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AGENT-BASED SUPPORT TOOL FOR THE DEVELOPMENT OF AGRICULTURE POLICIES

NEWSLETTER

Issue 5: August 2022

In this issue:

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AXIA INNOVATION

1. Data Characterisation

What is a dataset?

A dataset is a collection of one or more tables, schemas, points, and/or objects that are grouped together either because they are stored in the same location or because they are related to the same subject.

An EU statistical dataset is a collection of data, georreferenced or not, produced by the EC and whose geographical scope includes all the MSs. The variables within these datasets may be economic, socio- demographic, environmental, etc. The economic variables are measures that describe economic units, like the Gross Domestic Product (GDP), inflation or interest rates recorded in a country; on the other hand, social variables are those concerning the characteristics of a relevant population such as - among others - age, gender, culture, religion.

The uses of statistical datasets includes developing developing ex-post or ex-ante analyses of the different policies that the EU MSs governments and the EU itself define in their administrations action.

One of the goals of the AGRICORE project is to provide researchers and policy makers with a tool that facilitates the task of identifying relevant and useful data for performing agricultural policy analysis. To do so, the AGRICORE partners devised a characterisation methodology for describing the available data sources and their content to enable proper mapping and searching capabilities over the gathered information.

The methodology approach is based on:

1. A dedicated ontology: The AGRICORE DCAT-AP 2.0 Extension
2. The Agricultural Research Data Index Tool (ARDIT)
3. The data governance strategy

Ontologies

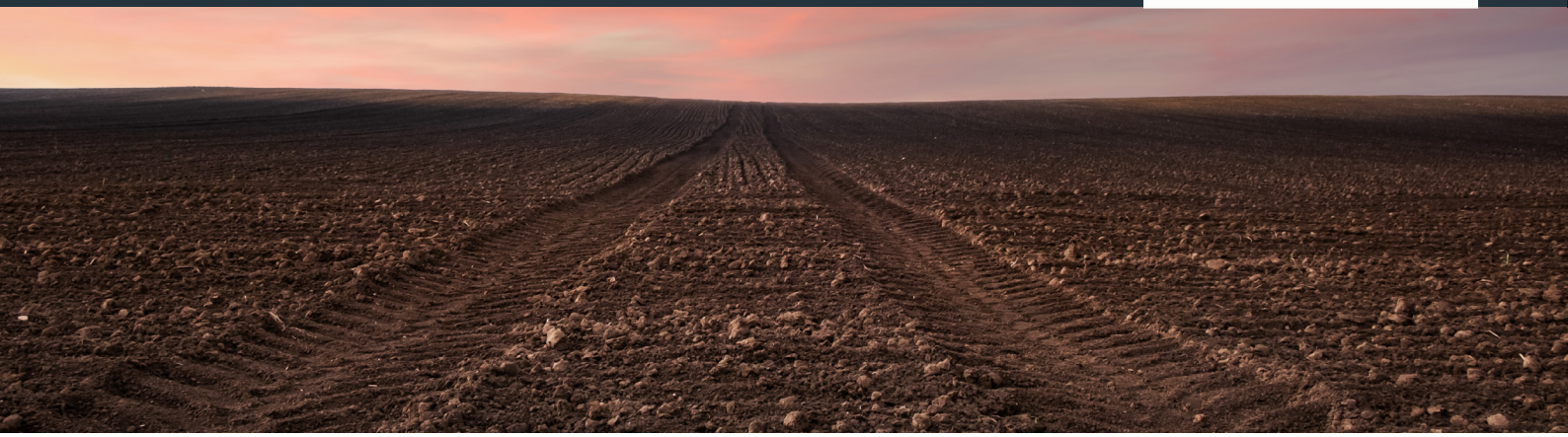
Users need daily access to large quantities of information, typically collected in different formats and often with different relationships among them. To ensure consistently structured and meaningful publicly available information, ontologies can be used.

An ontology can be defined as a model that represents a set of concepts and their relationships, within a knowledge domain, such that it can be seen as a model of knowledge and the tool for its management. Within an organisation, or in a project context, an ontology represents a structure created for users to answer complex queries posed to the information systems. Ontologies allow a standardized way of characterising datasets, enabling grouping of datasets with similar properties and easy metadata extraction.

An ontology, or a set of them, allows:

1. To share a common understanding of the information structure among people or software agents.
2. To enable the reuse of domain knowledge.

1. Data Characterisation



3. To make domain assumptions explicit.
4.To separate domain knowledge from the operational knowledge
5. To analyse domain knowledge
6. To secure the interoperability of datasets
In order to build the AGRICORE DCATA-AP 2.0 extension, the dedicated ontology for the AGRICORE project used to characterise the datasets in ARDIT,

Characterisation Process

Project partners performed, an initial characterisation of a number of datasets to identify the information that had to be captured through the AGRICORE ontology and defined the necessary meta-information to be recorded through ARDIT.. Consequently, the ARDIT back end has been organised in 7 sections:

KEYWORDS

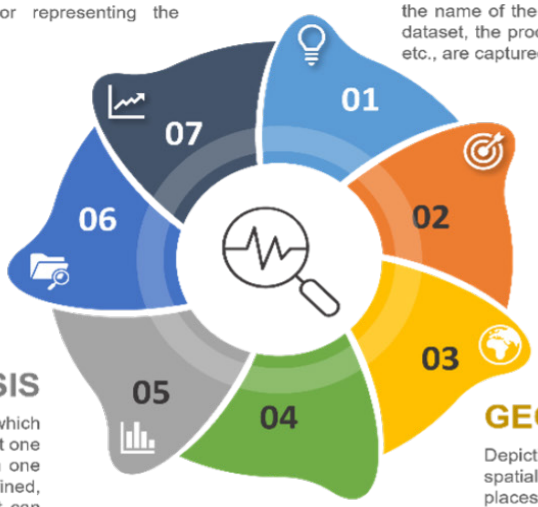
In ARDIT there is also a section to list the KEYWORDS describing or representing the dataset.

GENERAL

One GENERAL section where information such as the name of the table, the description, the type of dataset, the producer, issue date and last update, etc., are captured.

CHARACTERIZATION OF VARIABLES

Once the UoA has been created, the related variables are characterised through unit of measurement, temporal extent, mathematical representation, data frequency, aggregation level and UoA to which the variable refers. In the case of price variables, currency, price type and size unit will be displayed as well.



PURPOSE

Definition of the purpose of the dataset for. In this section, we find information on the temporal extent of the data collection period, on the object of the dataset, on the purposes of the dataset and the data, and on the theme covered (derived from DCAT-AP).

UNIT OF ANALYSIS

The UNIT OF ANALYSIS (UoA) is the object to which the variables are referred. Every dataset has at least one UoA, but in one dataset there could be more than one UoA. The UoA is generally something spatially defined, such as the holdings, a region or a country, but it can also be something different such as a commodity.

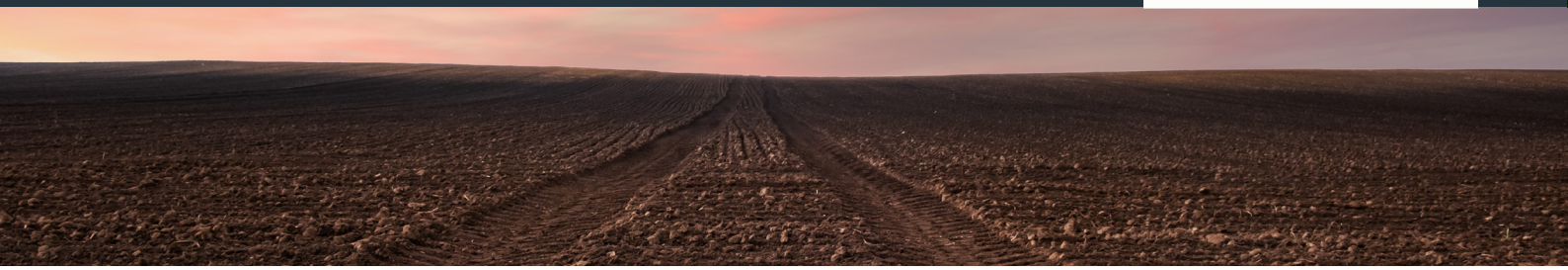
GEOGRAPHICAL COVERAGE

Depiction of the geographic features of a dataset. It's a spatial property. It's a list of spatial regions or named places. It can be represented using a controlled vocabulary or with geographic coordinates.

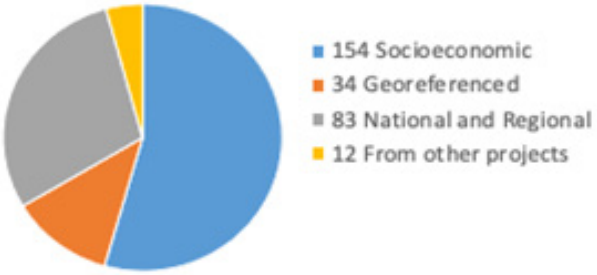
DISTRIBUTION

The distribution of a data set is the format in which the data can be retrieved. A dataset might be available in multiple formats, such as spreadsheet, pdf, CSV, etc. This section, besides information on the title, issue date and description, collects all data on access rights, byte size, procedures to access the data, URL and format.

1. Data Characterisation



Once the information required for the characterization process was defined and the ARDIT tool shaped to serve the purpose, the AGRICORE Partners jointly characterized 298 datasets, mostly European socio-economic datasets, but also national, regional, georeferenced and datasets resulting from previous projects.



This characterisation exercise went beyond previous efforts documented in literature, providing details on the information up to the level of the variables. The possibility to perform semantic searches capable of retrieving information on unique and selected variables is a significant advancement in the search functionalities of a public data index.

The quality and usefulness of these datasets descriptions depend on the quality and efficiency of the ontologies used. ARDIT, being publicly available (https://ardit.agricore-project.eu/login), allows researchers to contribute to the characterisation of new dataset increasing, over time, the tool capabilities to provide useful and efficient data access.

Find more under:
https://zenodo.org/record/5929127#.YqmUcezP25c

2. Partners´ Interview UNIPR- Lisa Baldi

1. "What were your main reasons for getting involved in the project? What excites you the most about this project?"

My doctoral research is about predicting the effect of the Common Agricultural Policy measures on the supply of ecosystem services through positive agent-based modelling, thus joining AGRICORE gives me a great opportunity to have hands-on experience on this topic. On the other hand, thanks to my previous international background in complex IT project management, I can bring an effective contribution to a smooth delivery. I am very excited about working with people from different European countries and different academic backgrounds. It is challenging working with people disseminated in different countries and with different working cultures, but it is extremely stimulating and rewarding when you can combine different high-level expertise towards a common goal.

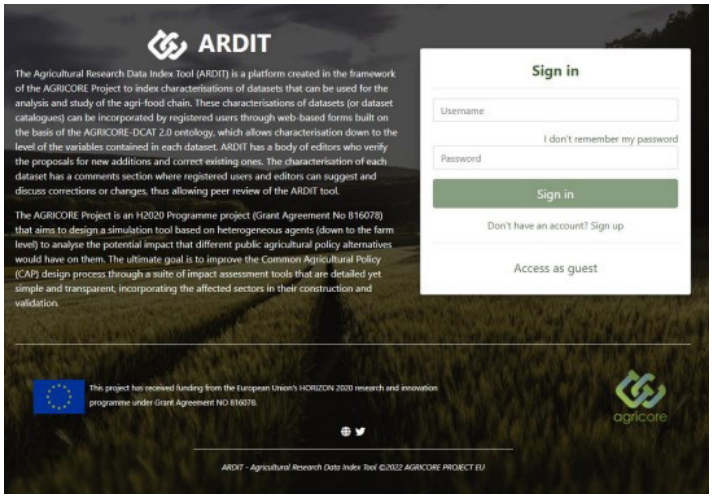
2. "What could be the benefits/take-home messages for all stakeholders involved in such an initiative?"

We are working on a very complex and ambitious project, but with the contribution of all stakeholders, project partners but also researchers, policy makers and farmers, we can deliver a suite of solutions capable to assess agricultural policies, in their design and implementation phase, to face the more than ever pressing environmental and social challenges. For the project Partners and the University of Parma in particular, it is a great opportunity to build on its credibility and reputation among European Accademia, EU Institutions, national and regional policy makers.

3. "What aspects of the project are you mostly looking forward to seeing come to fruition?"

I am anxious to see the AGRICORE agent-based model integrating, through a recursive approach, its short period dimension, which optimises the farm's utility function (field of expertise of our research group at the University of Parma), with the long-term farmer's financial perspective and the Biophysical component. The long-term perspective, as well as the model georeferencing capabilities, are crucial to assess the environmental impact of agricultural policies addressing climate changes and environmental issues in general. I personally believe that the success of this project can only be measured based on its effective future use by policy makers.

3. ARDIT Tool



AGRICORE is a Research and Innovation Action funded by the European Commission under the call RUR-04-2018 whose objective is to design and build an Agent-based-modelling tool to carry out impact assessments of different measures and instruments alternatively implementable within the Common Agricultural Policy (CAP).

These impact assessments fall into three main categories (socio-economic, environmental and delivery of ecosystem services) and will serve both to assess a posteriori the effects of measures already implemented (ex-post analysis) and to predict a priori the impact of measures in the design phase (ex-ante analysis).

Depending on the policy instrument whose impact is to be assessed, it is necessary to detect and access data that enable the assignation of values to the set of attributes of interest that make up each of the agents.

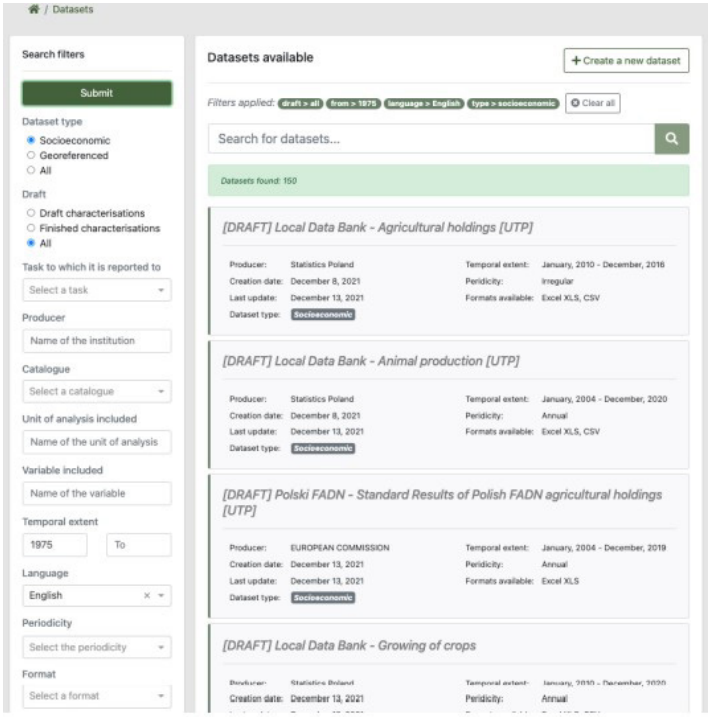
This information must be statistically representative of the set of real farm holdings to be synthesised, precisely those that are affected by the policy measure under study in terms of their typology (technical-economic orientation), size (economic dimension) and location (geographical and administrative scope).

For this purpose, the AGRICORE project provides the Agricultural Research Data Index Tool (ARDIT), as a web application with two well-defined objectives for the project.

The first one is to deliver an open data portal where researchers can publicly access an index of available agricultural data sources. The platform serves the metadata of the datasets and the links to their origin or download URLs; this means that ARDIT does not store the raw data of any indexed dataset.

The second objective is to use this tool within the project to provide necessary data to fill the attributes of the farm agents that compose the synthetic populations used in the ABM.

We can resume The Agricultural Research Data Index Tool (ARDIT) as a platform created in the framework of the AGRICORE Project to index



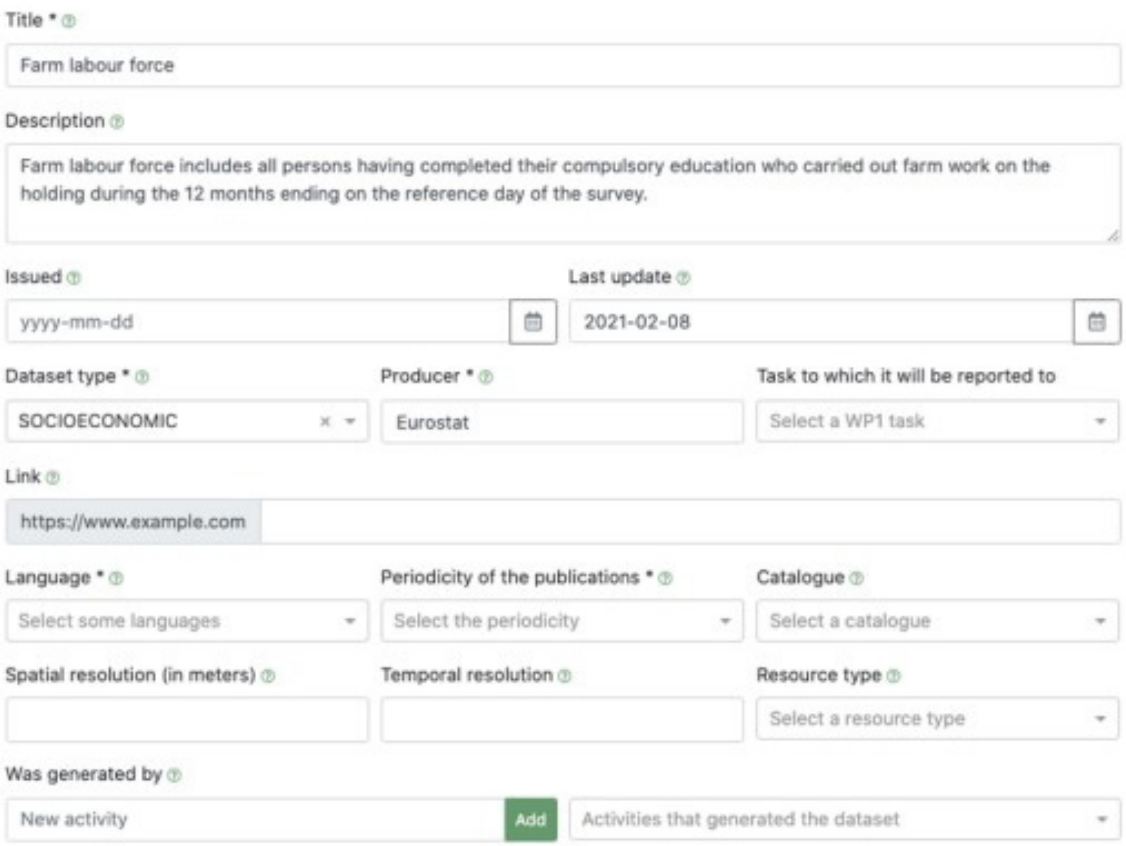
3. ARDIT Tool

characterisations of datasets that can be used for the analysis and research of the agri-food chain.

These characterisations of datasets (or dataset catalogues) can be incorporated by registered users through web-based forms built on the basis of the AGRICORE-DCAT 2.0 ontology, which allows characterisation down to the level of the variables contained in each dataset.

The ARDIT tool has been designed using a REST (Representational State Transfer) architecture. This type of architecture is characterised by the complete separation between web client (frontend) and web server (backend), unlike monolithic web applications, where the frontend and the backend are fully embedded, combining the user interface, business logic and data access layer in the same project or code base. In this way, whether through other websites, mobile applications or any other software of any kind, can access or modify the same data regardless of the platform they use.

The importance of providing ARDIT with a REST API lies in the possibility of giving users and researchers a way to access and redistribute the data stored on the platform without the need to use a user web interface It also enables the possibility to build customised interfaces that consume the API to freely process the datasets characterisations available on the platform. Finally, it promotes research, innovation, reutilisation and the creation of a community of users specialised in agricultural datasets.



4. Synthetic Population Generation

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Can we synthesize a population of farmers with some characteristics from a sample of farmers?

The answer is yes, by utilizing machine learning and advanced statistical learning techniques. The task of synthetic population generation is a 4-stage procedure. During the first stage a network is applied to learn the relationships among the attributes of the collected sample of farmers, while in the second stage a synthetic sample is generated. The synthetic sample matches the characteristics of the observed sample to a high degree, based on a battery of advanced multivariate distributional hypothesis tests.

During the third stage we compute the representation weights for each farmer while accounting for some known population totals. Finally, the synthetic population is generation using the weights.

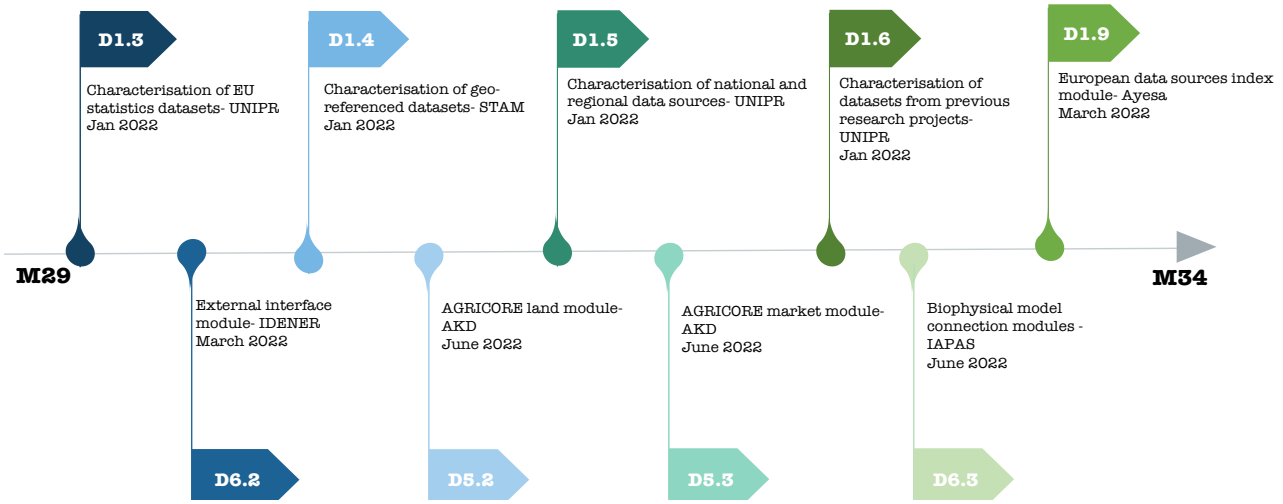
Our procedure, unlike existing procedures found in the literature is designed for a more difficult problem. Current techniques work with categorical attributes, whereas our procedure works with categorical and mainly with continuous attributes (harder case), it allows for tens of attributes, and we also validate our process during the synthetic sample generation to ensure a realistic sample of farmers.

Thirdly, even if the representation weights are unknown, we manage to estimate them. Finally, our procedure can be applied to case scenarios other than agriculture and other disciplines.

5. Progress

AGRICORE went through a very fruitful period during the last months!

Overall, 9 crucial deliverables were submitted since the beginning of the year. On the one hand UNIPR and STAM prepared a set of deliverables regarding the characterisation of various datasets such as EU statistics datasets (D1.3- UNIPR), geo-referenced datasets (D1.4- STAM), national and regional data sources (D1.5- UNIPR) and datasets from previous research projects (D1.6- UNIPR). Furthermore, Ayesa submitted the D1.9 which referred to the European data sources index module explaining what ARDIT is, how it has been constructed, how it works and its importance within the AGRICORE project. For this purpose, a detailed description of its architecture is provided together with annexes that include user manuals for operating the platform and characterising agricultural datasets. In D6.2, IDENER reported the advances done in the development of the communications system between the AGRICORE modules, according to the specifications and technologies proposed in deliverable D6.1. The document was designed to companion the implementation performed, providing additional information and clarifications about it. AKD completed the deliverables related to the AGRICORE land market module (D5.2) presenting the module developed for the interaction between agents regarding the use and transfer of land as well as the AGRICORE market module (D5.3). Finally, IAPAS presented in D6.3 the biophysical model connection modules depicting a software solution allowing to parse the ABM Simulation module queries to an external biophysical model.



6. AGRIMODELS Cluster

Read the news from our sister projects BESTMAP and MINDSTEP forming the AGRIMODELS Cluster!

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OTHER CLUSTERING PROJECTS

BESTMAP

Since the start of the year, BESTMAP released 3 open-access scientific publications:

- Response of endangered bird species to land-use changes in an agricultural landscape in Germany;
- Typologies of European farmers: approaches, methods and research gaps;
- Understanding the accuracy of modelled changes in freshwater provision over time.

All publications are available on our website.
Furthermore, to widen the accessibility and openness of project findings by publishing not just regular scientific articles, but also additional materials that cover the complete research cycle, our team has created a collection in Research Ideas and Outcomes (RIO) journal. Reports, protocols, techniques, research and other project outputs will all be included in the collection.
The aim of BESTMAP is not just to reach scientific success but also to find ways to implement those findings in the real world. Due to this, between March and April 2022, our five case studies (the UK, Germany, Spain, the Czech Republic and Serbia) conducted co-design workshops with regional and national stakeholders. The goal of these talks was to talk about how our modeling results can best support policy decisions and how the interactive dashboard we're working on can help us use our findings.
Moreover, between February and March 2022, the BESTMAP team performed an online survey designed as a discrete choice experiment. The study was given to farmers in the five case studies aiming to explore new facets of BESTMAP's research subject and examine how farmers decide whether or not to implement agri-environmental programs.
Last but not least, we are extremely excited to share about all the insightful events that will happen very soon. On 13 and 14 September 2022, BESTMAP's third General Assembly (GA) meeting will take place. Representatives from all partnering institutions will gather to discuss the current achievements of the project, as well as future potential challenges and further updates, awaiting ahead on BESTMAP's list of tasks.
Also, between 12 and 16 September 2022, our team is organising a Summer School, specifically tailored to look into the modelling policy impacts on ecosystem services and biodiversity. In addition, it will give an insight and hands-on training on agent-based modelling, biodiversity/species distribution modelling, and ecosystem services modelling, focusing on examples of both provisioning and regulating ecosystem services.

For more information and news about our project visit our website and subscribe to our newsletters.

6. AGRIMODELS Cluster

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OTHER CLUSTERING PROJECTS

MIND STEP

• **MIND STEP annual project meeting in Piacenza:** Between 10 and 11 March, the MIND STEP team reunited for a meeting in Piacenza, Italy, to discuss the progress of the project. The meeting, which luckily could be held in-person, was the perfect opportunity to share experiences on the implementation of project activities, enhance collaboration between partners, and discuss the state of play of the MIND STEP toolbox.

More info click here

• **IIASA project partner hosting a project meeting on MIND STEP toolbox.** On 19-20 of May part of the MIND STEP team got together in Laxenburg, Austria to discuss the MIND STEP model toolbox. IIASA hosted the hybrid meeting as Work Package 5 leader. Other MIND STEP partners are attending online and participating in the discussions. One of the main objectives of this meeting is to operationalize MIND STEP model toolbox.

More info click here.

• **MIND STEP featured at the Agricultural Economics Society Annual Conference.** The 96th Annual Agricultural Economics Society (AES) conference was organized in Leuven, Belgium, on 4-6 April 2022, Within the session on behavioural drivers, Scarlett Wang, a team member of MIND STEP partner Wageningen University (WU), presented her research paper on Dutch farmers' intention to adopt climate mitigation measures. At the beginning of the presentation, she mentioned MIND STEP and what is the role of WU in the project.

More info click here

7. Who we are

The AGRICORE project builds on the strong knowhow and expertise of its partners in the addressed scientific and industrial areas. The consortium is comprised of 11 European partners from 6 countries. AGRICORE is a well-balanced project between industry and academia ensuring and speeding up the successful implementation of all the actions towards its fruitful results.

4 Universities
(AUTH, UNIPR, AKD, UTP)
4 SMEs
(AXIA, EXE, STAM, IDE)
1 Research and Technology Organisation
(IAPAS)
1 Large Company
(AYESA)
1 regional farmer association
(CAAND)

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