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AUTHORS:

Cristina Arias-Navarro (INRA), Luis de Sousa (ISRIC), Jean-Baptiste Laurent (CIRAD), Jean-François Soussana (INRA), Sari Tanikawa (INRA).

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FOREWORD

Web based collaborative tools are now increasingly mature and can be used to strengthen large research communities, however current knowledge is fragmented, e.g. in multiple data bases and scientific papers and needs to be better synthesized.

From its very start, CIRCASA has endeavored to make a highly inter-disciplinary assessment of state-of-the-art research, networks and projects in the field of agricultural soil carbon and to better structure and disseminate this knowledge, while addressing key knowledge gaps through synthesis activities.

A pilot Knowledge Information System has been set up through the Open Collaborative Platform (OCP) which will serve as structured knowledge repository as well as an international exchange forum for researchers and all stakeholders that have expertise to share to usefully complement and collaboratively validate the available knowledge.

The platform will be extended into a crowdsourcing tool that will gather the soil carbon research community around a common space for improved knowledge sharing and transfer.

INTRODUCTION

Strengthening the International Research Community on agricultural soils carbon requires not only advanced information and communication tools like the existing Open Collaborative platform OCP (<https://www.ocp.circasa-project.eu/en/1/home.html>) but also sharing data and research results in the field of soil carbon. The main objective of CIRCASA is the alignment of research on SOC sequestration in agriculture, in this sense, data and knowledge sharing are key to the success of the project.

The pilot Knowledge Information System (KIS) has been established to share and visualize soil data and metadata from relevant existing repositories in one unique place. With this tool, scientists and other stakeholders can access to a large range and international knowledge gathered in one tool. The KIS provides geo-referenced meta-data and (when possible) data from experiments, data visualisation, observations and surveys, as well as from models and

synthesis activities and methodological guidelines developed by CIRCASA. Moreover, the tool provides links to real data to download if possible; the tool does not replicate existing efforts but allows gathering them, make it freely accessible via CIRCASA's Open collaborative platform. These tasks will lead to an enhanced international knowledge system delivering improved scientific resources of both global and local significance (e.g. maps showing the technical potential for SOC sequestration of diverse agricultural practices).

Those two tools are an angular stone of the CIRCASA project and are conceived to reach the project's goals in terms of results dissemination, strengthen international synergies, knowledge sharing, but also to support CIRCASA's legacy, the future International Research Consortium (IRC) expected in 2021. Knowledge sharing, capacity building, and matchmaking proposed by the platform OCP are complemented by the KIS.

THE KNOWLEDGE INFORMATION SYSTEM

1. User requirements and technology survey

Work on the Knowledge Information System (KIS) began early in the CIRCASA project towards the collection of user requirements. ISRIC conducted collective stakeholder sessions during the project's kick-off meeting (November of 2017) and subsequently carried on individual interviews with project participants (potential users of the OCP and KIS). Deliverable D1.2 (CIRCASA/ISRIC 2018) was the result of this process, revealing ambitious expectations from users, including items such as detailed user access management, use of open source technologies and compliance with open standards.

Afterwards ISRIC and INRAE entailed an exhaustive technology survey, seeking a solution that could on the one hand fill as many user requirements as possible and on the other facilitate the integration with the OCP. The data platforms surveyed included Dataverse, PANGEA, GeoNetwork and GeoNode. The main findings of this task are gathered in a special report (Batjes 2018) that also includes considerations on upcoming technologies and standards (particularly those emanating from the World Wide Web Consortium (W3C)). The selection

eventually fell on Dataverse, due to its advanced dataset management features and ease of integration with the OCP.

2. Development

The KIS development is one of the tasks in Work Package 1 established to support the structured process of knowledge on agricultural soil carbon sequestration. This knowledge system has been developed by INRAE in strong collaboration with CIRAD and ISRIC based on open source technologies.

The current pilot Knowledge Information System is composed of two parts

- a. Data referencing: the tool that allows referencing all kind of data and metadata from different repositories, as mentioned in the deliverable D4.2.
- b. Data cartography: allows to visualize the georeferenced data.

Those two components are hosted by the OCP and users can surf between both tools without leaving the platform.

a. Data referencing

The current OCP dashboard, accessible for registered members, is composed of several “widgets¹”; each one provides different types of information displayable in one common page. A special widget has been conceived for the KIS (Figure 1) allowing platform users to have a quick look on the latest publications on the KIS through the OCP dashboard. This widget, at the left side of the dashboard shows:

- The title of the last 10 datasets published
- The publishing date
- The total number of publications

¹ Interactive virtual tool that provides single-purpose services such as showing the user the latest news, publications or an interactive calendar.



Currently, this KIS widget is linked to several data repositories such as:

- Dataverse: INRAE data repository and CIRCASA project data, results and deliverables repositories. Each dataset² published has its own and unique DOI (Digital Object Identifier).
- ESDAC datasets: The [European Soil Data Center](#) products
- SoilsGrid datasets: The ISRIC system for digital soil mapping based on a global compilation of soil profile data and environmental layers.
- FAO datasets

Furthermore, the widget will be linked to the EJP Soils datasets and other relevant repositories. The platform administrator, who can easily add or remove data repositories linked to the Knowledge Information System via the OCP's Back office, manages this widget.

A "See all" button allows users to access the data directory, this page gathers all the datasets available in the different repositories. Results can be filtered by date and repository of origin. By clicking in the dataset name, the user can access directly to the corresponding repository where data is stored and, if possible, access to real data and even download the dataset.

Figure 1: Screen shot of the KIS widget inserted in the OCP.

² A data set (or dataset) is a collection of data, documents or files.

b. Content

The value of the pilot Knowledge Information System (KIS) is that it is conceived to create an access for platform users to a large range of data. These data can be geo-spatial data, metadata, deliverables, research results, modeling results, data from experiments, observations and surveys, as well as from models and synthesis activities and methodological guidelines developed by CIRCASA.

Geo-referenced meta-data and (when possible) data, is especially displayed through the data cartography tool of the KIS.

An interactive map allows platform users to visualise geo-spatial data (rasters) stored in different data repositories. The cartography is based on QGIS technologies, a free and open-source geographic information system (GIS). It supports both raster and vector layers, shapefiles, coverages, personal geodatabases, dxf, MapInfo, PostGIS, and other data formats. This software has been completed with PostGIS, a spatial database extender that follows the [Simple Features](#) for SQL specification from the [Open Geospatial Consortium](#) (OGC). PostGIS acts as an internal database of the KIS and stores only spatial data. It should be noted that this database does not store the real data but it references it via an URL link.

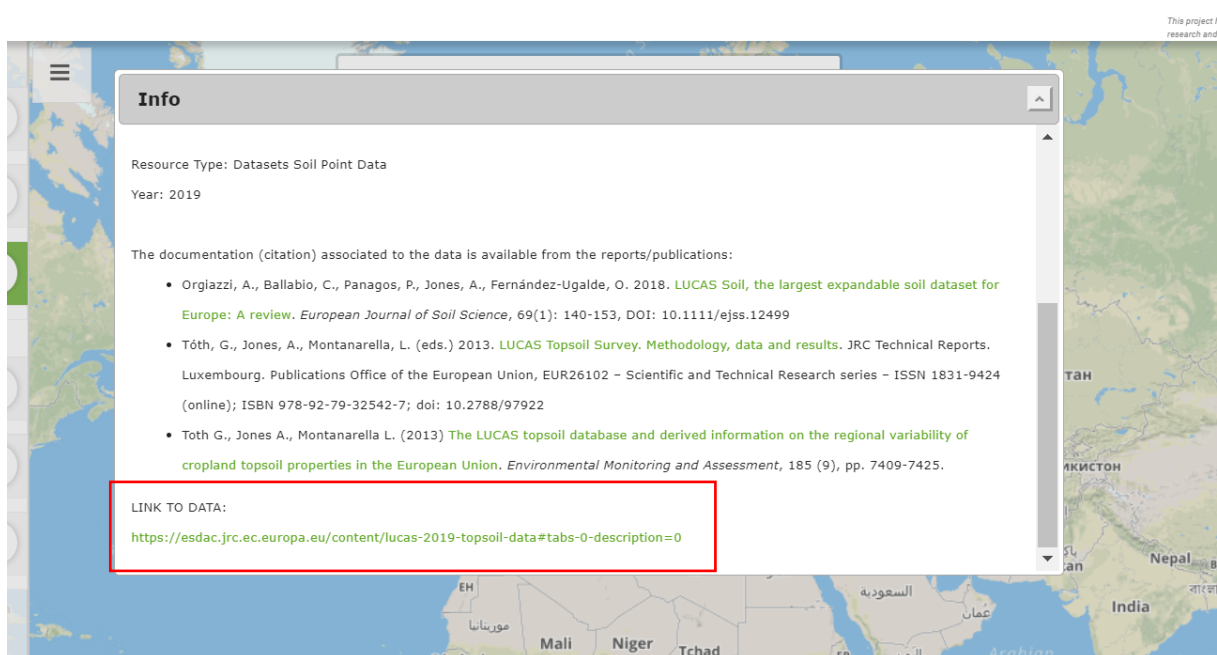


Figure 2: Screen shot of the data cartography, showing an example of the data information form. In this form, we can see the “Link to data” URL.

By clicking on the “link to data” URL, the OCP user gains direct access to the original repository and can thus download the actual data.

Today the KIS is linked to several repositories and several geo-referenced datasets can already be visualized such as:

- LUCAS 2019 TOPSOIL DATA from the European Soil Data Center (ESDAC): Data on soil characteristics at European level
- SoilsGrids data from ISRIC: Data on soil organic carbon content, soil organic carbon stocks, and soil grids at different depths from 0 cm to 200 cm underground worldwide.
- FAO’s GSOC (Global Soil Organic Carbon) datasets worldwide.

The KIS is updated regularly with data from new initiatives, platforms and data sources relevant for the OCP-KIS.

3. KIS integration within the OCP

The pilot Knowledge Information System (KIS) integration within the Open Collaborative Platform (OCP) of CIRCASA and the data fluxes are summarized in (Figure 3). The platform and the KIS are linked by different sets of functions and procedures allowing the creation of applications that access the features or data of the operating (application programming interface (API)):

- API n° 1.1 allows access to the KIS content from the OCP via the Widget (figure 1).
- API n° 1.2 allows a search engine on the OCP to search results directly on the KIS
- API n° 1.3 has not been developed but could allow OCP users to publish data on the KIS (Dataverse repository) through the platform.
- API n° 2 allows the visualization of data cartography on the OCP.

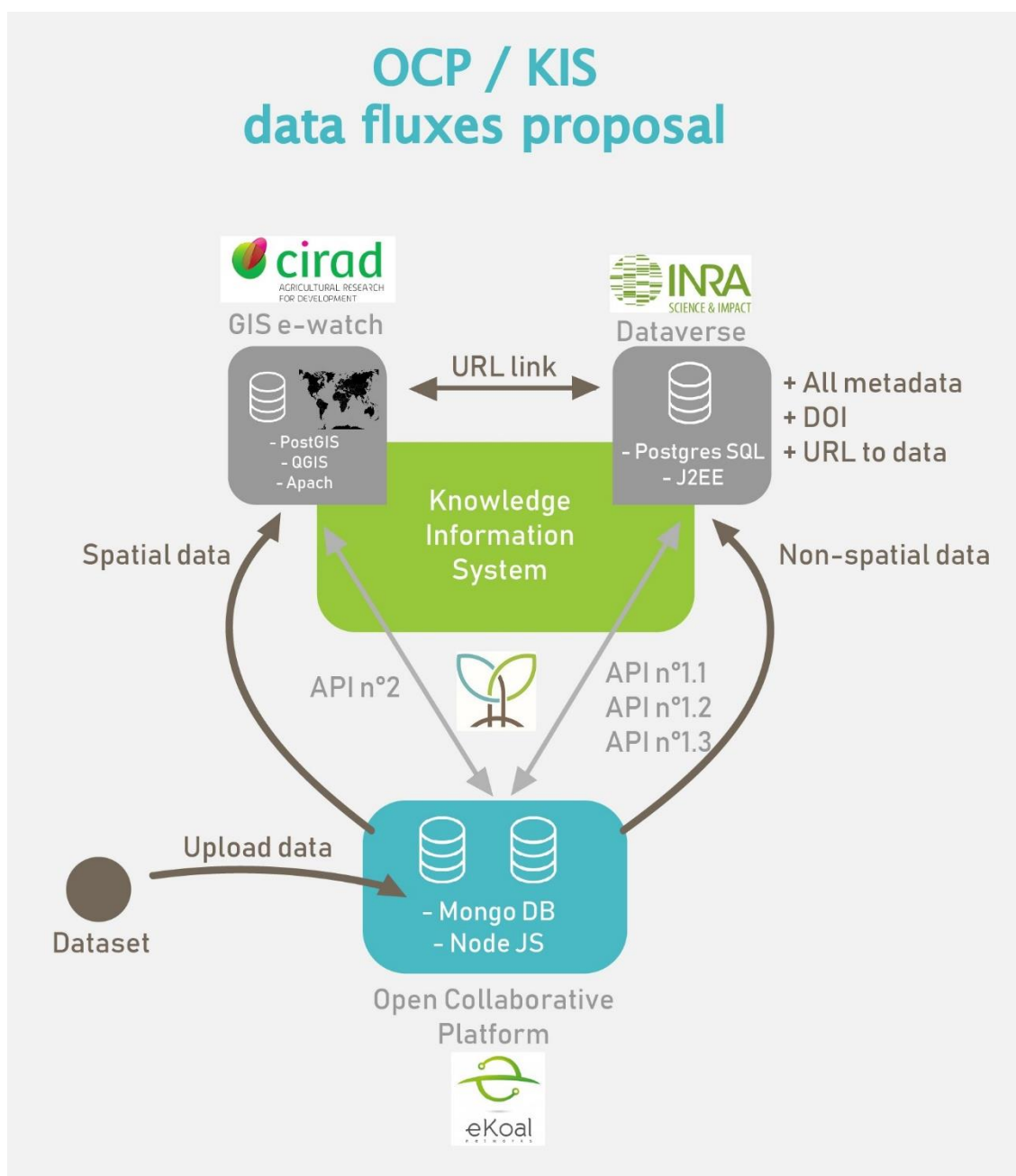


Figure 3: KIS / OCP structure and linkages.

CONCLUSIONS

Despite a wealth of local studies on soils and agricultural practices, there are currently no international database and model infrastructures that could be used to support action plans on soil organic carbon sequestration developed by public and private stakeholders. This pilot knowledge system is a first attempt. Outreach and communication is supported by the interactive OCP including a range of state-of-the-art information and communication tools. The knowledge system developed with support of the OCP tool will boost the knowledge base available internationally by crowdsourcing local knowledge, e.g. on agricultural practices and their role for soil carbon and, conversely, on how soil carbon changes can affect agricultural productivity, GHG mitigation and climate change adaptation. The pilot KIS will be expanded with geo-referenced meta-data and (when possible) data from experiments, observations and surveys, as well as from models and synthesis activities and methodological guidelines developed by CIRCASA.

Strengthening the International Research Community on agricultural soils requires advanced information and communication tools and the development of a collaborative online knowledge system. The CIRCASA OCP not only allows internal communication within the project (i.e. intranet), but also external communication, matchmaking between users, collaborative development of a knowledge system and crowdsourcing of knowledge, e.g. on agricultural practices and soil carbon. The KIS helps map observations, experiments and research teams and infrastructures, strengthen the links across regions and institutions worldwide and will lead to a strengthened international research community on agricultural soils. The open side of the platform will guarantee the continuation of this community building and strengthening process across countries, even after the end of the project.

ANNEX 1: KIS implementation method

Defining the type of link between OCP and Dataverse (API n°1). Three different needs were identified:

- Show on the OCP the Dataverse content (Widget) = API 1.1
- Create a search engine on the OCP to search results on the KIS = API 1.2
- Be able to publish data on the Dataverse via the OCP = API 1.3

API 1.1

Existing APIs developed by Dataverse and accessible on Open Source.

API 1.2

Two options were proposed to search data from CIRCASA repositories

- To create in the first place a simple search engine that searches directly on CIRCASA Dataverse. An API already exists to personalize the type of metadata that this search engine will reach. Nevertheless, as in the future we want this search engine to search data from other repositories including Dataverse, it was proposed to develop since the first time option b.
- OAI-PMH is a harvesting protocol that can search into different repositories, all the metadata is stocked on a temporary repository that updates automatically every x time. It allows the data indexation. This development is longer and more complicated but once it is done, it is easy to add new repositories to the KIS (ISRIC SoilGrid, FAO repository...)

API 1.3

Currently, raster data is manually integrated into the KIS cartography system (integration into PostGIS database and WMS flow setup).

In the future, the project aims to allow platform users to deposit their own data on the KIS. Those APIs are needed to create a template to add data on the platform that will create automatically a dataset on Dataverse CIRCASA with its own DOI

A roadmap is proposed for data fluxes.

First, the data loaded via the OCP should be distinguished between geospatial data and other data at the platform level (Data can be distinguished by the type of file). This is easy to implement if API 1.1 and 1.2 work correctly.

- Non spatial data and metadata will be stocked directly on Dataverse via API 1.3
- Spatial data will be sent directly to the GIS e-watch, metadata, DOI and URL to data will be on Dataverse

An URL will link the e-watch GIS to Dataverse and *vice versa*.

This work requires of specific developments, but it will allow a non-IT specialist to add geographic data to the KIS easily.

References

- Batjes N.H., 2018. Review of possible information platforms for CIRCASA's Knowledge Information System. Report 2018/02, ISRIC – World Soil Information, Wageningen (doi: 10.17027/isric-7Y7B-6S67)
- CIRCASA/ISRIC 2018. Knowledge Information System Requirements Specification (deliverable D1.2; Compiled by Luís de Sousa/ISRIC), Coordination of International Research Cooperation on Soil Carbon Sequestration in Agriculture (CIRCASA), Wageningen. <https://www.circasa-project.eu/content/download/3660/35410/version/1/file/D1.2.pdf>



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