of Genetic Diversity), found from the main bar under **LINKED IS > GD²**, that contains genetic and georeferenced passport data of different genetic units (populations, single trees) that are traditionally analysed in genetic surveys conducted in natural populations. From this page it is possible to view the GD² unit mapped with the GCUs for all available species. It is possible to filter the populations by country, species as well as its distance from the nearest GCU (radius) (see figure 18).

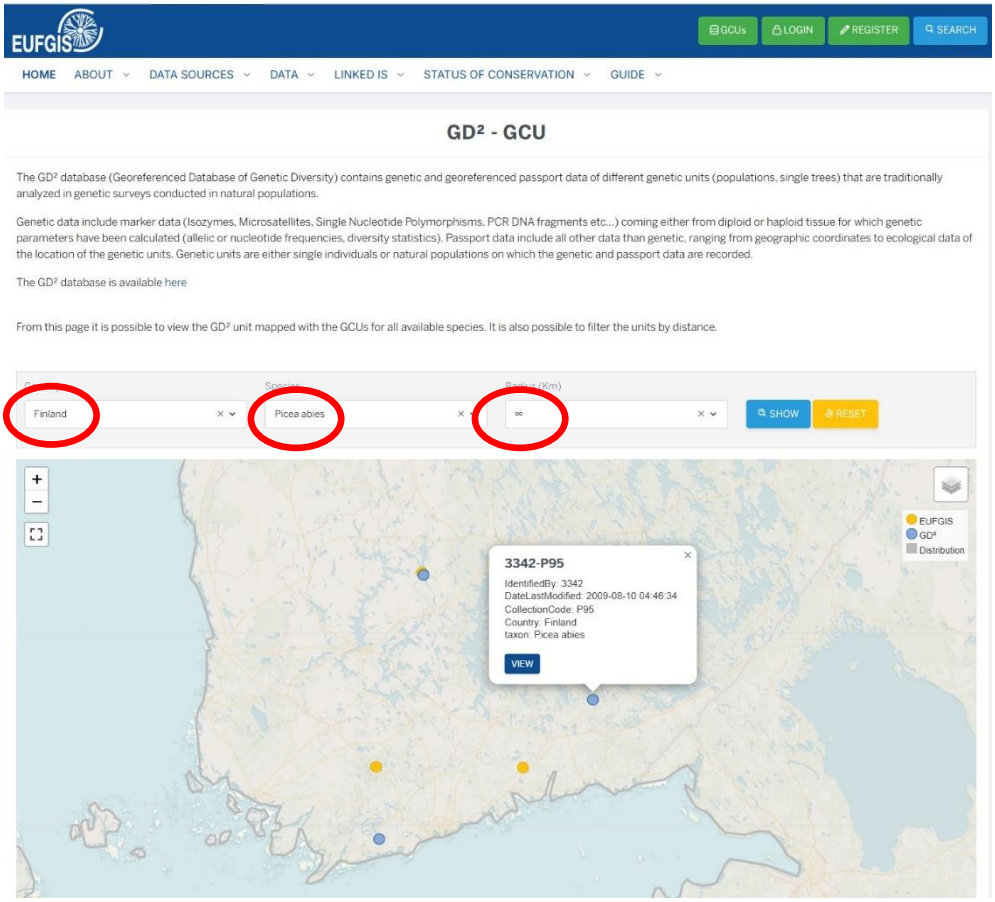

Figure 18.

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10. MAKING COMPARISONS

The portal also offers the possibility to compare different GCUs for a selected number of indicators. The starting page for making comparisons opens when selecting from the main menu DATA > **COMPARISON**. From this page one first selects the species for which one wants to compare GCUs. Next one can select GCUs from the list for that species. When the GCU selection is left blank all GCUs with this target species will be included in the comparison. Then one can select either **DISCRIPTORS** or **TAGS**. From **DESCRIPTORS** one can select as many individual descriptors as wanted from all groups (see figure 19a) to be compared in the output. After having made the desired selections, one has to click the **DOWNLOAD TEMPLATE** button on the bottom of the page. Before the output will be downloaded the user has to agree on the terms and conditions. Depending on the amount of information requested the downloading may take a few minutes. From **TAGS** one selects one of the three tags to get an output that includes only comparison of those descriptors with the corresponding tag (see figure 19b).

The output is downloaded as an Excel file, which is made up of six pages: Dataset, Metaset, Single value indicators, Time-series indicators, Dictionary and Citation. The output presents the values for all GCUs of that particular species for which data is available.

- Dataset: list of indicators.
- Metaset: list of GCUs and sample size
- Single value indicators: values for each GCU
- Time-series indicators: annual values for each GCU
- Directory: Information on each indicators from the data dictionary
- Citation: Information on the citation to be used when the information in the report is used for publication.

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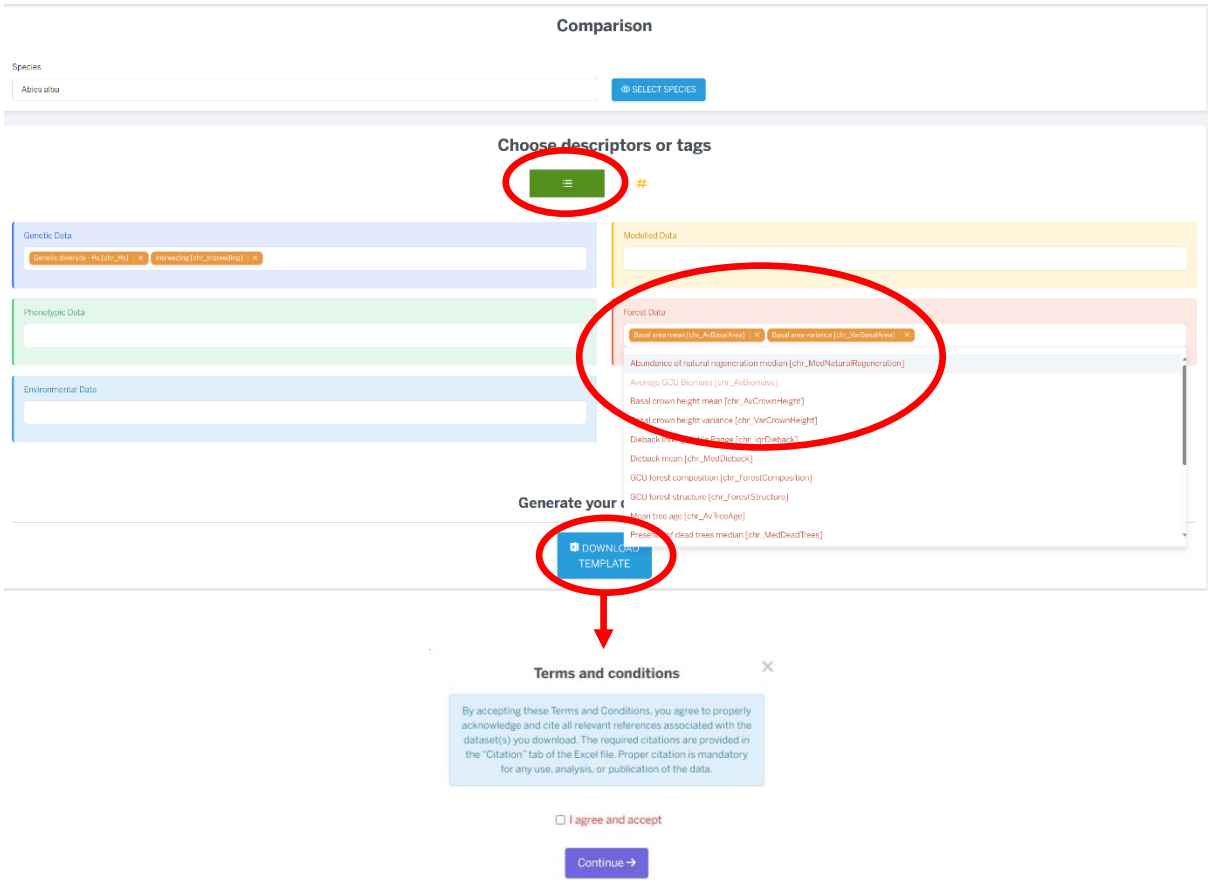

Figure 19a.

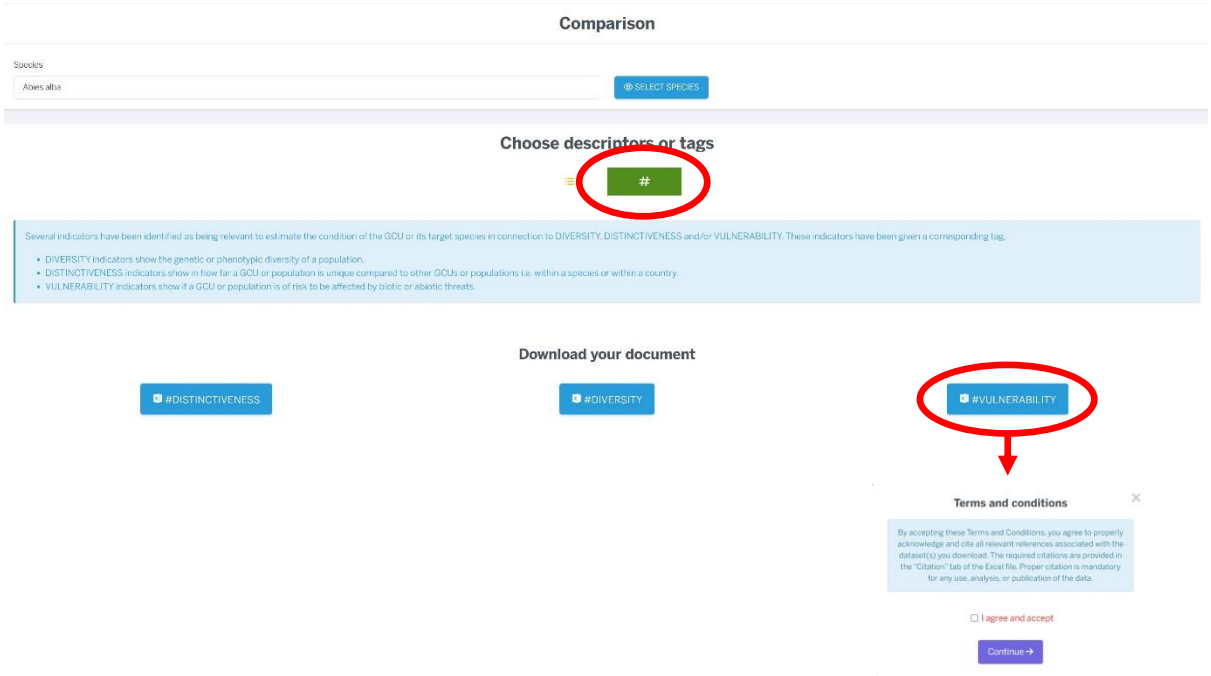

Figure 19b.

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11. PREPARING AND DOWNLOADING REPORTS

11.1. REPORTS ON GCUs

After one has selected a GCU, but not yet a target, both the GCU and the SITE page have a **Show report** button on the right top of the page. For both pages this button opens the same new widow showing the basic information of in a report format. By clicking PRINT on the right to of this page one can either send the report to a printer or save the report in PDF-file format.

After one has selected also a target species the same **Show report** button appears in the upper right corner of the screen (see figure 20). The report that opens clicking this button after having logged-in provides an extended report giving also the values for all the indicators that have been assessed in the GCU and the target population, including time series. Both the reports can be printed or saved as a PDF-file by clicking **PRINT** in the report window.

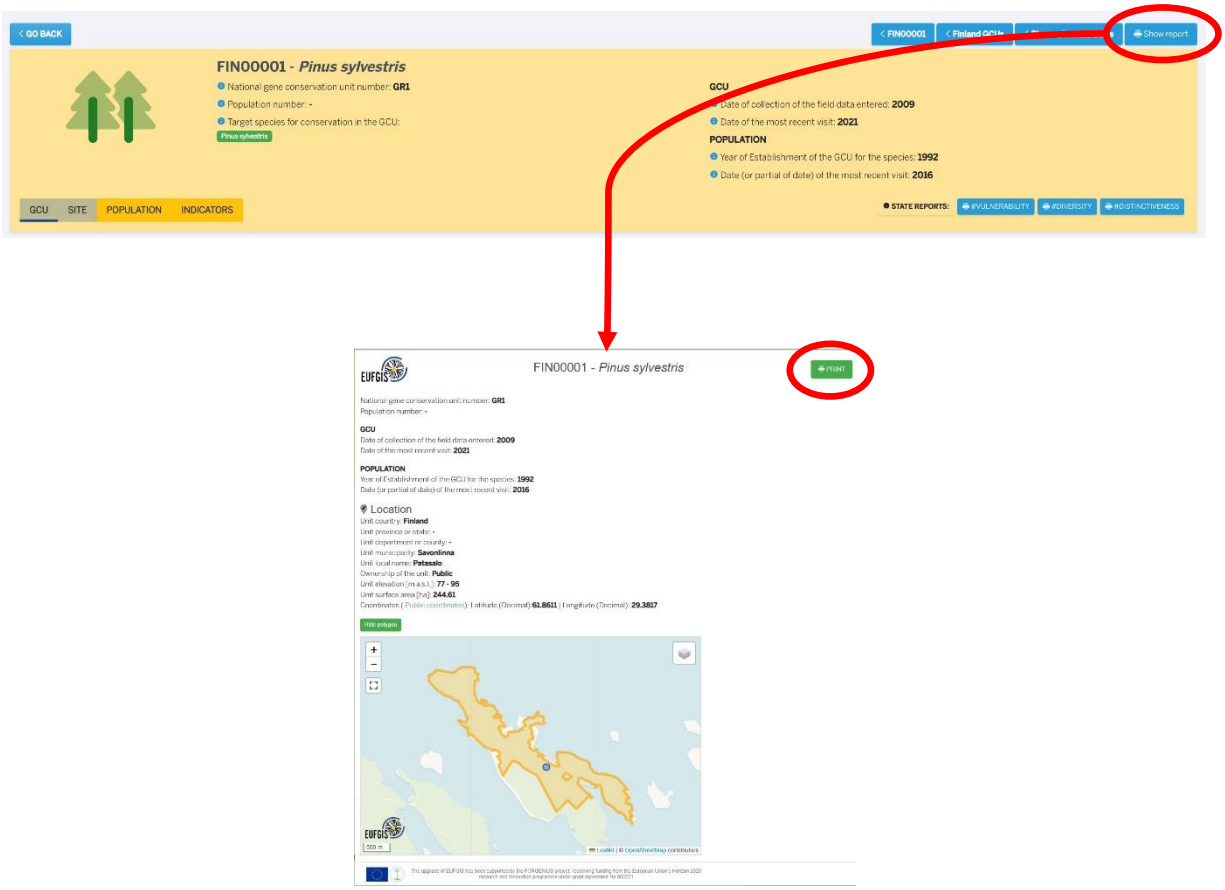

Figure 20.

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11.2. REPORTS ON THE TAGS FOR GCUs

After one has selected a GCU and one of its target species in the upper yellow box three buttons appear: **#VULNERABILITY, #DIVERSITY** and **#DISTINCTIVENESS**. When clicking on one of these buttons a new window opens showing a report with the basic information of the GCU as well as the values for those indicators that have been provide with the respective tag (see figure 21). This report can be printed or saved as a PDF-file by clicking the **PRINT** button. In case no indicators with a certain tag are available for the selected GCU, the respective button is shown as disabled.

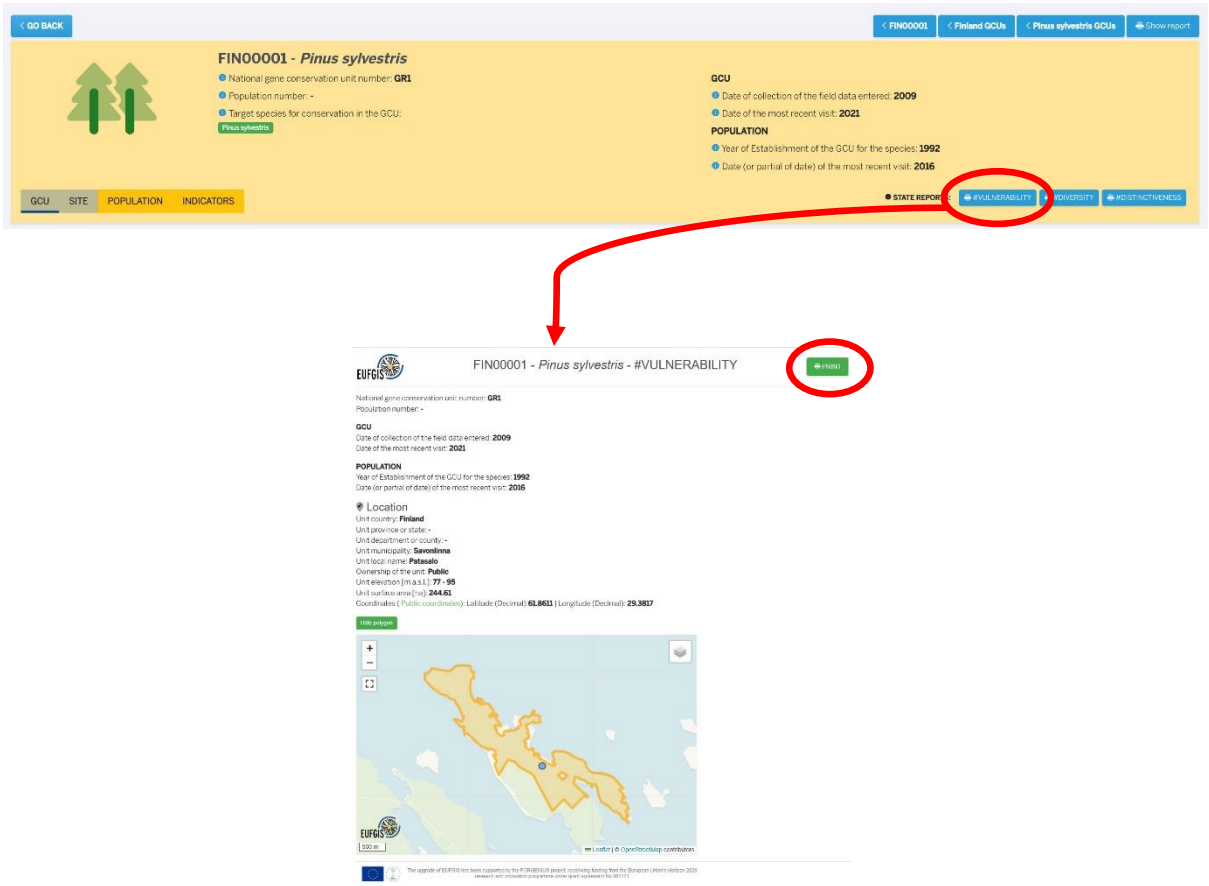

Figure 21.

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11.3. REPORTS ON INDICATORS

Both the maps and the data of the reports on specific indicators (see paragraph 7.3, figure 14) can be saved and printed. The data for the indicator for each GCU can be downloaded in Excel format using the button DOWNLOAD DATA. For the maps one can choose either print or download, by clicking on the respective buttons. When choosing to download the map will be saved in PNG-format. (see figure 22).

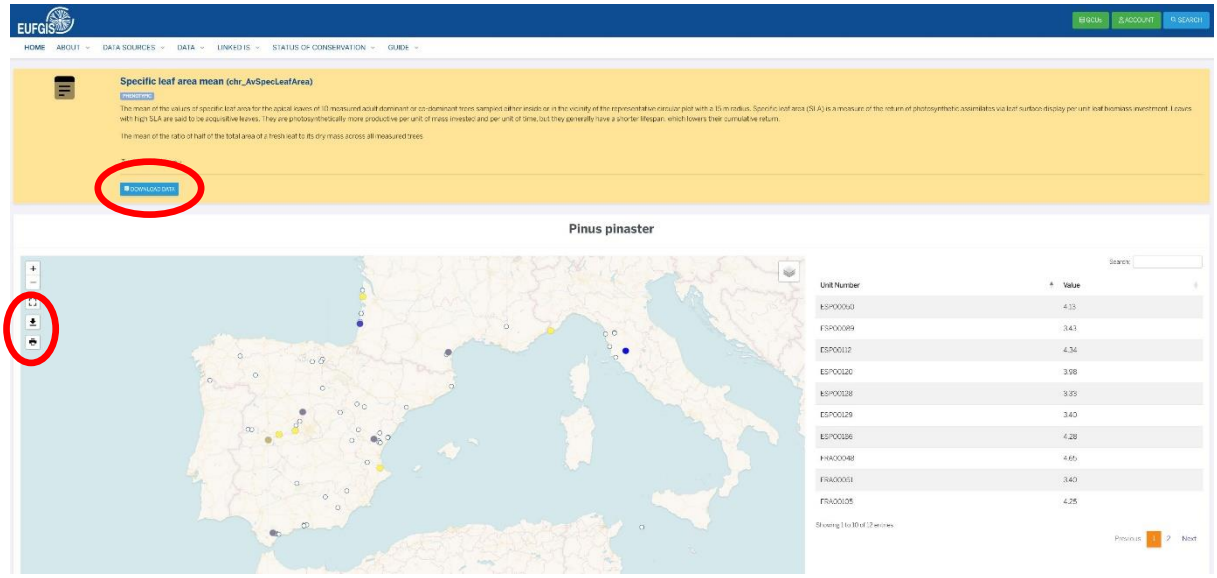

Figure 22.

11.4. REPORT ON THE STATUS OF CONSERVATION IN EUROPE

The link **STATUS OF CONSERVATION** provides access to the Forest Europe Indicator 4.6 reports on the status of conservation of FGR in Europe. The user can choose to get reports on either **COUNTRIES** or **SPECIES** level and respectively choose a country or a species. By clicking on the link STATUS OF CONSERVATION one can choose between reporting by **SPECIES** or by **COUNTRIES**. The link brings one to the page **Status of the conservation of FGR in European Countries**. From here it is possible to select sub-indicators for individual species (see figure 23a) or countries (see figure 23b) respectively. The interpretation of the sub-indicators is available behind the button.

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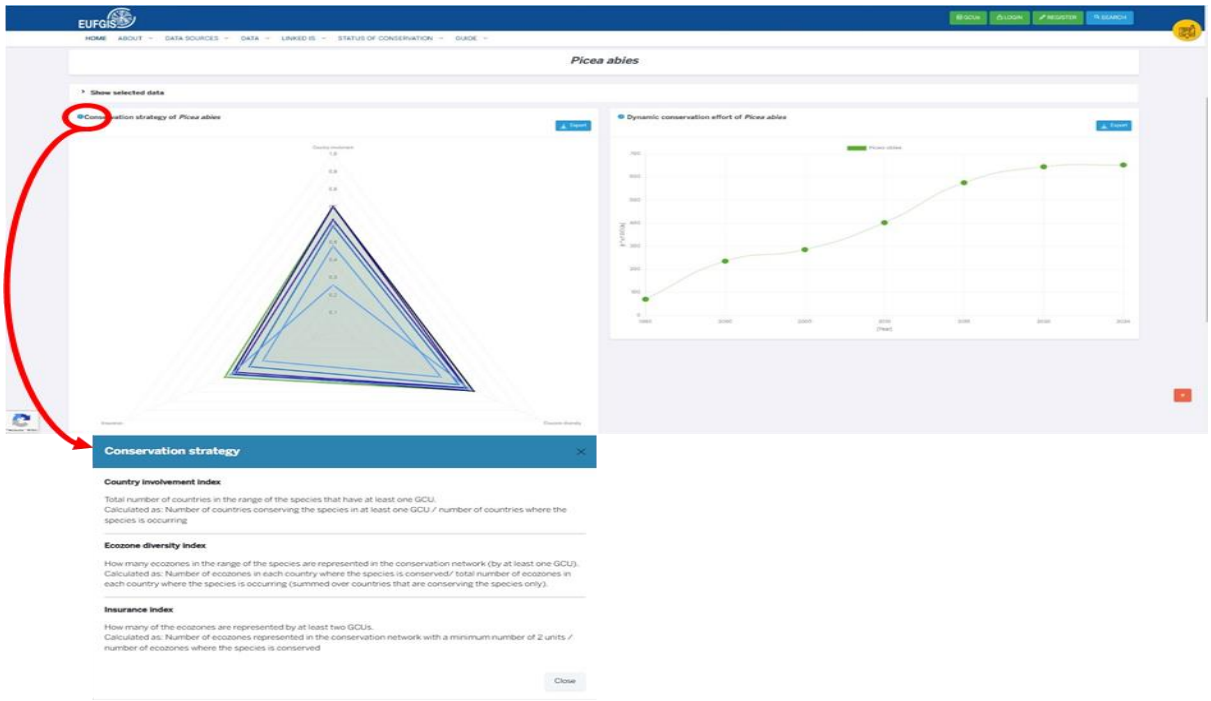

Figure 23a.

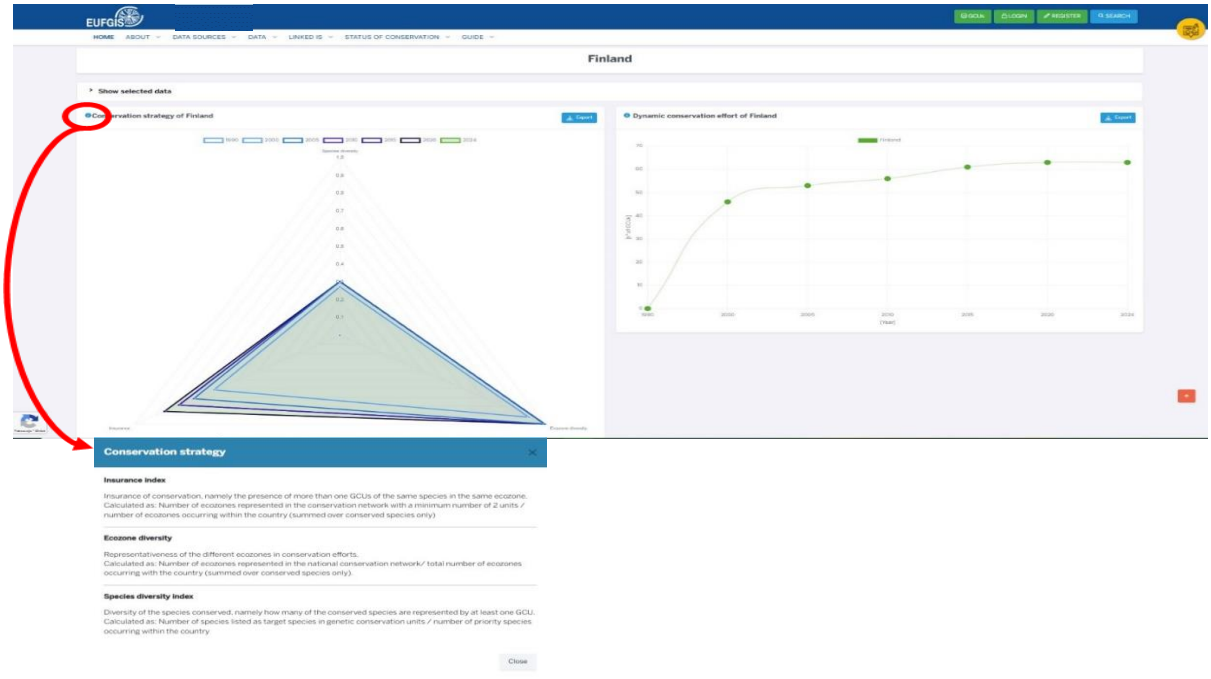

Figure 23b.

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12. UPLOADING OR EDITING DATA

Uploading data is limited to a small group of end-users that have access to the EUFGIS Intranet.

National Focal Points, appointed by the EUFORGEN National Coordinators, are responsible for providing and curating GCU and targets species data. The National Focal Points may also use EUFGIS for custom data upload and storage, visible only to them and National Coordinators for the given country.

Characterisation data related to the GCUs may be provided by partners of projects like FORGENIUS or by by National Focal Points. Providers other than National Focal Points will have to apply for access from the EUFGIS manager. A precondition is that the data has been obtained following FORGENIUS protocols. Those protocols can be downloaded from the portal. The links are:

- Protocols for field sampling (genotyping, microdensity and NIRS)
- Protocols for phenotypic characterization and GenRes resilience to climate extremes
- Protocols for genotyping in the FORGENIUS SPET data paper.

Before any submitted data is made public on the portal it will be checked by the EUFGIS manager.

Environmental and climatic data is partly uploaded automatically, partly periodically, under supervision of the EUFGIS manager.

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ANNEX 1: LIST OF INDICATORS

Indicator name (Title)	Short description (Definition)	Domain	Diversity tag	Distinctiveness tag	Vulnerability tag	Measurement unit (if applicable)
Proportion of reproductive trees	Proportion of trees with reproductive structures	Genetic				
Sample size	Number of individuals used to calculate the measurement	Genetic				
Number of loci	Number of loci used in genetic analysis to calculate genetic indices.	Genetic				
Type of Marker	Type of marker (SNP, SSR) used for calculation of genetic indices	Genetic				
Method	Method and technology used to determine the genetic index	Genetic				
Proportion polymorphic loci	Number of polymorphic loci divided by the total number of loci examined	Genetic				
Genetic diversity - Hs	Genetic diversity (Hs) measures genetic variation within a single subpopulation. It quantifies the probability that two randomly selected alleles from the subpopulation are different under Hardy-Weinberg equilibrium	Genetic	X			
Nucleotide diversity - π	Mean number of nucleotide substitutions per site between any two randomly selected orthologous DNA sequences (of the same loci) in a population (π)	Genetic				
Population's contribution to molecular diversity within populations	Contribution of one population to the total diversity due to its own diversity	Genetic				
Population's contribution to molecular diversity between populations	Contribution of one population to the total diversity due to its divergence/distinctiveness	Genetic				

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Indicator name (Title)	Short description (Definition)	Domain	Diversity tag	Distinctiveness tag	Vulnerability tag	Measurement unit (if applicable)
GCU originality - population specific Fst	Level of genetic differentiation of the target population from an ideal ancestral population from which all populations in the species diverged	Genetic		X		
GCU originality - pairwise Fst	The current level of genetic differentiation whithin a species	Genetic		X		
Clonality - proportion of clones	Number of clonal individuals divided by the total number of individuals of the population	Genetic	X			
Clonality - size of clones	Surface covered by each single clone	Genetic				
Admixture index - proportion of ancestry of detected gene pools	Proportion of population's ancestry in each gene pool of the target species	Genetic				
Hybridisation index - proportion of ancestry of detected species	Proportion of population's ancestry in each of the two hybridising species	Genetic		X		
Inbreeding	Probability of two alleles in an individual being identical by descent	Genetic	X		X	
Recessive genetic load	The reduction of fitness in a population due to the accumulation of deleterious alleles	Genetic				
Genomic offset	A population measure of maladaptation under future environmental conditions	Genetic			X	
Evolvability	The ability of a population to respond to directional selection	Genetic	X		X	
Risk of frost damage	The simulated fraction of leaf buds killed by one or more frost events during the year	Modelled			X	
Risk of desiccation during drought	Simulated loss of hydraulic conductance	Modelled			X	Percentage loss of hydraulic conductance (%)
Risk of desiccation during drought - variance	Variance of the simulated loss of hydraulic conductance, which represents the risk of mortality	Modelled	X	X	X	Percentage loss of hydraulic conductance (%)
Risk of carbon starvation	The simulated annual risk of mortality due to carbon starvation computed with the Castanea model	Modelled				

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Indicator name (Title)	Short description (Definition)	Domain	Diversity tag	Distinctiveness tag	Vulnerability tag	Measurement unit (if applicable)
Vulnerability to wild fire	The simulated GCU's canopy fuel moisture content which is a key driver of fire ignition and spread if there is an ignition source	Modelled			X	g_H2O/g_DryMass (g_H2O/g_DryMass)
Drought index	The number of days of the year with the soil relative water content below the treshold of 0.4. Indicator of moderate drought with no or low influence on survival	Modelled			X	
Tree height mean	The mean of the vertical tree height across all measured trees	Phenotypic				
Leaf turgor loss point mean	The mean of the water potential at which leaves lose turgor across all measured trees	Phenotypic				MPa (MPa)
Leaf turgor loss point variance	The variance of the water potential at which leaves lose turgor across all measured trees	Phenotypic				MPa (MPa)
Xylem vulnerability to embolism mean	The mean of the water potential at which 50% of the xylem capacity to conduct water to the leaves is lost across all measured trees	Phenotypic				MPa (MPa)
Xylem vulnerability to embolism variance	The variance of the water potential at which 50% of the xylem capacity to conduct water to the leaves is lost across all measured trees	Phenotypic				MPa (MPa)
Residual conductance mean	The mean of the leaf water vapour conductance remaining after stomatal closure across all measured trees	Phenotypic				mmol m-2 s-1 (mmol m-2 s-1)
Residual conductance variance	The variance of the leaf water vapour conductance remaining after stomatal closure across all measured trees	Phenotypic				mmol m-2 s-1 (mmol m-2 s-1)
Hydraulic capacitance mean	The mean of the change in the branch relative water content (RWC) per unit change in water potential across all measured trees	Phenotypic				%RWC MPa-1 (%RWC MPa-1)
Hydraulic capacitance variance	The variance of the change in branch relative water content (RWC) per unit change in water potential across all measured trees	Phenotypic				%RWC MPa-1 (%RWC MPa-1)

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Indicator name (Title)	Short description (Definition)	Domain	Diversity tag	Distinctiveness tag	Vulnerability tag	Measurement unit (if applicable)
Huber value mean	The mean of the ratio of under-bark sapwood cross-sectional area to the leaf area distal to the cross-section in all measured trees	Phenotypic				cm2/m2 (cm^2/m^2)
Huber value variance	The variance of the ratio of under-bark sapwood cross-sectional area to subtended leaf area in a branch across all measured trees	Phenotypic				cm2/m2 (cm^2/m^2)
Specific leaf area mean	The mean of the ratio of half of the total area of a fresh leaf to its dry mass across all measured trees	Phenotypic				cm2/kg (cm^2/kg)
Specific leaf area variance	The variance of the ratio of half of the total area of a fresh leaf to its dry mass across all measured trees	Phenotypic				cm2/kg (cm^2/kg)
Wood density mean	The mean of the ratio of dry mass to fresh volume of a branch wood sample across all measured trees	Phenotypic				g cm-3 (g cm-3)
Wood density variance	The variance of the ratio of dry mass to fresh volume of a branch wood sample across all measured trees	Phenotypic				g cm-3 (g cm-3)
Sapwood area trunk mean	The mean of the sapwood area across all measured trees	Phenotypic				
Sapwood area trunk variance	The variance of the sapwood area across all measured trees	Phenotypic				
Average GCU Biomass	Above-ground biomass af all species (tree, shrubs, annuals)	Forest				t/ha (t/ha)
Trend (temporal dynamics) in Average GCU Biomass	Temporal trends of the above-ground biomass of all species	Forest				t/ha/year (t/ha/year)
GCU forest structure	Forest stand structure of the GCU assessed visually	Forest				
GCU forest composition	Tree composition of the GCU assessed visually	Forest				

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Indicator name (Title)	Short description (Definition)	Domain	Diversity tag	Distinctiveness tag	Vulnerability tag	Measurement unit (if applicable)
Trunk circumference mean	Mean trunk circumference measured at breast height in a representative circular plot within the GCU (only for trees of circumference > 23.6 cm)	Forest				
Trunk circumference variance	Variance of the trunk circumference measured at breast height in a representative circular plot within the GCU (only for trees of circumference > 23.6 cm)	Forest				
Basal crown height mean	The mean of the vertical distance from ground level to the lowermost point on the main stem where the tree crown starts across all measured trees	Forest				
Basal crown height variance	The variance of the vertical distance from ground level to the lowermost point on the main stem where the tree crown starts across all measured trees	Forest				
Basal area mean	The mean of the basal area per ha across all measured trees, whether living or dead	Forest				m2/ha (m^2/ha)
Basal area variance	The variance of the basal area across all measured trees, whether living or dead	Forest				m2/ha (m^2/ha)
Total basal area	Total basal area of living or dead trees inside the representative circular plot, for all species in the plot	Forest				m2/ha (m^2/ha)
Presence of dead trees median	Median of the presence of dead trees in the GCU	Forest			X	
Abundance of natural regeneration median	Median of the abundance of natural regeneration for the target species of the GCU assessed around all measured trees	Forest			X	
Mean tree age	Mean age of the trees belonging to the target species	Forest				years (years)
Tree height variance	The variance of the vertical tree height across all measured trees	Forest				

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Indicator name (Title)	Short description (Definition)	Domain	Diversity tag	Distinctiveness tag	Vulnerability tag	Measurement unit (if applicable)
Dieback mean	The median of the dieback index across all measured trees	Forest			X	
Dieback InterQuartile Range	The InterQuartile Range of the dieback index across all measured trees	Forest			X	
Rooting depth	The depth at which the deepest roots can be found	Forest				
Soil moisture anomaly	The SMA indicator is used to detect and monitor agricultural drought, which is one of three main types of drought that are defined according to the variables of the hydrological cycle. SMA expresses the deviation of actual SMI from its long term mean . The baseline period for SMA is 1995 to the last available full year. SMA is negative when soil moisture is lower than the reference baseline. The following classification can be applied: SMA<-1.0: mild drought; SMA<-1.5: severe drought; SMA<-2: extreme drought	Environmental			X	
Soil moisture index	SMI is an indicator of moisture conditions in the uppermost soil layers (skin layer and root zone). SMI is equal to 0 when the soil is severely dry (wilting point) and equal to 1 when the soil moisture is high (above field capacity)	Environmental			X	
GCU elevation - measured	Local elevation measured in the representative circular plot with a radius of 15 m.	Environmental				
GCU slope - measured	Local slope measured in the representative circular plot with a radius of 15 m.	Environmental				grades (°)
GCU aspect - measured	Local aspect measured in the representative circular plot with a radius of 15 m.	Environmental				Gradient (%)
GCU topography	Micro-topography assessed in the representative circular plot within the GCU	Environmental				

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Indicator name (Title)	Short description (Definition)	Domain	Diversity tag	Distinctiveness tag	Vulnerability tag	Measurement unit (if applicable)
Trend (temporal dynamics) in GCU Max Land surface temperature	Temporal changes of the maximum canopy surface temperature in degree and per month.	Environmental				Degrees Centigrades/month (°C/month)
Trend (temporal dynamics) in GCU's NDVI	Temporal trends of the Normalized Difference Vegetation Index	Environmental				-/month (-/month)
Average GCU NDVI	Monthly average of the Normalized Difference Vegetation Index	Environmental				-/month (-/month)
Max GCU NDVI	Maximum of the Normalized Difference Vegetation Index	Environmental				-/month (-/month)
Average GCU LAI	Monthly average of the Leaf Area Index	Environmental				m^2 Leaf/m^2 Soil (m2 Leaf/m2 Soil)
Maximum GCU LAI	Maximum of the Leaf Area Index	Environmental				m^2 Leaf/m^2 Soil (m2 Leaf/m2 Soil)
Trend (temporal dynamics) in annual maximum of monthly GCU averaged LAI	Temporal trends of the annual max of monthly remotely sensed LAI.	Environmental				m^2 Leaf/m^2 Soil (m2 Leaf/m2 Soil)
Average GCU GPP	Monthly average of the Gross Primary Productivity	Environmental				kg of C/m2/day (kg of C/m^2/day)
Trend (temporal dynamics) in GCU's GPP	Temporal trends of the Gross Primary Productivity	Environmental				kg of C/m2/day/month (kg of C/m2/day/month)
Average Annual GCU GPP	Average of yearly Gross Primary Productivity	Environmental				kg of C/m2/year (kg of C/m2/year)
Average GCU NDWI	Average Normalized Difference Water Index	Environmental				
Trend (temporal dynamics) in GCU's NDWI	Temporal trends of the remotely sensed Normalized Difference Water Index	Environmental				-/month (-/month)
GCU soil depth	Vertical distance from soil surface to the bottom of the excavated pit or of the soil auger core	Environmental				
GCU soil coarse elements	Average percentage of soil coarse elements in the soil of the GCU	Environmental				

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Indicator name (Title)	Short description (Definition)	Domain	Diversity tag	Distinctiveness tag	Vulnerability tag	Measurement unit (if applicable)
Overal True PAI index	The projected area of green leaves, needles and some branches or trunk per unit horizontal ground surface area	Environmental				m2 of plant/m2 soil (m^2 of plant/m^2 soil)
Measured latitude of the plot	Latitude measured in the field by projects (not NFPs)	Environmental				latitude (decimal degrees)
Measured longitude of the plot	Longitude measured in the field by projects (not NFPs)	Environmental				longitude (decimal degrees)
Fraction of Photosynthetically Active Radiation	This biophysical variable is directly related to the primary productivity of forests and some models use it to estimate the assimilation of carbon dioxide in vegetation. FPAR can also be used as an indicator of the state and evolution of the vegetation cover	Environmental			X	Percentage (%)

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