

WP4 - Bringing interactions between actors to a new level: living labs and virtual space



```

1 # api.R
2 library(plumber)
3 library(jsonlite)
4
5 # Source your existing code
6 #load data and interface of all models
7 source("load_interface_data.R")
8 #source default functions to compute the suitability
9 source("default_functions.R")
10 #load the suitability functions
11 source("load_suitability_functions.R")
12
13 ## @apiTitle AgroforestryTreeAdvice API
14 ## @apiDescription API for computing tree suitability with dynamic parameters
15
16 ## Get tree suitability with dynamic parameters
17 ## @param req The request object containing all query parameters
18 ## @get /suitability
19 function(req) {
20   # Parse all query parameters dynamically
21   query_params <- req$argsQuery
22
23   if (is.null(query_params$model)) {
24     return(list(status = "error", message = "model parameter is required"))
25   }
26
27   tryCatch({
28     desiredmodel <- query_params$model
29     allotherparameters <- setdiff(names(query_params), c("in_language", "model"))
  
```

Compilation of existing open-source data

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Authors	DigitAF project
Contact	Michael den Herder (michael.denherder@efi.int), Marie Gosme (marie.gosme@inrae.fr), João Palma (joaopalma@mvarc.eu), Ana Tomás (anatomas@mvarc.eu), Kristoffer Rønn-Andersen (kristoffer@regenfarmer.com), Rico Hübner (huebner@defaf.de), Miska Nevalainen (Miska.Nevalainen@efi.int)
Approved	Sonja Kay (19.12.2025), revised version Marie Gosme (13.1.2026)

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1 Context

The DigitAF research project (July 2022 - June 2026), funded by the European Commission, aims at a high-quality implementation of agroforestry to foster climate change mitigation and adaptation in agriculture and to ensure sustainable management of natural resources. Our goal is to provide the main actor groups with tools answering their needs, in particular digital tools. The three actors' groups that are target by DigitAF are:

- Policy actors: policymakers and administrations concerned with applying agroforestry -related regulations, at regional, national and European levels, who set the scene for the adoption (or not) of agroforestry.
- Practitioners: farmers, landowners and by extension, farm advisers playing an active role in designing and managing AFS and whose choices determine the agronomic, economic, environmental, and social performance at farm-level and beyond.
- Beneficiaries of AF products and services: stakeholders in the value chain, including wholesalers, retailers, organisations trading the carbon sequestration and biodiversity benefits of AFS, and final consumers seeking verification of the benefits of AF in clear and accessible terms.

This deliverable is relevant for the integration of knowledge and actions of all three stakeholders' groups. It contains a brief overview of a platform the "[Data Catalogue](#)" compiling all data produced by DigitAF and linked to open-source data providers.

2 The DigitAF Data Catalogue

A compilation of existing open-source data relevant for agroforestry is brought together in the DigitAF "[Data Catalogue](#)". The online Data Catalogue gathers datasets in one place to ease their access in line with the DigitAF Data Collating Plan (den Herder et al. 2024). The Data Catalogue contains both existing datasets that were selected by the project partners because of their exceptional relevance for exploring agroforestry related topics, as well as datasets compiled during the project by the project partners themselves. A FAIRness score is available for each resource to enable an assessment preview of the easiness of their findability, accessibility, interoperability and reusability. The FAIRness scoring methodology was developed in DigitAF Deliverable D4.5 (Tomás et al. 2024).

2.1 How the Data Catalogue can be used by different types of users

Different types of users may find useful data in the Data Catalogue. The online Data Catalogue contains datasets related to a variety of topics such as suitable tree species, tree and crop growth, agroforestry management, soil, climate, land use and land cover, natural vegetation and tree cover, erosion susceptibility, biodiversity, wetness, and nutrient loads. Different topics covered by the datasets can be explored by applying the filter "Indicators" (Figure 1). The online Data Catalogue contains data on different spatial scales and depending on the scale, data can be relevant for agroforestry at a global, European, country, regional or local scale. Available filters allow users to search for resources by regional extent, type of indicator, time interval, type of data, or spatial scale. Regional data can be explored by using the filter "regional extent" and selecting a specific country or region. Data at different spatial scales (from "leaf" to "global") can be explored by applying the filter "Spatial scale".

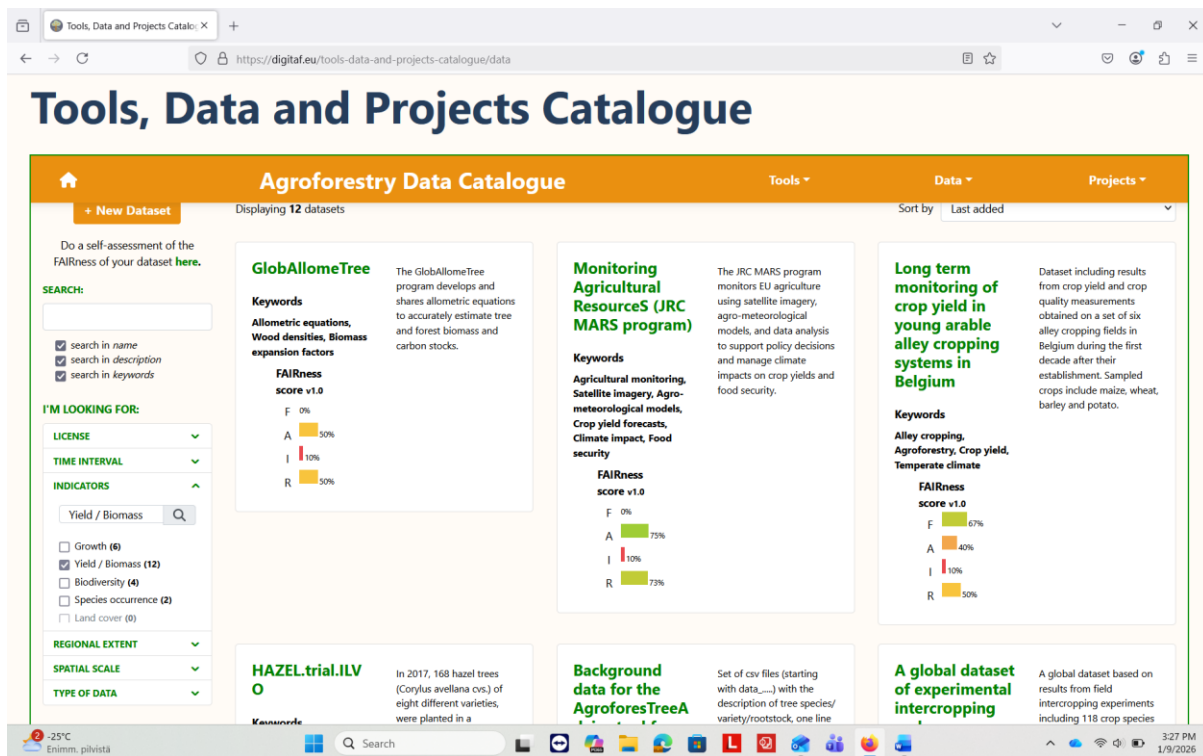


Figure 1. The datasets in the Data Catalogue can be explored by applying the filters on the left or a key word search.

The Data Catalogue can also be explored by a key word search. In addition, we are testing the use of an [AI tool](#) to explore the information in the catalogue. Currently, the functionality of the AI tool is tested by a small test group, but it will be released to a wider audience soon.

Different types of users may find relevant information in the Data Catalogue. The type of information interesting for the users can depend on many factors, for instance the type of questions they may have, the user group to which they belong (policy, practice, value chain, or research), geographic location, type of agroforestry or crop/tree/livestock species, etc. Below we provide some examples how different user groups may explore the Data Catalogue.

Policy actors (policy- and decisions makers and administrations): Policy actors are likely to be most concerned with agroforestry-related regulations and possible social, economic and environmental impacts of agroforestry at regional, national and European levels. Policy makers would need reliable information on many different issues such as food security and safety, land use, climate, biodiversity, finance, economics, human and animal well-being, etc.

Example: A person working as an assistant of a member of the European Parliament needs to gather information relevant for updating the Common Agricultural Policy but lacks an overview of what type of data sources relevant for climate policy exist at the European level. In a Webinar organised by DigitAF, the assistant has heard about the DigitAF Data Catalogue and decided to have a look. From the filters on the left (Figure 2), the assistant selects the filters “REGIONAL EXTENT = Europe” and “INDICATORS = Carbon”. The search results in two datasets containing relevant data on soil carbon at a European scale (Figure 2). The first dataset, the “European Soil Data Centre (ESDAC) contains relevant soil data and information including soil carbon at a European level and is a very good starting point to explore further. The LUCAS 2018 Topsoil Data provides very useful information how soil is sampled at a European scale, what kind of data are collected in the soil sampling surveys, and how soil

organic carbon is assessed in the sampling points. The assistant now has a better grasp what kind of data exists and how it can possibly be applied in making European wide assessments needed for informing climate and agricultural policies.

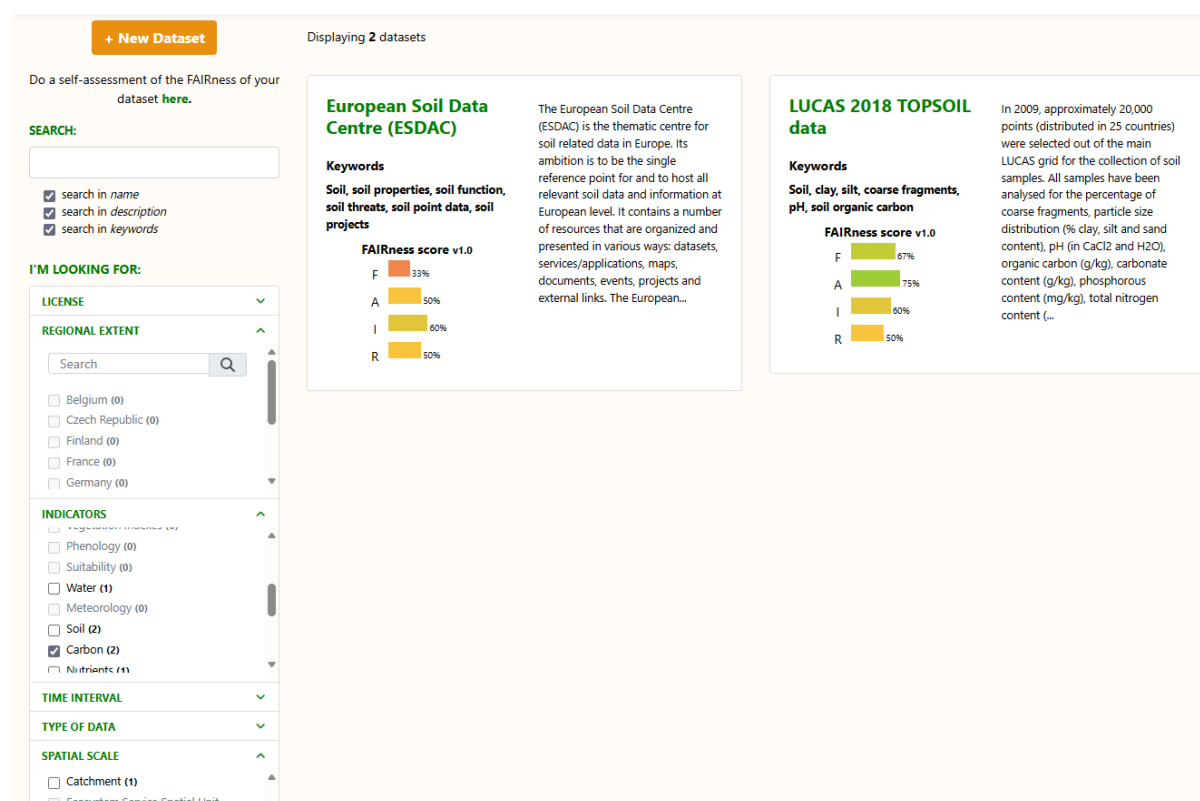


Figure 2. The search applying the filters “REGIONAL EXTENT = Europe” and “INDICATORS = Carbon” results in two datasets containing relevant data on carbon in agricultural soils in Europe.

Practitioners (farmers, landowners, extension services, farm advisers): Practitioners play an active role in designing and managing agroforestry systems and these decisions have an impact on the agronomic, economic, environmental, and social performance at farm-level and beyond. Therefore, practitioners need information to inform decisions related directly to the management of their farm, or in case of farm advisors to provide solid advice to farmers based on the most up-to-date knowledge. In this case yield of crops and trees, suitable tree species, issues related to farm management such as erosion, soil health, nutrition, water availability and wetness would be relevant.

Example: A farmer in Finland is interested in soil. During one of the meetings of the Finnish Living Lab, the farmer learned about the Data Catalogue and wanted to explore a bit more at home. After opening the Data Catalogue, the farmer selects the filters “REGIONAL EXTENT = Finland” and “INDICATORS = Soil”. The search results in four datasets containing relevant data on soil in Finland (Figure 3). Two datasets contain information on soil erosion in farmland (Erosion susceptibility of agricultural land) at 2- and 10-meter spatial resolution. One dataset (Carbon Action Field Observatory) contains information on soil health and soil carbon at farms participating in the “Carbon Action Network”. The fourth dataset (Maaperä 1:20 000/1: 50 000 – The Superficial deposits 1:20 000/1: 50 000) contains detailed information on soil types in the entire country. All four datasets provide useful data that the farmer can explore for their own farm (Figure 3) and make better informed decisions. To facilitate the visualization and analysis of this data through simple descriptive statistics (e.g. compute the mean over the whole farm area and compare it to the mean in a surrounding bounding box, DigitAF is also developing a [LPIS-based Sustainability Compass](#) (Tomás et al. 2025).

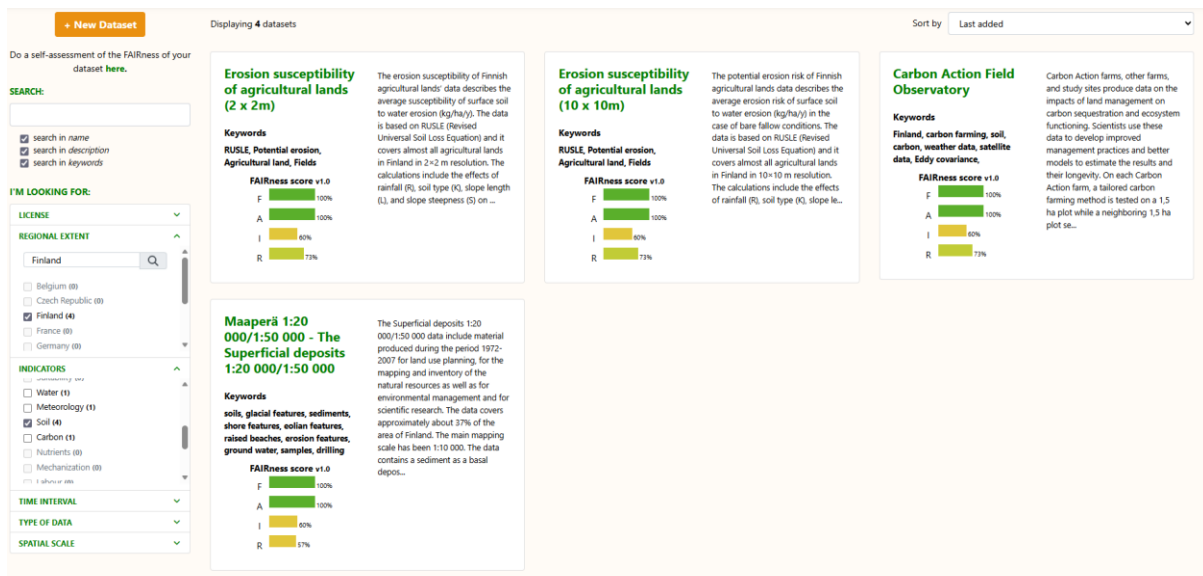


Figure 3. The search applying the filters “REGIONAL EXTENT = Finland” and “INDICATORS = Soil” results in four datasets containing relevant data on soil in Finland.

Beneficiaries of agroforestry products and services (stakeholders in the value chain, including wholesalers, retailers, organisations trading the carbon sequestration and biodiversity benefits of agroforestry, consumers): Users in this group may be interested in the environmental impact or benefits of the agroforestry products they sell or buy. Information such as greenhouse emissions, carbon sequestration, water use and biodiversity impacts of the products may be very important.

Example: A person working at an Italian pasta producer was in charge of calculating the carbon footprint of durum wheat cultivation on farms contracted by the company. Now the boss of the certification department wants to explore the possibilities of participating in setting up a new scheme for Nature Credits, for which the employee has no experience. After hearing about the DigitAF Data Catalogue, she goes to DigitAF website, finds the Catalogue and selects filters “REGIONAL EXTENT = Italy” and “INDICATORS = Biodiversity”. The search results in zero datasets containing relevant data on biodiversity in Italy. Then she realizes that wild species probably do not care much about national borders, so she changes the “REGIONAL EXTENT” filter from “Italy” to “Global”. Now the search results in four datasets (Figure 4). The “Global Biodiversity Information Facility (GBIF)” and “Observation.org” are both large data platforms containing data on species diversity, occurrence and abundance across the entire globe. “iNaturalist” also contains data on species occurrence based on citizen science. “The Conservation Evidence database” contains references to scientific evidence on the effectiveness of conservation measures for improving biodiversity and includes many conservation measures applied in agriculture. All four datasets include valuable information on species that could be used in the development of a possible system for Nature Credits.

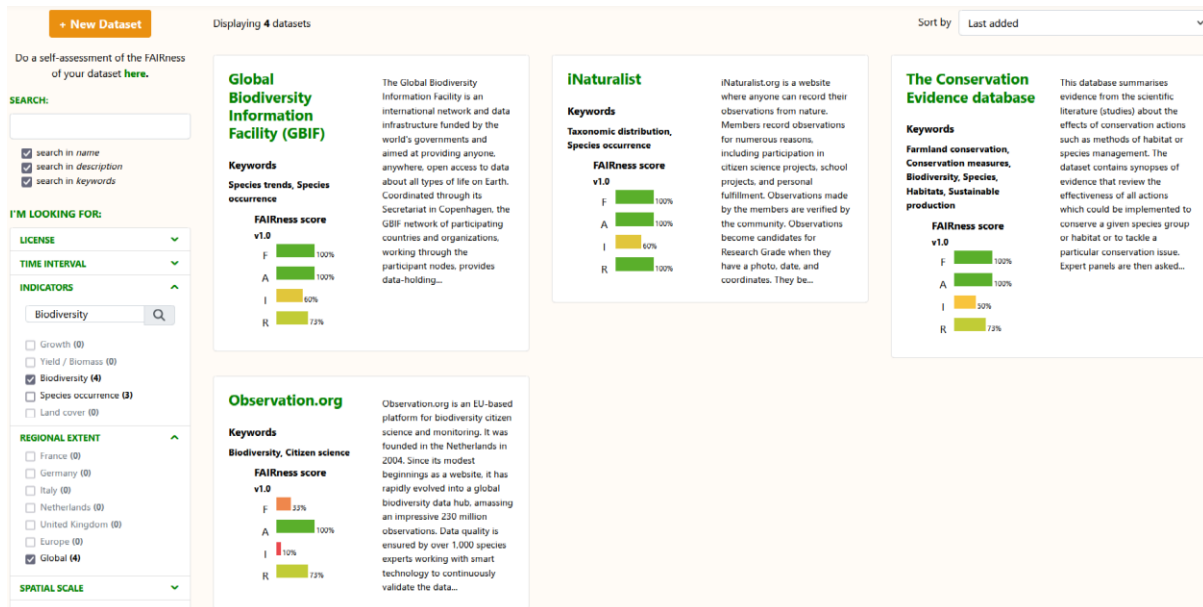


Figure 4. The search applying the filters “REGIONAL EXTENT = Global” and “INDICATORS = Biodiversity” results in four datasets containing relevant data on biodiversity.

Researchers: Researchers work on both fundamental as well as practice- and policy-oriented research questions. The research community may be interested in data that can be used for e.g. sustainability impact assessment or improving the current models and evaluation tools. The focus of this group is very broad and depending on the topics of investigation, it can include all the previously mentioned questions by the user groups described above and much more. It is of utmost importance that the data are from a reliable and trusted source and that sufficient metadata is provided to understand how the data is collected, for verification, possible replication and possible comparison with other data sources. For instance, for researchers working on calibrating yield models, the Data Catalogue provides a place for agroforestry measurement data (e.g. data from the Living Labs) providing “Ground Truth Data”. The Data Catalogue can also be source for “test data” for validation and further development of digital tools.

Example: A researcher in the UK is looking for yield data for agroforestry trees to calibrate a yield model. The researcher selects the filters “REGIONAL EXTENT = UK” and “INDICATORS = Yield/Biomass”. The search results in one dataset containing relevant data on poplar in an agroforestry system in the UK (Figure 5). Unselecting the “REGIONAL EXTENT” filter results in more datasets from other countries. This is a good start. Hopefully in the near future more datasets will be uploaded so that the Data Catalogue can provide a better overview of available data sources.

+ New Dataset

Displaying 1 dataset

Do a self-assessment of the FAIRness of your dataset [here](#).

SEARCH:

☒ search in *name*
☒ search in *description*
☒ search in *keywords*

I'M LOOKING FOR:

LICENSE

TIME INTERVAL

INDICATORS

Yield / Biomass

☐ Growth (1)
☒ Yield / Biomass (1)
☐ Biodiversity (0)
☐ Species occurrence (0)
☐ Land cover (0)

REGIONAL EXTENT

☐ Finland (0)
☐ France (0)
☐ Germany (0)
☐ Italy (0)
☐ Netherlands (0)
☒ United Kingdom (1)
☐ Europe (0)

SPATIAL SCALE

TYPE OF DATA

UK Silvoarable Network data

Keywords

Silvoarable arable crop yields
poplar tree heights diameters
experiment results

FAIRness score v1.0

F	67%
A	100%
I	60%
R	100%

Silvoarable agroforestry (the intercropping of trees and arable crops) can diversify farm incomes, increasing tree planting and improve farm biodiversity. In the UK, in 1992 a silvoarable experiment, comprising three replicate blocks of four poplar (*Populus* spp.) hybrids (at a spacing of 10 m x 6.4 m) and three arable treatments, was established by Cranfield University in Bedfordshire, Leeds Unive...

Figure 5. The search applying the filters “REGIONAL EXTENT = UK” and “INDICATORS = Yield/Biomass” results in one dataset containing relevant data on poplar yield in a silvoarable system in the UK.

2.2 How to contribute data to the catalogue

Contributing datasets to the data catalogue may seem difficult or a bit overwhelming at first sight, however, after some practice and uploading your first dataset it is a relatively easy and straightforward process. In DigitAF, the aim is not to reinvent the wheel and create a new data repository. Instead, the aim is to improve the access and findability of data, and how different datasets and models can “talk” to each other (Interoperability). Therefore, each dataset stays in its own original place. Our aim is only to enhance digital access and the use of digital resources. Therefore, before listing a dataset in the DigitAF Data Catalogue, each dataset should be published in an existing and trusted repository.

Published datasets can be uploaded to the DIGITAF Data Catalogue quite easily. Previously unpublished data should first be uploaded to an existing repository, before adding it to the Data Catalogue. Zenodo is an example of an existing repository (Figure 6).

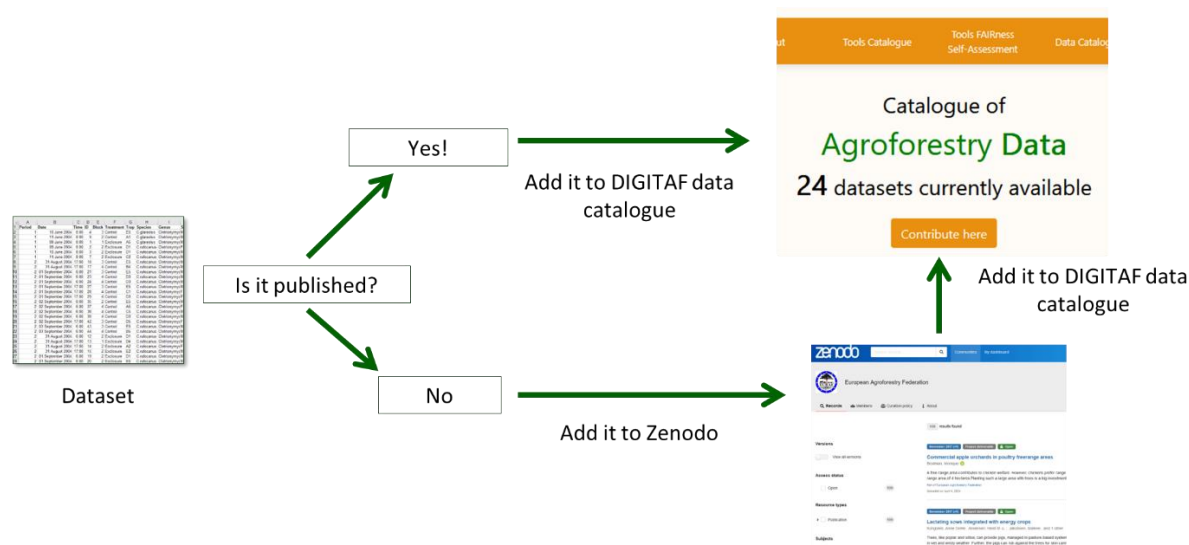


Figure 6. Published datasets can be uploaded straight to the DIGITAF Data Catalogue. Previously unpublished data should first be uploaded to an existing repository, before adding it to the Data Catalogue. Zenodo is an example of an existing repository, but also other trusted repositories can be used.

Once, the dataset of your interest is published in an existing repository, you can start uploading it to the Data Catalogue. During the uploading process you need to complete all the required metadata in the upload form, available at <https://digitaf.eu/tools-data-and-projects-catalogue/data/add>. Therefore, it is recommended to explore the dataset of your interest and familiarize yourself with its content.

2.3 How to motivate contributors to upload datasets

Currently the [Data Catalogue](#) contains about 40 datasets. It is foreseen that more datasets will be uploaded. Many of the DigitAF project tasks are still ongoing and the aim is that all data produced by the project will be available through the open-source data platform.

The Data Catalogue has been presented in several meetings of the Living Labs. Most stakeholders see this as a very valuable resource; however, they also seem to be a bit hesitant to contribute with new datasets. To make the stakeholders more familiar with the Data Catalogue, it will be presented in the upcoming stakeholder meetings in the Living Labs. To reach a wider audience, the Data Catalogue and its uploading process will also be presented in upcoming DigitAF webinars. In addition, a YouTube video will be produced introducing the Data Catalogue and explaining the process of how to contribute data to it.

A dedicated Session (S4.5 – Agroforestry Virtual Space: Where stakeholders and code developers meet to use and improve digital tools for agroforestry) at the 8th European Agroforestry Conference in Neuchâtel, Switzerland on 22 – 26 June 2026, will also be an excellent opportunity to present the Data Catalogue.

2.4 Interoperability of the data catalogue

Any user can contribute with new datasets or edit any incomplete or outdated information. The Data Catalogue is open-source and shared via the [EURAF GitHub](#) contributing to the legacy of the catalogue and its curation.

AI tools can programmatically access these datasets from the Data Catalogue using APIs or web scraping techniques, depending on the data provider's policies.

Regarding the interoperability of the data catalogue, the following points are most relevant:

2.4.1. BUILT-IN FAIRNESS SCORING

The "FAIRness score" is in the core of the catalogue and is calculated for every entry in the catalogue. Interoperability is one of the four pillars (Findability, Accessibility, Interoperability, and Reusability) evaluated.

Methodology: For datasets, interoperability is assessed using a specific scoring logic (`data_fairness_scoring.js`) based on whether the data uses formal, shared, and broadly applicable languages for knowledge representation and whether it employs vocabularies that follow FAIR principles.

Goal: The score serves as both a preview for users (to see how easily a dataset can be integrated) and a self-assessment tool for developers to improve their data's connectivity.

2.4.2. STANDARDIZED DATA STRUCTURE (/CATALOGUE/DATA)

The "database" in this repository is not a traditional SQL database but a collection of JSON files. This choice significantly enhances interoperability:

- *Machine-Readable Format*: By storing data in JSON, the project ensures that the catalogue is easily parsable by various programming languages (Python, JavaScript, R) without proprietary software.
- *Uniform Schema*: All datasets are described using a consistent set of fields defined in `datasets_form.json`. This standardization allows different agroforestry datasets to be queried and compared using the same attributes.

2.4.3 PROGRAMMATIC DATASET SUBMISSION AND ACCESS

- *GitHub-based Contribution Workflow (GitOps)*: The repository uses the PyGitHub API to handle contributions. When a user submits a new dataset via the web form, the system automatically generates a JSON file, creates a branch, and opens a Pull Request. This "GitOps" approach makes the data pipeline transparent and programmatically accessible.
- *GitHub-as-an-API*: Beyond contribution management, the repository also functions as a read-only data API. Users can directly access the full list of available datasets through the central catalogue file https://github.com/euraf/AF_FAIRness/blob/main/catalogue/data/datasets_list.json and programmatically retrieve individual dataset descriptors for use in their own workflows and applications. For example, a specific dataset can be accessed directly at https://github.com/euraf/AF_FAIRness/blob/main/catalogue/data/a_global_dataset_of_experimental_intercropping_and_agroforestry_studies_in_horticulture.json. This design enables seamless reuse, automation, and integration of datasets without requiring

additional backend services, leveraging GitHub as a lightweight, persistent, and openly accessible API.

2.4.4. HUMAN-IN-THE-LOOP QUALITY CONTROL

While the technical format is automated (JSON/GitHub), interoperability is maintained through manual verification. Members of the EURAF community and the DigitAF consortium review every Pull Request to ensure that the metadata and data links provided are accurate and adhere to the expected standards before they are merged into the main "database."

2.4.4. CATALOGUE INTEGRATION & PORTABILITY

The project is built to be "embeddable" rather than a siloed silo.

DigitAF Integration: The catalogue is already implemented as the engine behind the DigitAF project's tools and data catalogue.

Web Integration: The repository includes instructions and scripts to allow other agroforestry institutions (like national EURAF branches) to integrate these catalogues into their own websites, ensuring the "interoperability of the service" itself.

The DigitAF Data Catalogue has currently its own integration of an AI tool for querying the datasets. The "Ask DigitAF" AI tool which can be accessed at: <https://digitafmagicbox.vercel.app/embed> . Currently the AI tool is being beta-tested. It retrieves its information from the MVARC and EURAF Zenodo communities, as well as EURAF Github Repository, where, amongst other projects, there is also the Data, Tools and projects Catalogue. More data sources can be added at a later stage while the "Ask DigitAF" will be regularly (automatically) updated with new content in the repositories.

3 DigitAF Virtual Space

The DigitAF [Data Catalogue](#) is part of the DigitAF [Virtual Space](#), which provides a rich source of data, tools and other information for agroforestry-tool user, tool designer, testers but also for researchers and practitioners. All in all, many agroforestry stakeholders can find a different purpose for the knowledge available in the virtual space (Figure 1).

Virtual Space



Agroforestry Gallery

A dynamic space to share and explore agroforestry images. Upload your photos to the EURAF Zenodo community, get a DOI, and see them integrated automatically under CC BY 4.0 via IIF and the Zenodo API.



Agroforestry Map of Europe

Explore agroforestry areas, providers, and organisations across Europe. Verified entries appear promptly, with the map co-developed by DigitAF and REFOREST and hosted by EURAF. Contact your national organisation to join.



Agroforestry Tools Catalogue

Explore a curated collection of digital tools for agroforestry. Filter by purpose, check FAIRness scores, assess usability, and find resources that support decision-making, research, and sustainable practice.



DigitAF Tools Videos

Explore #DIGITAFTOOLS, a series presenting open-source digital tools for agroforestry. Learn how each tool supports decision-making, research, and sustainability goals.



Agroforestry Data Catalogue

Browse a comprehensive collection of agroforestry datasets. Access resources to support research, analysis, and evidence-based decision-making.



Agroforestry Projects Catalogue

Discover ongoing and completed agroforestry projects across Europe. Explore initiatives that advance research, practice, and sustainable land management.



EURAF Zenodo Community

Access and deposit agroforestry documents, from policy briefs to presentations. All entries receive DOIs, ensuring resources remain permanently findable and citable.



EURAF GitHub Community

Deposit and access open-source agroforestry software. A shared space for tools and code that support research, innovation, and practice.



Community Questions & Answers

Join the Agroforestry Q&A forum to ask questions, share knowledge, and connect with peers. Open to all, powered by the DigitAF project.

Figure 1. The DigitAF Virtual Space

Acknowledgements

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