LIFE Project Number

LIFE16 ENV/ES/000287

Final Report

Covering the project activities from 01/09/2017 to 31/10/2021

Reporting Date

21/02/2022

LIFE PROJECT NAME or Acronym

Collective management of crops at the service of environmental programs related to the use and quality of water

Data Project

Project location:	Spain (Andalucía, Castilla La-Mancha, Cataluña, Navarra, País Vasco and Comunidad Valenciana)
Project start date:	01/09/2017
Project end date:	31/08/2021 **Extension date:** <31/10/2021>
Total budget:	2,396,438 €
EU contribution:	1,436,212 €
(%) of eligible costs:	60%

Data Beneficiary

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AGROGESTOR

[LIFE 16 ENV/ES/287]
Con la contribución del instrumento financiero LIFE de la Comunidad Europea
With the contribution of the LIFE financial instrument of the European Community

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ITAP

Instituto de Investigación y Formación Agraria y Pesquera
CONSEJERÍA DE AGRICULTURA, GANADERÍA, PESCA Y DESARROLLO SOSTENIBLE

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2. List of key-words and abbreviations

- HAD: Herramienta de Ayuda a la Decisión (Decision Support Tool)
- UGC: Unidad de Gestión de Cultivo (Cultivation Management Unit)
- AGC: Área de Gestión colectiva (Collective Management Area)
- AP: Agricultura de Precisión
- SIG: Sistema de Información Geográfica
- SIGPAC: Sistema de Información Geográfica para la Política Agraria Comunitaria
- ITa: Itinerario técnico de agricultor
- ITg: Itinerario Técnico de gestor
- OC: Operación de cultivo
- EB: Elemento base
- GT: Grupo de trabajo
- DMA: Directiva Marco Europea del Agua
- IoT: Internet of Things
- GEI: Gases Efecto Invernadero
- CA (comunidad autónoma); CCAA (comunidades autónomas)
- MAG (Manual de apoyo a la Gobernanza)
- PA: Programa Ambiental
- ICT: Information and Communication Technologies
- CAP: Common Agricultural Policy
- FaST: Farm Sustainability Tool for Nutrients.
- FEGA: Fondo Español de Garantía Agraria, (Spanish Agrarian Guarantee Fund)
- DG-AGRI: Commission's Directorate-General for Agriculture and Rural Development
- WFD: EU Water Framework Directive

3. Executive Summary

The new Common Agricultural Policy (CAP), which starts in 2023, aims to foster a sustainable and competitive agricultural sector, and is aligned with the strategies of the Green Deal, in particular those derived from the "Farm to Fork" strategy and the 2030 Biodiversity Strategy.

The LIFE AGROgestor project has focused on reducing the environmental impact of irrigated agriculture through a decision support system that facilitates effective COLLECTIVE PLANNING AND MANAGEMENT, promoting the use of sustainable practices in agrosystems, in line with European strategies and in the face of the challenges posed by climate change.

The core results of the project are two linked platforms AGROgestor and AGROasesor in an innovative **Digital Platform Ecosystem**. It provides a specialized technical assistance tool for the Management of Environmental Programs by indicators to support COLLECTIVE MANAGERS of farms with advisory services. The Environmental Programs undertaken in the project are for water and fertilization governance and its efficiency in vulnerable areas by integrated management. This approach is aligned with the proposal of the ECO-schemes impulse commission, as a strategy analysis instrument adapted to sustainability criteria.

AGROgestor platform has provided an analytical tool through indicators in different scenarios: real, simulated and climate change scenarios. In addition, the **Digital Platform Ecosystem** had validated and demonstrated in three complementary pilots representing the main Environmental Problems in three partners' areas: the pilot on aquifers at risk of over-exploitation (Castilla La Mancha), the pilot over nitrate vulnerable zones (Navarra) and the pilot on high-level organic waste zones (Cataluña).

In Action A1 an information and consultation process was carried out to involve stakeholders in the project through working groups in the pilot areas and online collective management days, such as basin days and transnational workshops. The COVID pandemic fostered new techniques of interaction with multi-stakeholder groups.

A major debate took place over the indicators (A2) including how to run, evaluate and use them in collective management areas in the Digital Platform Ecosystem. The data model (structure) used by AGROgestor platform and the required modifications to the structure and functionalities of the AGROasesor platform, for the interconnection of the two platforms developed in actions B1 and B2, were decided in parallel to action A2. Finally, the indicator module of AGROgestor platform includes 31 indicators grouped as follows:

- **Economic:** Productions and Gross Margins.
- **Water use:** Water consumption, water productivity and Water footprint and its components (blue, green and gray). Water Stress Index.
- **Nitrogen management:** Consumption of total, mineral, and organic N, organic N in relation to total N, excess of N, contribution of N from irrigation water.
- **Phosphorus management:** Consumption of total P2O5, mineral and organic, % of organic P over total P, excess of P2O5.
- **Emissions balance:** Carbon and energy footprint.
- **Use of phytosanitary products**: Number of phytosanitary treatments in a campaign, toxicity in fresh and marine water, terrestrial and human toxicity.
- **Biodiversity:** Different crops in rotation and incorporation of legumes in the last 4 years.

The AGROgestor platform modular architecture integrates a working process, in connection with AGROasesor platform. Both were operating into the integration framework by March 2020, with data from 2018 and 2019 seasons of all pilots in Action B5. The new Digital Platform Ecosystem has several modules that facilitate the consultation and generation of scenarios, in which the evaluation, simulation and recommendation of strategies are carried out:

- **AGCs creation module,** which includes 12 multi-criteria to select crop management units (UGC) (B1.1).
- Module for the **evaluation of scenarios** with 31 indicators (B1.2- B1.3)
- Module for the **creation of Strategy Itineraries** in AGROasesor (B2.1)
- Module for the **creation of Environmental Programs** with strategy itineraries (B2.3)
- **Module of simulation** of a Strategy Scenario (B2.4)
- **Module on evaluating climate projections** and selecting climate change scenarios (B2.2)
- **New methodologies** and collective management protocols for **crop monitoring**; that use remote sensing, soil monitoring and warning and alert services have been developed in the AGROasesor platform (B4).
- A new **AGROasesor traceability app** (Android and IOS) to simplify data entry (B4)

We have fostered synergies between actors, selecting valid elements to support and evaluate **Governance** through three manuals, and allowed to publish **3 good practice manuals**. (B3)

Twelve demonstration pilots were carried out in the 2018-2021 campaigns, some of which are planned to continue in the After-LIFE plan:

- 3 Environmental Pilots developed during three campaigns to analyze in irrigated agrosystems, and the interaction of different environmental problems (B5).
- 5 Pilots focused on the analysis of collective management through the use of the developed platforms and the interaction between management groups (B6.1).
- 4 replication pilots in 4 new ccaa, in which the implementation of a management model of the platforms developed in the project has been tested from scratch. (B6.2)
- 3 transnational workshops have been held to address replication in the EU (B6.3).

In actions C1 and C2, in this report we have collected the analysis of the indicators monitored in the environmental pilots of action B5. The 2018 campaign was regarded as the initial scenario so as, to establish a baseline for comparison with the final indicators of the 2020 campaign, following the implementation of strategy itineraries. We measured a reduction in water consumption per ton produced of 22% and 25% in CO2 eq emission per ton. In addition, it was observed that in the pilot areas both N and P surplus improve the EUROSTAT indicators for Europe and Spain.

Project communication and dissemination (D1-D2): the project has established a training and awareness channel on the website (https://agroagestor.es/), to support the sector in the adoption and integration of digital tools in the monitoring of farms. Focusing on the service that these tools offer to improve farm management, 45 training courses was carried out with more than 240 students, and 20 manuals, 2 demo and 5 training videos, as well as 22 awareness documents. Numerous activities were carried out to disseminate the project: nearly 12,000 visits to the website, 24 informative panels and posters, 3 technical articles and 4 scientific articles, 18 press releases, 44 conferences and seminars, and 22 journeys with more than 7,000 attendees. 24 networking actions have been carried out.

A collaborative space was built, using the Google Drive open tools, as an intranet, in order to facilitate coordination between the members of the Consortium (E).

The project has created living tools in constant development that represent a commitment of the advisory services to address the digital challenge, under the umbrella of the new framework created in the project (B6.3-B6.4): **AGROGESTOR ALLIANCE**, that is part of the After-LIFE plan designed by the project (E).

LIFE AGROgestor has allowed us to continue the process initiated 10 years ago of creating digital platforms to support crop management and advice and extend it to 9 CCAA.

The Layman report summarizes the work carried out in the LIFE AGROgestor project, and has been published on the project's website https://www.agrogestor.es/en/wp-content/uploads/2022/02/LAYMAN-REPORT-ENG.pdf

4. Introduction

The adaptation of farming to climate change is one of the key challenges to be faced in the upcoming decades, since the farming sector is one of the most sensitive to climate change.

European farmers need crop management tools that take into account the effects of climate change that impact farming. The AGROgestor tool has the potential to simulate different climatic scenarios and hydric resources availability for farming purposes at macro-scale level.

The European Green Deal is the EU's new climate policy and growth strategy for Europe to become the first climate-neutral continent by 2050. The new CAP, starting in 2023, aims to foster a sustainable and competitive agricultural sector that can support farmers' livelihoods and provide healthy and sustainable food for society, as well as vibrant rural areas.

In this new framework, LIFE AGROgestor project has developed tools and made good practices visible, through collective information management and aligning with the EU's Farm to Fork strategy. We have taken steps with the project to support the digital transformation of the sector, with the development of two interconnected digital platforms open to further evolution and supporting multi-stakeholder advisory ecosystems.

LIFE AGROgestor project has developed an **innovative Digital Platform Ecosystem** based on the digital integration of information introduced by farmers using AGROasesor platform, and linked **to** the AGROgestor platform that allows collective management of defined management areas:

- To promote management of collective areas using realistic and measurable environmental, economic and technical **indicators** (31 indicators and 12 multi-criteria selectors): **AGROgestor platform**.
- To promote **multi-actor advisory ecosystems** that integrate farmers as a source of knowledge and digital data of their farms, to monitor farms with collective and individual indicators. This working model promotes and supports farm extension services with new information and digital management techniques: **AGROasesor platform.**
- To promote **digitalization of activity** in the field and the use of **remote sensing services** from the Copernicus program. The main goal is to proactively bridge the digital gap. An example is the use of remote sensing as a tool to improve water use and nitrogen efficiency: **AGROasesor platform**.

The following tasks were carried out to achieve the core goal of this project:

- Develop a decision support tool for the collective management, dealing with and facilitating the crops´ Planning and Management via indicator analysis in different scenarios, within a Collective Management Area (AGC) addressed to Collective Managers (cooperatives, irrigation communities, agro industries, service companies, environmental authorities, public bodies, etc.).
- Promote the wider adoption of nutrient management plans and take advantage of the digital technologies to facilitate their computation.
- Evaluate group management strategies, and tools forwarded to achieve environmental objectives via indicators.
- Carry out and validate governance strategies to deal with the environmental objectives.

- The feasibility of the innovative digital platform ecosystem (AGROgestor and AGROasesor) platform was evaluated in 12 pilots that focused on three environmental problems: basins and aquifers that are overexploited in terms of irrigation; pollution of nitrates in drainage waters and overuse of farming waste. Lastly, a replication plan was designed at national level and was analyzed at international level.

The main results that the AGROgestor project had obtain are:

- An Analysis Tool AGROgestor for indicators for the Planning of Environmental Programs validated in 3 environmental scenarios and replicated at national level and evaluated at international level.
- A **Digital Platform Ecosystem** based on the digital integration of an evolution of AGROasesor platform linked to the AGROgestor platform.
- A tool to classify climate scenarios, which enables identification of simulations for the temperature variables Precipitation and Eto, so that they can be evaluated with the AGROasesor balance tools.
- A set of Farmer Management and Strategies: 3 governance manuals and three good practice manuals, in relation to the three environmental issues addressed
- Utilities, Tools and Collective Management Services to carry out the programmed environmental Plans.

The project activities have enabled other priority results to be achieved, which are:

- Evaluation of environmental indicators (hydric and carbon footprint, fertilizers efficiency of use, etc.).
- Strategic planning of crops and itineraries with farmers according to environmental indicators, using different alternative scenarios and simulations (climatic, availability of hydric resources, crops and varieties, etc.); and through the application of different strategies (choice of crops substitution, controlled deficit irrigation) and governance tools (agreed production systems and application of internal regulations).
- Development of ICT tools for effective monitoring during the campaign through remote sensing and soil monitoring.
- Communication via warnings and alerts to efficiently transmit the recommendations to the appropriate farmers
- Replication of the AGROgestor Platform in 4 Spanish regions
- Three EU-wide functionalities evaluation workshops.
- Training of Collective managers in AGROgestor Platform.
- AGROgestor and AGROasesor DEMOS's, in a real farm.
- Raising environmental awareness of Collective managers and farmers.
- Documents, such as:
    - 3 best practice guides for water governance and irrigation as benchmarks for the three scenarios in different regions.
    - AGROgestor and AGROasesor user's guide.
    - 3 governance guides for the different environmental programs.

The new **Digital Platform Ecosystem** platform allows collective managers and advisors, using fertilization and irrigation HADs of the AGROasesor platform to offer their farmers the most sustainable technical itineraries. This approach is aligned with the proposal of the Commission to promote the ECO-schemes, as an instrument for analysis of strategies adapted to sustainability criteria.

This project has **demonstrated environmental benefits** through the application of strategies planned with the AGROgestor model in three pilots:

- More efficient use of available water for irrigation.
- Minimization of the nitrate lixiviation problem.
- Protection of aquifers by avoiding bad irrigation practices

These benefits were evaluated by reducing two key indicators in the monitoring of the project, **water consumption and carbon footprint by product**. We measured an decrease of 22% in water consumption per ton and of 25% in CO2 eq emissions per ton produced. In addition, it was observed that in the pilot areas both N and P surplus were lower at the end of the project and improved the EUROSTAT indicators for Europe and Spain, therefore clearly reducing the risk of nitrate lixiviation. It should also be noted that a better use of N is essential for reducing the carbon footprint, since it is the main contributor to GHG emissions.

The project **provides long term benefits**, by developing the operational plan of the ALIANZA AGROGESTOR:

- Mainstream use of environmental management
- Promote management at the level of plots, irrigable areas and river basins.
- Promote good agricultural practices.
- Create advisory channels between actors

5. Technical part

5.1. Technical progress, per Action

Preparatory actions

- **Action A1. Formalization agreements between the supporting groups of the project**

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:
A1	Completed	01/11/2017	01/11/2017	31/12/2017	31/8/2021

In this action, an information and consultation process were launched to involve the stakeholders in the project through the AGROgestor working groups.

Although this action was planned to be carried out in the first 4 months of the project, it was actively developed throughout the project in actions: B3 for governance of environmental programs, B6 for replication and D for dissemination, awareness and training.

A1.1.- Creation of AGROgestor working groups and definition of its functions

In this action, an identification of the entities that we needed to involve for the development of environmental programs, and of demonstration and replication actions, both at national and European level, was carried out.

The choice of actors involved in the working groups, was made in coordination with action B3 in order to carry out the analysis of governance strategies.

To carry out an initial study of potential stakeholders in the project, we contacted 185 entities of interest through an online survey (75 responses received and analysed), and personal interviews. At the end of the project, we identified **264 contacts** that we grouped into **106 entities**. The conclusions obtained from the interviews were analysed by the partners in order to set up the project's working groups.

In order to actively involve the project agents in action B3 for environmental programs governance, B6 for replication and D for dissemination, awareness and training, the following groups of action were defined:

- GROUPS OF INTEREST: **46 contacts** in public and national administrations, collective managers (approached in the D actions)
- MULTIACTOR GROUPS: **14 contacts** in advisory bodies and innovation agents: Technicians, experts in digitalization, new technologies and IoT (approached in the D actions)
- Management groups of demonstration PILOT programs: **46 entities** that have taken part in the 12 demonstration pilots in total developed between Actions B5 and B6, and that have also collaborated in action B3.
- NETWORKING GROUP: **24 contacts** counted in the action D1.

A1.2.- Establishment of action protocols and contracts with the replicates in Spain and Europe

National replication has been proposed as an extension of the service in 4 Autonomous Communities through the management of a pilot program in each one. European replication was analyzed in this action, aiming to plan a standardized collaborative data model.

Bilateral meetings were held between each of the public entities that developed the replication and with the partners that were mentoring each of the replication pilots. In these meetings the following was proposed to all the collaborating entities: (i) a chronogram of the actions to follow in order to tackle the achievement of all goals proposed in actions B6 replication and (ii) an agreement of collaboration.

The outcome of this action was a workshop organized in Madrid for the launch of the national replication pilots (10/05/2019). All the stakeholders involved in the different pilots attended this workshop and the agreements with the new Autonomous Communities were signed.

The outbreak of the COVID pandemic redefined the transnational collaboration model, which was finally redirected in Action B6 to three European-wide workshops.

During the development of the project, two milestones allowed us to redefine the objectives of the European workshops:

- the publication in December 2020 by the European Commission of the Green Deal and in particular the two strategies that will mark the development of the European agri-food sector: the biodiversity and farm to fork strategies.
- the adaptation of the different member states to the post-2020 CAP.

One of the aspects highlighted by the European Commission in the Farm to Fork Strategy is the need for producers to have access to objective and impartial advisory services within the framework of effective agricultural knowledge and innovation systems (AKIS). The proposal for a Regulation for the strategic plans to be drawn up by the Member States under the CAP positions the AKIS in a relevant way in the new programming period. Two of the European workshops that were held, have addressed how the tools developed in the project can support and form part of the objectives of AKIS (EUFRAS and Fairshare Workshops).

In addition, in the third approach, we have been able to develop a collaboration with other European countries, to use the development of the AGROasesor nutrient balance tool, through a direct contract with the DG-AGRI, and whose result is the new FaST NAVIGATOR platform.

A1.3.- Agreements and contracts with the data and maps provider entities

Since the entities and collective managers involved in the project (subscribed to the support letters presented in the report), started providing information since the beginning of A1 action, it has not been necessary to establish specific agreements with new entities.

To support remote sensing information at the level of all the Autonomous Regions involved in the project, an official satellite image provider of the Copernicus program has been hired: the Sentinel HUB platform (https://www.sentinel-hub.com), with global coverage service of

updated satellite images and interface service compatible with OGC (WMS, WCS, WFS) and proprietary API (as described in http://sentinel-hub.com/apps/wms).

HETZNER was contracted to support the hosting of the new digital ecosystem of platforms.

To support the hosting of the new digital ecosystem of platforms, HETZNER was contracted.

After the analysis of the requirements for the exploitation of the platforms after the project, carried out in action B6, the decision was made to change to a cloud hosting, scalable according to the evolution of users in the coming years. For this, a reservation of space and machines was made in the AWS service (Amazon Web Services)

- ❑ **Action A2. Definition of indicators to be used by the platform according to the environmental program of the collective management**

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:
A2	Completed	01/11/2017	01/11/2017	31/12/2017	01/4/2018

In this action, we work to identify the indicators we need to focus on collective management from aspects of economic, productive and sustainability management. Analyzing the availability of data to collect from digital platforms developed in the project.

A2.1.- Definition of indicators for the three environmental programs in AGROgestor

The 31 indicators selected for decision-making in terms of the most suitable itinerary for a particular plot within an AGC can be checked in https://www.agrogestor.es/wp-content/uploads/2021/06/Manual_aplicacion_AGROgestor_V3.pdf

Two levels of indicators directly related to the assessment of biodiversity have been included:

- those that positively affect biodiversity: different crops in the rotation in the previous 4 years, number of legumes in the previous 4 years, accounting for plots in which crop residues are incorporated.
- those that negatively affect biodiversity: number of phytosanitary treatments, and accounting for plots in which crop residues are not buried.

A2.2.- Definition of itineraries as key tool for crop management

It was defined as an open Module for Technical Itineraries. It allows us to create base scenarios, to plan target scenarios through strategies and to manage real scenarios. The conceptual analysis of the module was carried out, as well as the definition of the most relevant indicators to be used in the PA (Environmental Programs) of reference that will be used in the pilots of action B5.

In action B2, the requirement analysis was completed by the partners as well as the programming part by Prodevelop. The final output was an indicator module integrated within the AGROgestor platform.

Within the technical itineraries' module, the most important variables for the calculation of environmental and economic indicators proposed in sub-action A2.1 were identified.

Implementation actions

- **Action B1: Development of the evaluation module: creation of basis scenario and analysis according to environmental indicators for collective management**

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:
B1	Completed	01/01/2018	01/01/2018	01/07/2019	01/4/2020

During the first 3 months of 2018 the partners carried out a functional analysis of the components of the new AGROgestor platform.

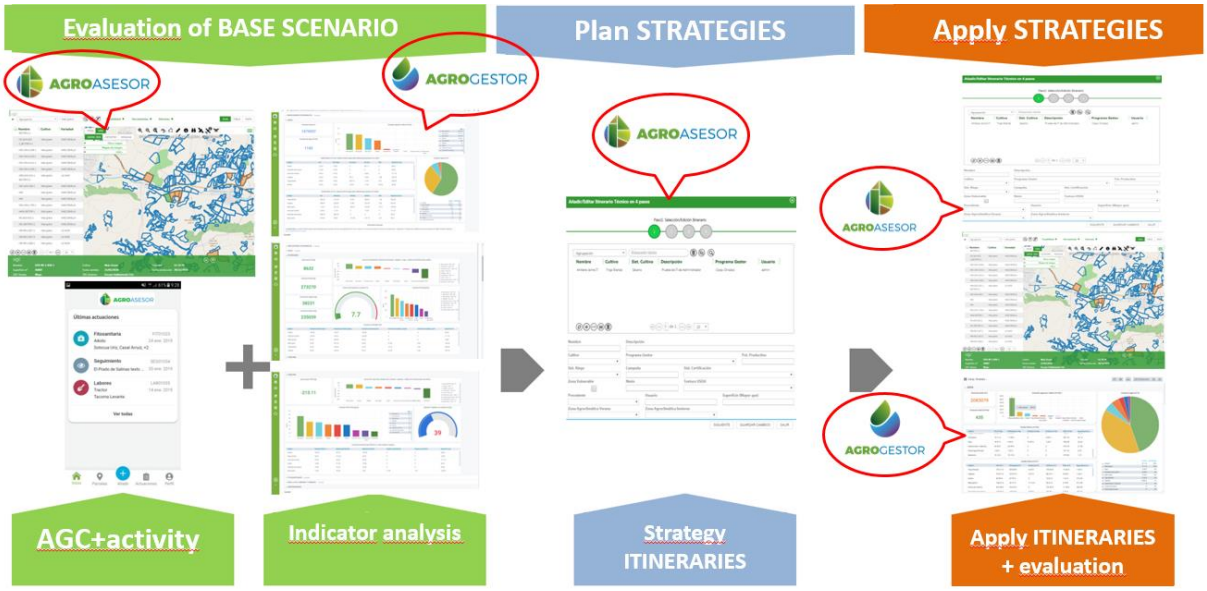
The initial analysis was carried out in line with to two aspects. On the one hand, the analysis of the architecture of the AGROgestor platform and its functional components and on the other hand, the analysis of the current state of the AGROasesor platform, as basis for the design of new client interfaces.

In the analysis, Prodevelop designed the data model of both platforms., working in the integration of a collective management model that connects management of all activities done by farmers in the AGROasesor platform, with the new AGROgestor platform.

In this action we analyzed the data management model of AGROasesor that is shared by the two platforms, as a starting point to structure the architecture of the modules that were finally implemented in AGROgestor:

- Module for the creation of AGC (Collective Management Areas).
- Module for the creation of Technical Itineraries (IT).
- Scenario building module.
- Module for the evaluation of scenarios through indicators.

The following conceptual model is the output of the analysis of B1 and B2 actions goals and of the analysis of the case study that helped conceptualizing the integrated models in the digital platform ecosystem.

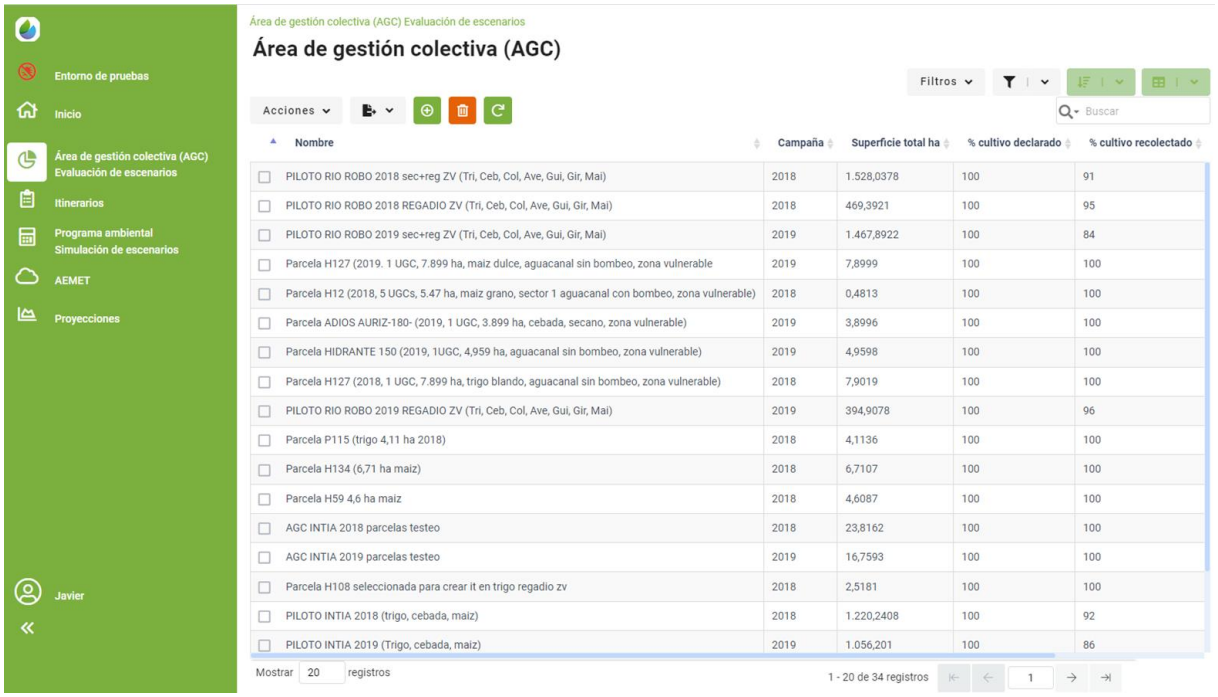


The digital platform ecosystem works in 3 steps:(i) create and analyze scenarios (ii) simulate and propose management strategies, (iii) strategies reevaluation throughout 31 indicators with the support of a climate scenarios simulation tool.

The operation interface of the AGROgestor platform can be seen in the following image:

B1.1.- Delimitation of collective management areas (AGC) and classification (responsible partner INTIA)

In this action, the requirements to build an AGC were defined. An AGC is understood as a group of UGCs (Crop Management Unit) that share qualitative and/or quantitative conditions over a period of time. Thus, the AGC creation module includes multi-criteria filters based on the classification parameters of an UGC.



The AGC module contains **12 multi-criteria filters to define the AGC**: Crop, irrigation system, preceding crop, certification system (e.g. organic production), agro-climatic zone,

zone vulnerable to nitrate pollution, range of production potential, and range of surface area, soil texture, farmer, agricultural plots, municipality and management programe.

The AGC module access UGC data from campaigns in the AGROasesor database. A change was made to the data model in order to be able to manage the collective data of the UGCs of different campaigns. and a tool for the annual update of the SIGPAC was implemented.

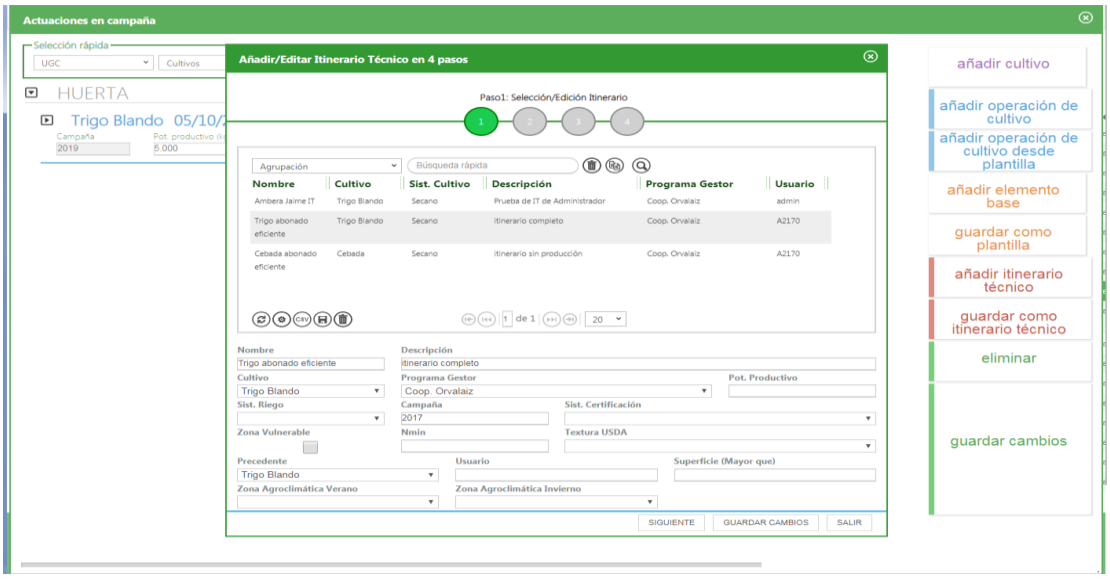
B1.2.- Definition of basis scenario (responsible partner: ITAP)

In this sub-action an initial analysis of the integration of AGROgestor in the architecture of AGROasesor was carried out: in parallel, the Strategy Itineraries module was created and the Base Scenario of a Collective Management Area (AGC) was defined.

The base scenario includes the AGCs, the environmental conditions of that area and the farming activities that took place in each of the UGCs that are part of the AGC over a period of time.

The strategy itineraries module (IT) permits the following:

- All advisor in AGROasesor can analyze a base scenario and creates strategy itineraries (IT)
- DSTs can be used to evaluate IT of past scenarios or expected scenarios
- ITs are created in AGROasesor
- created ITs are used in AGROgestor
- all advisors can deliver created IT strategies to users (farmers)
- each farmer can accept the IT recommendation according to the management decisions in their farm



All information required for conceptual analysis for base scenario module can be found in deliverable **D6_B1_Protocolos y requerimientos del módulo de escenarios base**

B1.3.- Analysis of the base scenario using indicators (Responsible partner: Neiker)

For the first months, the programming needs for the indicator's module were planned. The Carbon Footprint equation programmed in LIFE sigAGROasesor platform was revised and validated to be adapted according to new legal requirements (ISO14067).

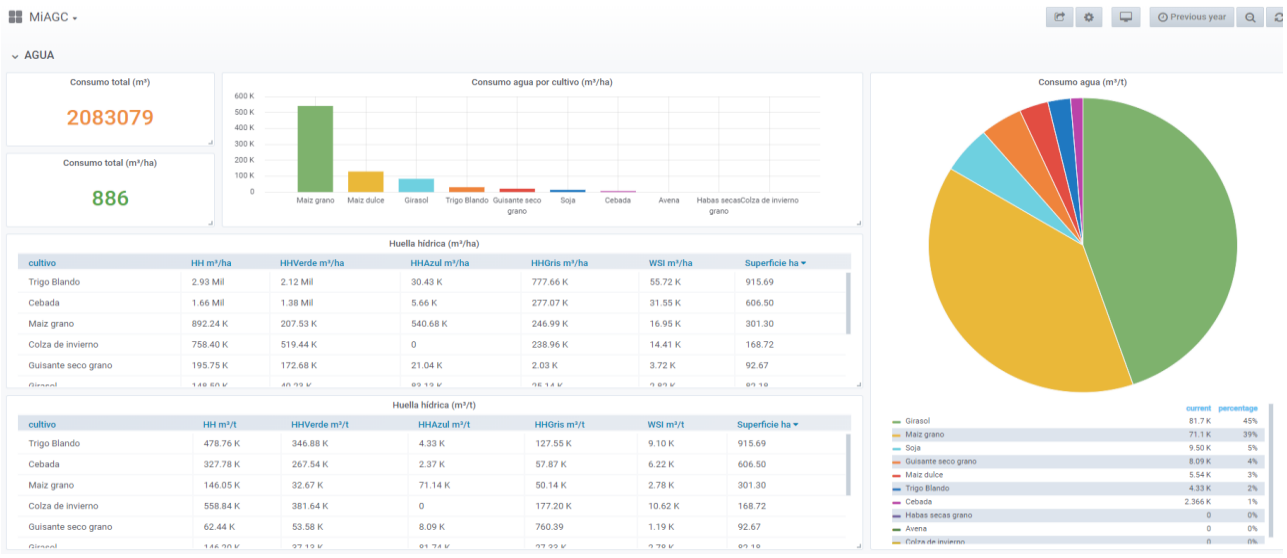
The indicator module analyses groups of UGCs and provides grouped results. However, individual indicators for each UGC are also calculated for farmers in order to compare these indicators with those calculated for the AGC (Action B4.4.).

Several external reference values are used to evaluate calculated indicators. Thus, for the Carbon Footprint and Hydrical Footprint, the data base from Agri-foodprint V4.0 2017 is used. For Eco-toxicity, the reference values come from Recipe 2016. All these are based on security norms: Life Cycle Analysis ISO 14.040. For water use, N, P and N and P surplus, average values per country from Eurostat database were included.

With the analysis executed by NEIKER in action A2 and the collective analysis from all partners in this action, Prodevelop programmed 85% of the Indicator Module by 01/04/2019.

AGROgestor provides us with a dashboard; a kind of "summary" that collects data from all the plots/users in a single place and presents them in a "digestible" way. It allows data analysis and decision-making by means of 31 indicators grouped into the following blocks:

- Economic: Production and gross margin.
- Water use: Water consumption, water productivity and Water Footprint and its components (blue, green and grey). Water Stress Index.
- Nitrogen management: Total, mineral and organic N consumption. Organic N in relation to total N, excess N, N contribution from irrigation water.
- Phosphorus management: Total, mineral, and organic P2O5 consumption. Organic P as % of total P, excess P2O5.
- Emission balance: Carbon footprint and energy.
- Use of phytosanitary products: Number of phytosanitary treatments in a campaign, toxicity in fresh and marine water, terrestrial and human toxicity.
- Biodiversity: Different crops in rotation in the last 4 years, incorporation of leguminous plants in the last 4 years.



Indicator Module view for values, tables and charts calculated for Water Strategy.

❑ Action B2. Development of the planification module: generation of target scenarios by collective management strategies

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:

B2	Completed	01/01/2018	01/10/2018	01/10/2019	01/4/2021

All the analysis, programming and testing work carried out in the development of this action has been coordinated with the analysis, programming and evaluation of action B1. The strategy model had to be analyzed in parallel, through the pilots of action B5. The great difficulty in ICT development in parallel with the analysis caused significant delays in the operational availability of the programmed modules.

Prodevelop facilitated evaluation by building three programming environments: a pre-production environment with temporary data from the test farms in AGROasesor and AGROgestor, an integration environment with the modules of the two platforms connected, and a final production model, with the complete digital ecosystem, the operational modules and the data from the pilots transferred from the pre-production versions and completed. By March 2020 we had pre-production and integration test versions available to evaluate the baseline and strategy scenarios. Production version was available by March 2021.

B2.1- Definition of strategies

The crop succession model was defined (B2.1.1) and the requirement analysis to use HADs in foreseen strategies was completed. See other Annexes:

- OA42_Manual_HAD_FERTI_completo_usuario_250919
- OA43_Manual_HAD_RIEGO_completo_usuario_250919 and
- OA44_Manual_HAD Teledeteccion_20190925

The requirements analysis for the management of Irrigation Turns was carried out (B2.1.3). To do so, the needs of collective managers in the management of infrastructure was analyzed. We detected three key points that we need to review in depth, in relation to the management of information, connections and customer services in AGROgestor:

- Compulsory crop declaration in the CR
- Connection with network analysis programs (Gestar, Epanet ...)
- Load the result of the network analysis in AGROgestor to show alerts in the network

The last two points involve managing irrigation network information on the AGROgestor platform, which we cannot address within the framework of the project. There are also online applications that provide this type of service. Nevertheless, the AGROgestor platform allow to manage a model of collaborative data (action B6) to provide irrigation communities with useful information such as the crop statement in the base scenario and the simulation of areas in the strategy scenario.

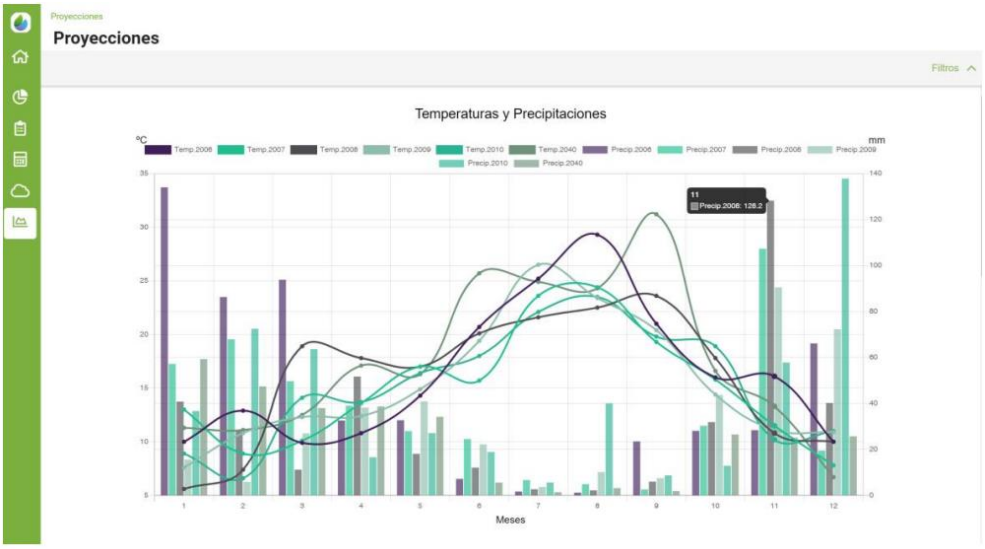
ITAP, INTIA and IRTA had planned strategies based on the analysis of the base scenario with the data of the three pilot studies during the 2018 campaign (action B5).

B2.2.-Evaluation of the use of target scenarios along medium and large temporal scales

A Climate Projections tool has been built to simulate the behaviour of crops in climate change scenarios on the AGROgestor and AGROasesor platforms, with the aim of assessing the impacts and vulnerability of crops.

Climate projections for the 21st century have been used as a basis, specifically the daily data produced by AEMET, elaborated in the Fifth Assessment Report of the IPCC, AR5-IPCC, within the Spanish territory.

The Climate Projections tool permit the following: (i) Easily classify and select specific scenarios for the simulation of crop behavior. (ii) Export the meteorological information of the scenario for analysis in AGROgestor and AGROasesor (iii) Identify simulations for the temperature variables precipitation and Eto, so that they can be evaluated with the AGROasesor balance tools.

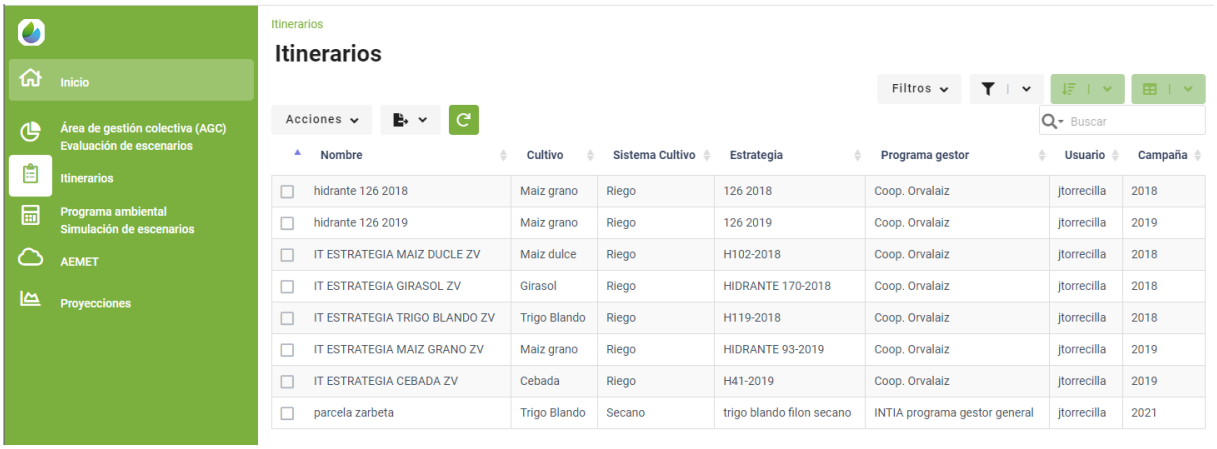


AEMET has proposed the following lines of work when analyzing temporal scenarios: In the most representative meteorological stations of each pilot the last 15 years within the corresponding quintile have been tagged (for instance: Extremely hot, very hot, hot, average, cold, very cold and extremely cold). In this way, the collective manager can choose the year that meets the model of the climate scenario to be analyzed, with all the daily meteorological data uploaded in AGROasesor.

The climatic characterization is done for monthly, seasonal and annual periods of time, from average monthly values and monthly accumulated precipitation values.

B2.3.- Generation of new scenarios: analysis by indicators and selection of the target scenario to adopt (Responsible partner: INTIA)

Strategies on the two platforms are managed through cultivation itineraries (ITs), which have been evaluated and selected, based on their indicators. Strategy ITs can be created by advisors and collective managers via the following steps: (i) using AGROasesor's DADHs which standard plots can be selected for an Environmental Program, (ii) creation of strategy ITs and creation of an environmental program in AGROgestor for monitoring and simulation, (iii) selection of the set of farmers to whom we want to send a strategy IT, using the AGROasesor's warnings module.

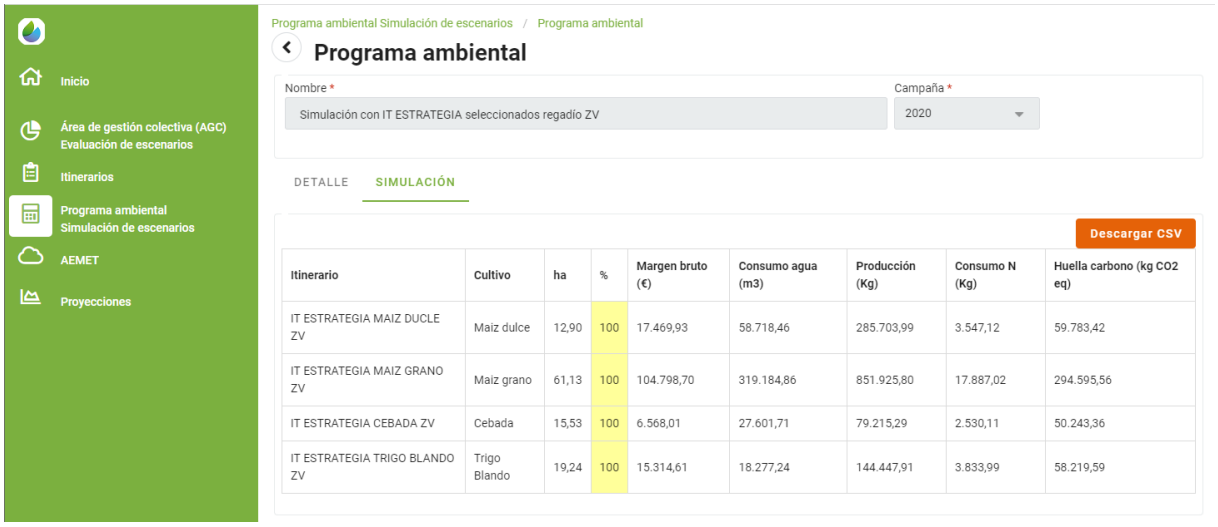


D10_B2_Informe sobre la herramienta de generación de itinerarios objetivo o de estrategia

B2.4.- Definition of goal itineraries: Indicators for strategy follow up

Finally, AGROgestor includes a module to simulate strategy itineraries in an environmental programme and evaluate it with indicators.

The simulation of the environmental programme is directly evaluated with 5 indicators: Gross Margin (€), Water Consumption (m3), Production (Kg), N Consumption (Kg), Carbon Footprint (kg CO2 eq), and the remaining 26 can be downloaded for a complete evaluation.



Itinerario	Cultivo	ha	%	Margen bruto (€)	Consumo agua (m3)	Producción (Kg)	Consumo N (Kg)	Huella carbono (kg CO2 eq)
IT ESTRATEGIA MAIZ DUCLE ZV	Maiz dulce	12,90	100	17.469,93	58.718,46	285.703,99	3.547,12	59.783,42
IT ESTRATEGIA MAIZ GRANO ZV	Maiz grano	61,13	100	104.798,70	319.184,86	851.925,80	17.887,02	294.595,56
IT ESTRATEGIA CEBADA ZV	Cebada	15,53	100	6.568,01	27.601,71	79.215,29	2.530,11	50.243,36
IT ESTRATEGIA TRIGO BLANDO ZV	Trigo Blando	19,24	100	15.314,61	18.277,24	144.447,91	3.833,99	58.219,59

The deliverable **D19_B1_Herramienta de planificación y evaluación de escenarios base operativa.** Final version shows the final programmed simulation model in its final version.

❑ **Action B3. Governance of the environmental programs on collective management. Incentive and fidelity scheme of farmers**

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:
B3	Completed	01/01/2018	01/01/2018	01/10/2019	01/06/2021

Work was done in this action on planning and monitoring a governance program in each of the three Environmental Pilots, in order to finally create a training Module on Governance.

An efficient resource management enhances both economic and environmental farm performance, and this is the objective followed to analyze the Environmental Pilots from the Governance perspective.

In this action a preliminary information and consulting process was organized to involve the actors in the project through working groups in AGROgestor (identified in action A1).

B3.1.- Creation and functioning of the collaborative governance groups

These areas have been selected as pilot programs for the project due to the collaborative experiences between the different involved actors.

B3.2.- Evaluation of governance strategies

The analysis of governance experiences has been done in areas where the pilots of the project are taking place. There were several meetings with each agent involved in each of the pilots to gather collective management strategies that are applied in those areas and to analyze the collective management strategies suggested in the project.

Different strategies were analyzed in each pilot, depending on the available indicators in the previous campaign2018). Each of the analyzed strategies are proposed, evaluated and implemented by following 7 steps.

In the proposal, we considered analyzing the establishment of quotas, concerted production systems and the application of internal regulations as fidelity measures; nevertheless, in the governance manuals carried out, these measures have not been selected by the working groups. However, measures adapted to the new scenarios that the EU has set for sustainable agriculture have been incorporated, from the Green Deal and specifically with the objectives of the Farm to Fork strategy and those of Biodiversity. The draft "Real Decreto de Nutrición Sostenible", and the need to have indicators for the Eco-schemes of the new CAP were also present in the evaluation of the Governance. The rise in fertilizer prices in the 2021 campaign was the trigger for encouraging the use of the balance sheet and precision agriculture tools.

B3.3.- Information, training and awareness of involved farmers

A Manual to Support Collective Managers in Governance was created as a tool to manage PAs in an AGC. The manual intends to help with most common problems that collective managers might find and to offer specific and realistic solutions that can work as a guideline for collective managers.

It was used to create the three MAGs for each B5 pilot and finally, to develop the Collective Management group governance training module in digital versión in the web page: https://www.agrogestor.es/wp-content/uploads/2021/12/B3_Modulo-de-formacion-en-la-gobernanaza-de-los-grupos-de-gestion-colectiva_v2.pdf

Within each governance manual, training and communication sheets have been included, including:

- Training courses, for farmers and for advisors, two distinct modules have been created.
- Active participation techniques, such as surveys to assess governance measures, which have been proposed for re-evaluation in the postlife.
- Establishment of simple communication channels, which have made it possible to transfer the HAD manuals to the farmers.

➢ **Action B4. Development of "TIC" tools and functionalities for collective management of the campaign: execution stage.**

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:
B4	Completed	01/01/2018	01/11/2017	01/4/2020	01/12/2020

B4.1.- Development of collective remote sensing services (Responsible partner: IFAPA)

A significant advance in this action was made in parallel with the development of satellite imagery services under the Copernicus Program. SENTINEL HUB services were hired to get images and index values at national level. This service provides on-time images based on SENTINEL satellites. Prodevelop adapted all the remote sensing tools to the new image provider services.

During the project, the access to SENTINEL HUB data evolved with significant changes such as: improvement in the search tool of images, improvements in the user interface, metadata from layers was included in the view window interface, new spectral index values, automatic update of image layers or upload of keys.

The last version of the remote sensing module includes the functionality "Temporal evolution of indexes per agricultural plot". This functionality shows the temporal evolution of each of the vegetation indexes obtained from the images at agricultural plot scale. It was fully operational in May 2020.

In May 2021, the intra-parcel grading tool was reprogrammed, so that the farmer was fully independent to create a variable dosage map, and transfer it to his application machinery.

Finally, the methodology for the biomass calculation produced by the crop was described. The model Monteith (1977) was followed with satellite images, meteorological information and tabulated parameters.

B4.2.- Development of shared monitoring services of soils (Responsible partner: INTIA)

In this sub-action a monitoring system was set up for the evaluation of measured Nmin (Mineral Nitrogen) in soil over agricultural plots of reference during one campaign. The goal of this system is to get zonal estimations of Nmin. The demonstration took place in the pilot organized by INTIA: 2 AGC were considered: AGC 1: Vulnerable Zone of Robo River (It includes two SAT: Obanos Cooperative and Valle Izarbe Cooperative) and AGC 2: Collective management of Orvalaiz pilot.

For the selection of the plots within the AGC, attributes related to each of the plots have been considered: Crop, Previous crop and application of organic fertilizer: YES/NO. The selected crops are those occupying most of the area and the most representative ones in the AGC: Corn for grain (irrigated), Common Wheat (irrigated and non-irrigated) and Barley (non-irrigated).

In AGC 1, samples of Nmin were collected in 11 plots where corn was planted on the 26/06/2018 and in 8 plots on 19/06/2019. In AGC 2 (Orvalaiz Cooperative pilot) during the 2018 campaign, Nmin was monitored in 45 plots on 18/12/2017 and in 55 plots on 12/12/2018.

A new parameterized work methodology has been proposed, organized from highest to lowest accuracy of the available data, as it is suggested by IPCC for the calculation of GHG emissions:

- Tier 1. - General parameters provided by IPCC to use them when there are no other values of reference.
- Tier 2. - Each state member or Autonomous Community (region in the country) is capable of defining more accurate parameters for their own territory. Those parameters should always be supported by the scientific community at regional level.
- Tier 3. - Parameters that are adjusted to more specific or localized examples regarding production type systems, varieties, regions and so on. These values should be always properly justified.

Nmin in soil
Tier 1. - General use chart for crops of reference and intensification level.
Tier 2. - Same chart but adapted to the state member or region (Autonomous Community, CCAA).

Tier 3. - Zonal estimation of Nmin in UFN (kg /ha) following Nmin in soil sampling strategy during the campaign over representative agricultural plots in an AGC.
To select the agricultural plot the following variables are taken into account:

- Crop in the campaign (Winter cereal, summer cereal, horticultural crops…)
- Previous crop (Legumes/fallow/other crops).
- Management of previous crop residues (included/not included)
- Organic manure inputs in the two previous campaigns (YES/NO).

This methodology will be used in the replication pilots.

All detailed information on the work done in this sub-action can be found in the deliverables **D18_B4_Resultados de la calibración de las metodologías de gestión colectiva de suelos en las parcelas piloto (PP) del piloto de zonas vulnerables** and **D13_B4_Descripción de la metodología de gestión colectiva de monitoreo de suelos**

B4.3.- Microclimatic warning services (Responsible partner: AEMET)

In this action AEMET has proposed the partners to choose between the following two options:

1. Using“Meteoalerta” (MeteoWarning) product services: Within each region there are several different agroclimatic areas: coastal, rain, wind, temperature. There are thresholds set for warnings in each of the areas. The thresholds are different on each area. These thresholds are set every 24 to 48 hours. They consist on data archives and a shape file but they cannot be modified. The information sent is simple and can be accessed in the AGROgestor platform with a link.

2. Using forecast data and creating their own system of warnings that can be managed. With the forecast at 7 days (maybe it could stay with the forecast to 24-48 hours) to see what parameters could be used to create warnings from the AGROgestor platform with a collective management of the threshold values.

In this project, we spent a lot of time on programming that was not well evaluated in the proposal, since until all the conceptual analysis work had been done on actions A2-B1 B2 and B3, so we could not identify it. We were less ambitious in the scopes that do not compromise key objectives of the AGROgestor platform. We decided to make an access to meteoalert visible with a link from agrogestor.

B4.4- Usefulness of continuous evaluation by individual and group indicators

In this action, the analysis of a module comparing the 4 main indicators for a UGC with the reference indicators for a collective management area was carried out. Finally, given the potential interest of the 31 indicators to be used as elements of comparison, it was decided to prepare for each AGC, the complete download of the indicators at the level of each agricultural parcel. With this new functionality, a technical advisor can prepare specific reports for each UGC, comparing the indicators he/she decides on for the total supply and comparing them with the collective indicators.

B4.5.- Development of communication, notice and warning services (Responsible partner: IRTA)

In this sub-action the potential of communication module and the programming resources needed to develop the module was analyzed. To do so, the current warning system module of AGROasesor was analyzed (this module was executed in the life AGROintegra project).

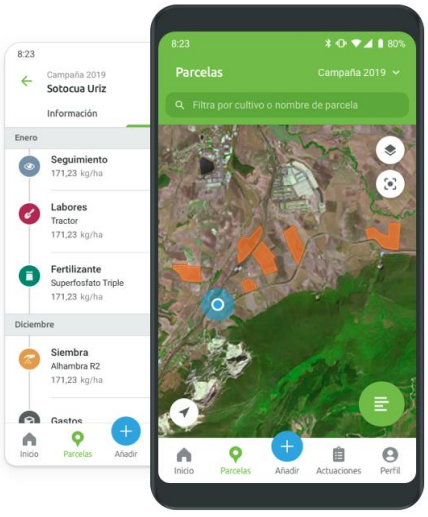
It was found that users and collective managers need warning models linked to traceability management (electronic recipe). In addition, communication by mobile phone is considered useful (delivery, answers and warnings).

The module for Itineraries creation in AGROgestor is in itself a model for electronic recipes creation. The environmental program advisor can use this module to send strategies based on itineraries at agricultural plot level. These strategies must be validated by the farmer in the AGROasesor platform. The notice module enables both actions to be combined to strengthen advisory actions.

B4.6.- Collective tools for traceability management (Responsible partner: ITAP)

In this sub-action a module was programmed for uploading a complete parcel map in the data management model that can be found in AGROasesor connected with the new services created in AGROgestor. Prodevelop programmed a new functionality according to the expected functional requirements by ITAP: a massive upload of new UGCs, grouped by users and their farm, including the title holder name and the initial upload for a group of new users.

An external company was hired for technical analysis of usability and functionality necessary to program the traceability App. After studying several quotes from different companies, the GUSTA company was selected. The output of the work done by the company consisted of a final document provided on 1/2/2019 that allowed Prodevelop to execute the programming of the App. The new **AGROasesor traceability app** was uploaded to the Android and IOS markets in October 2020



Detailed information on the work done in this sub-action can be found in the deliverable **D17_B4_Protocolos y requerimientos para la carga masiva de información** and in other annexes OA47_B4_4 app Design

❑ **Action B5. Platform validation in 3 pilot programs of environmental collective management**

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:
B5	Completed	01/01/2018	01/11/2017	01/12/2020	01/06/2021

The main goal of this action is to **implement pilot programs to validate the developments carried out in the project** and reduce the environmental impact in each one.

The establishment and organization of the CGAs was completed. The creation of working groups with all the actors involved in each pilot program was completed. In each pilot, information from three complete campaigns in each pilot area was managed:

The 2018 campaign was the base scenario used to analyze the strategies to be promoted in the 2019 or 2020 campaign. Depending on the development of each pilot, we worked with the strategy itineraries that focused on improvement results in the 2020 campaign. All the scenario analysis was carried out by calculating AGROgestor indicators.

The full results of the three campaigns as well as the conclusions and lessons learnt from each environmental pilot are described in detail in the deliverable **D37_B5_Informe final Pilotos.**

B5.1.- Pilot programs in watersheds and aquifers at over exploitation risk (Responsible partner ITAP)

ITAP is in charge of executing the pilot program where watersheds at risk or already in a state of overexploitation are considered. The pilot area is located in the groundwater area named Mancha Oriental, where 120000 ha of irrigation farming are located. This area suffers intense and high-pressure extraction of ground water resources.

The target of this pilot project was to improve consumption indicators in the irrigation area of the Mancha Oriental groundwater. The project involves the collaboration of different actors such as the Irrigation Communities (CR) and the Central Board of Irrigators of La Mancha Oriental (JCRMO). In total, the management covers a variable area of around 6,000-7,000 ha, and around 4,500 ha of surface was covered in the pilot.

ACTORES DEL PROGRAMA AMBIENTAL

ORGANISMO	FUNCIONES
CR Tesoro de Cadillo	Difusión informativa y gestión colectiva de sus agricultores.
CR Cruz Bermeja	Difusión informativa y gestión colectiva de sus agricultores.
CR Hoya del Aljibe	Difusión informativa y gestión colectiva de sus agricultores.
CR La Molineta	Difusión informativa y gestión colectiva de sus agricultores.
Junta Central de Regantes de La Mancha Oriental (JCRMO)	Asesoramiento y gestión coordinada de las Comunidades de Regantes y nexo de enlace entre actores.
Instituto Técnico Agronómico Provincial (ITAP)	Asesoramiento, evaluación y propuestas de estrategia.

Actions overview:

- Encouraging the creation of an environment of collaboration and transmission of information between technicians, RAS and RC managers.
- Establishment of a recurrent system for the exchange of periodic information necessary for the constant updating of the AGROasesor and AGROgestor platforms.
- The digitalization of the AGROasesor platform of the data per plot of the AGC.
- The monitoring of irrigation and its programming.
- Management of demonstration plots for monitoring with DST fertilisation and irrigation.
- Allocation of reference plots/crops in terms of the most appropriate management of water resources (and/or other inputs).

When analyzing the base scenario (2018), total water consumption in the pilot amounted to 18,857,028 (m3) and the average consumption per hectare was 4,258 (m3/ha).

In order to establish a good use of natural resources, it is essential to establish deficit irrigation that leads to lower water consumption in crops. The water footprint is a very relevant indicator for these evaluations between seasons because it represents the total volume of water used for crop production. By using the Strategy Itineraries, we **reduced N surplus by 7%**, also **reducing the emission of kg CO2 eq per tonne produced by 27%**. With **irrigation water consumption per ton of crop produced reduced by 24%**.

Over the four years of the project, 18 actions were carried out around the Albacete Pilot and the Albacete Environmental Program (Castilla-La Mancha), with nearly 150 attendees.

Ten workshops focused on the analysis of governance (B3), and 8 training workshops (D2), in which awareness-raising objectives have also been focused, on the management of areas vulnerable to nitrate pollution in over-explotation water risk areas.

B5.2.- Pilot programs in Nitrate vulnerable zones (Responsible partner: INTIA)

INTIA is in charge of the pilot program for collective management in Nitrate polluted vulnerable zones.

The pilot was carried out in the Vulnerable Zone corresponding to the Robo river basin. A total of 8,244 ha were declared as vulnerable to nitrate contamination, of which 4,124 ha are cadastral agricultural plots.

Two Agricultural Transformation Companies collaborated, which accounted for 50% of the irrigated agricultural surface area and about 35% of the rainfed surface area of the total irrigated and rainfed surface area in the Vulnerable Zone.

ACTORES DEL PROGRAMA AMBIENTAL

ORGANISMO	FUNCIONES
SAT Valleizarbe y Coop. Grupo Obanos	Digitalización de la información de actuaciones por parcela
Cooperativa Orvalaiz	Asesoramiento y equipo de Gestión y Gobernanza
Comunidad de Regantes del Sector I del Canal de Navarra-Valdeizarbe	Equipo de Gobernanza
Sociedad concesionaria: AGUACANAL	Equipo de Gobernanza y Digitalización de consumos de agua
INTIA	Asesoramiento, evaluación y propuestas de Estrategia
GAN	Dotación de medios de control ambiental

Actions overview:

- Monitoring of all the actions of the extensive crops of the two selected SATs.
- Monitoring of plots with organic/mineral inputs.
- Monitoring of 10 test plots of grain maize: soil Nmin + balances.
- Monitoring of pilot irrigation plots for grain maize: soil moisture sensors, irrigation ADH.
- Monitoring of pilot plot fertilisation of grain maize: HAD fertigation.
- Compilation of analytical controls carried out by GAN and CHE.
- Continuous measurement of flow and nitrates.
- Compilation of real consumption data per hydrant.
- Evaluation of the volume of water allocable to irrigation in Río Robo.

In the 2018 and 2019 seasons, the distribution of N and irrigation inputs per month for each crop in the pilot was analyzed. To do so, the different itineraries used by both SATs according to the varieties and chronology of the campaign were analyzed. This allowed us to detect that the N inputs made from February to April in rainfed winter cereals have an impact on nitrates in Río Robo rising above the 50 mg/l limit.

By using the Strategy Itineraries, we reduced N surplus by 29% and reduced the emission of kg CO2 per ton produced by 24%.

The pilot served to raise awareness of the importance of good fertilization management to maintain current levels, but it has also shown the stability of the basin at the levels of risk detection in nitrates due to the low seasonal flow of the River Robo.

Over the 4 years of the project, 26 actions were carried out around the Rio Robo Pilot Project and the Environmental Program for Vulnerable Areas in Navarre, with a total of almost 400 attendees. Five workshops focused on the analysis of governance (B3), 13 training workshops (D2) and 7 awareness-raising workshops (D2) on the management of areas vulnerable to nitrate pollution. In addition, a survey on the key INSTRUMENTS for GOVERNANCE was carried out among the actors who took part in the pilot project.

B5.3.- Pilot programs in areas with high concentration of organic residues (nitrates and phosphates) (Responsible partner: IRTA)

IRTA is in charge of executing the pilot program in areas with a high concentration of organic residues (livestock waste with a high content of nitrogen and phosphorous) in colaboration with Agraria de Torelló, in the region of Osuna. The agreements with Agraria de Torelló and its farmers provide a pilot program with 15 plots of land belonging to 7 farmers, representing more than 40 ha of surface area that generate an indirect impact on 5 different municipalities in the region. This co-operative manages a waste management plan for a total of some 4,000 ha. Of these, approximately 1,500 ha correspond to crop land within the Osona region.

ACTORES DEL PROGRAMA AMBIENTAL:

ORGANISMO	FUNCIONES
IRTA	Asesoramiento, evaluación y propuestas de estrategia.
Agraria de Torelló	Digitalización de la información de actuaciones por parcela. Gestión colectiva de las deyecciones.
esporc	Entidad privada de referencia en el sector agropecuario.
DARP	Dotación de medios de control ambiental. Administración pública.
Agència Catalana de l'Aigua (ACA)	Dotación de medios de control ambiental en cuenca hidrográfica.

Actions overview:

- Management of organic fertilizer inputs in vulnerable areas.
- Digitalization of data by AGC plot on the AGROasesor platform.
- Implementation of the itineraries proposed in the framework of the new fertilization management decree 153/2019.
- Dissemination and awareness-raising of the tools available and the regulations in force for the correct management of droppings.
- Follow-up of parcels with organic inputs to apply a collective management of livestock waste in the area and control N and P inputs in the system.
- Analysis of the analytics in soil samples (physico-chemical parameters, nutrient content and heavy metals) and livestock waste. The analysis made it possible to establish the itineraries to be followed and the calculation of indicators.
- Analysis of the base scenario in the pilot, strategy planning and other applicable measures for collective management to improve the organic levels in the parcels of the pilot.

- Analyses of soil and organic products applied by farmers in their parcels were carried out. The results of the analytics were used for the calculation of indicators derived from Nitrogen, Phosphorous and Potassium balances.

By using the Strategy Itineraries, we reduced N surplus by 122% and reduced the emission of kg CO2 per ton produced by 35%.

Various training and awareness-raising activities have been carried out, particularly relevant have been the conferences held in collaboration with the AGRICLOSE project.

Over the four years of the project, 10 actions were carried out around this pilot, with nearly 480 attendees. Four workshops focused on the analysis of governance (B3), and five training workshops (D2), in which awareness-raising objectives have also been focused, on the management of areas in areas with high concentration of organic residues.

❑ Action B6. Replication of the project

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:
B6	Completed	01/07/2019	01/05/2019	01/06/2021	01/04/2021

B6.1- Application of this service to 4 more regions in Spain

Replication pilots were launched in July 2019 after the meeting organized on 10th May 2019 in Madrid with all the pilots.

Through the development of 9 demonstration programs in 9 regions, we were able to address replicability, validation and transfer objectives. The LIFE programme promotes the demonstration of transfer in the EU and through the pilot programmes of this project the tools developed were validated, with an agro-climatic diversity, different types of crops and production structures through the collaboration of irrigation communities, cooperatives and farms, in 9 ccaa at national level.

Four demonstration pilots were conducted in 4 new CCAA, in which the implementation of a management model for the platforms developed in the projectwas tested from the ground up:

- Castilla-León (tutor: Neiker), irrigation efficiency pilot with the Irrigation Community of "Canal de Tordesillas" (Valladolid). Actors: ITACYL and Irrigation Community of "Canal de Tordesillas". 125 ha in 36 parcels.
- Aragón (tutor: INTIA), Pilot in Bizcarra farm, evaluation of the farm located in a vulnerable zone with pollution risk from nitrates. Actors: CITA, Riegos de Alto Aragón, Bizcarra farm and AGRARIUM. 309 ha in 19 parcels.
- Madrid autonomous region (tutor ITAP), pilot with the Irrigation Community of Hortifuela, in an area with high risk of pollution by nitrates and in a catchment at risk of overexploitation. Actors: IMIDRA, HELICONIA S.COOP.MAD, C.R. HORTIFUENLA, Agricultural park of Fuenlabrada.700 ha in 600 parcels.
- Extremadura (tutor IFAPA), Pilot with the "SOCIEDAD COOPERATIVA LIMITADA PRADILLO", in an area with high risk of pollution by nitrates. Actors: CTAEX and Cooperativa Pradillo. Around 1000 ha in 297 parcels.

The full results, as well as the conclusions and lessons learnt from each replication pilot, are described in detail in the deliverable **D39_B6_Informe final de cada una de las réplicas en las 4 CCAA.**

Five demonstration pilots were conducted in the partners CCAA, and focused on analyzing collective management through the use of the developed platforms and the interaction between management groups:

- País Vasco, Pilot to manage efficiently N in Garlan Coop. 50 ha in 49 plots. Pilot t focused on the analysis of Coop Garlan's management and needs, and on raising awareness of fertilization management, using variable rate techniques.

- Andalucía, Pilot for collective management of vulnerable zones to pollution by nitrates, within the hydrographical demarcation of the Guadalquivir, 2500 ha in 94 parcels. Actors: IFAPA and Serfica SL
- Navarra, Pilot managed with Coop Orvalaiz on in-season decision making for continuous adjustment of fertilization, with the aim of saving and efficiency in fertiliser application.500 ha in 50 plots.
- Castilla La Mancha. Monitor the 2018-2020 pilot area during the 2021 seasons by extending remote sensing crop monitoring, and further assess indicators of agricultural activity related to crop water use in the pilot area.
- Catalunya, we continue to work in 2021 with a working group already formed by technical advisors, farmers, specialists in organic fertilization, the fertilization office (DACC) and our reference cooperative in the area with the aim of cooperative of reference in the area with the aim of jointly analyzing the improvement of livestock manure in the management of livestock waste and the needs of farmers and livestock farmers in this area.

B6.2.- Extension of the service model AGROgestor in three countries of south Europe

From the beginning of the project, several strategies to tackle this action have been analyzed. The activity foreseen in action B6.2 and B6.3 was proposed at the beginning of the project to focus on the availability of a collaborative data model, which allows the AGROasesor and AGROgestor platforms to connect with other information platforms. Since the project proposal was written, the interconnection between technologies and databases and the digitization of information has become very important in the agricultural sector. At the same time, the difficulty of simultaneous analysis, programming and definition of the digital advisory ecosystem made us re-evaluate the objectives of these two actions.
Finally, given the course of the COVID pandemic, it was decided to hold online workshops for the management of transnational replication, in addition to fruitful contacts on the working group on Fast tools (Farm sustainability Tool for Nutrients).

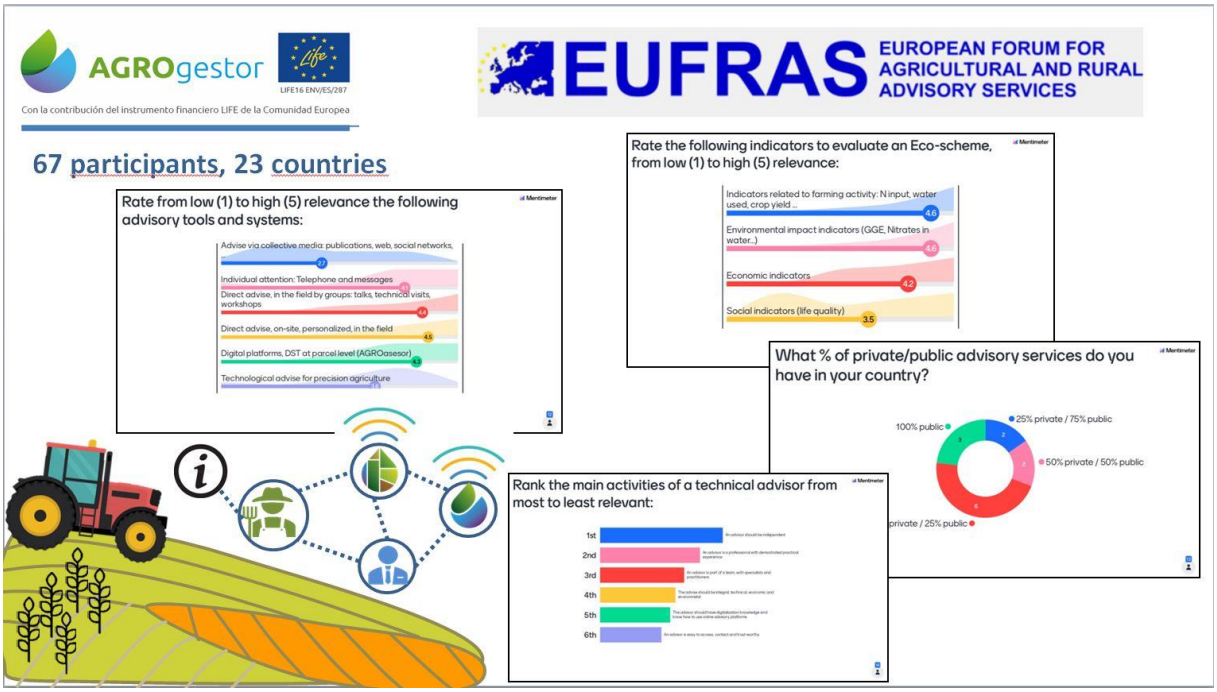
Finally, the final proposal for this action is focused in the following points:

- To promote a meeting between countries of Europe regarding the requirements for the nutrient balance tool at parcel level mentioned in the new CAP (FaST Farm Sustainability Tool for Nutrients.).
- To analyze how to manage advisory tools for collective management of Irrigation.
- To analyze the new European policies following the Green Pact and the Farm to Table strategies and the sustainability strategy.

Two Europe-wide replication workshops were conducted in 2020:

- H2020 FAIRshare workshop was celebrated on 19th November 2020: "Digital advisory tools. Eco-schemes in the new CAP", in the framework of the annual meeting of the H2020 FAIRshare project.
  The workshop focused on explaining how the digital tools, AGROasesor and AGROgestor, are integrated into farm advisory services, and how to implement and evaluate an ECO-scheme using these tools.
  45 participants from different European countries worked through different exercises on "How digital indicator-based analysis platforms can help us to approach an ECO-scheme".
- EUFRAS workshop: 5 and 6 October 2020 the European replication workshop "Digital advisory tools, Eco-schemes in the new CAP" was held in the framework of the web

conference "Preparing Advisers for the Digital Era", organized by LRATC / EUFRAS / IALB / GFRAS.
Several interactive exercises were carried out with around 67 participants from organizations in 23 European countr (Spain, Germany, Ireland, Poland, Slovenia, Hungary, Italy, Portugal Latvia...) and from Brazil, Russia, Chile, Mexico and Madagascar. The workshop was structured in 3 phases: in the first phase, the environmental program that needs to be addressed was identified (What environmental program do we want to assess and analyze? Where and which actors are involved? Which indicators and where to get the information?); in the second phase, the action plan that will address the issues identified in the previous phase was designed (the target scenario with key indicators is defined); and in the third phase, the outline of the measures implemented was evaluated.



B6.3.- Extension of AGROgestor service model in other European countries

This approach started to take shape in 2019 with a joint meeting organized by FEGA, where LIFE AGROgestopr together with UDCLM and Agrisat, presented their joint approach on FaST tools.
ITAP, INTIA and NEIKER take part in preparation and submission of proposal to the call for tender AGRI/2020/OP/0002 launched by DG-AGRI for the “Study for the development of a common framework for the quantitative advice of crop nutrient requirements and greenhouse gas emissions and removal assessment at farm level”
(https://etendering.ted.europa.eu/cft/cft-display.html?cftId=6306)
Finally the tender team brought together multidisciplinary stakeholders, who worked in July 2020 to analyse how the digital tools developed in the LIFE projects AGROasesor and AGROgestor (ITAP and INTIA group members) and in the H2020 projects FATIMA (UCLM/AgriSat, ITAP, CREA, Ariespace group members) and LANDSUPPORT (Ariespace group member), can be brought together to enhance the objectives of sustainable farm management. The tender submitted, won the call DG-AGRI and the collaboration has been carried out in 2021. The result has been a Fast NAVIGATOR platform, in which different levels of accuracy for nutrient balance and economic calculations have been integrated. One of the

most accurate levels is based on the AGROasesor platform. DG-AGRI is currently evaluating the distribution model of the developed tool to the rest of the EU countries.

We have extracted the lessons learned from each national and transnational workshop as a focal point for the objectives of the new AGROGESTOR ALIANZA

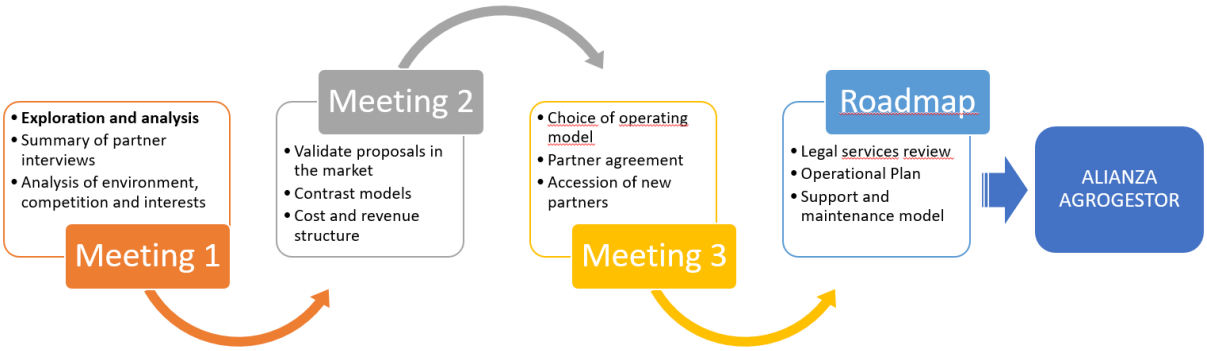
B6.4.- Business plan development

INTIA carried out a selection process to execute the business plan and exploitation of the platforms developed within the framework of the LIFE AGROgestor project. The contract was awarded on 23/07/2020 to Joseba Carricas who carried out the evaluation of different exploitation models, together with the partners and collaborators. As a result of the iterative process, the exploitation model has been defined that will give continuity, both to the exploitation of the platforms and to the dissemination of the actions carried out and the evolution of the developments achieved.

The summary is available at the deliverable **D44_B6_Informe de barreras y dificultades encontradas en la puesta en marcha demostrativa del Plan de Explotación Comercial**

Finally, on 27/01/2021, a joint workshop of partners and replicators was held to advance the specifications of the chosen model. The summary is available at the deliverable **D51_B6_Plan de negocio**

The exploitation plan was launched on 7/4/2021 with a consensus document of the exploitation model, a first version of the legal framework, and the agreement for the integration of new partners (**see Other Annexes OA52 to OA57**). From that moment on, the legal services of each of the entities that form part or will form part of the exploitation model proceeded to review it.



All the partners have developed a transfer and replicability plan through the creation of the **ALIANZA AGROGESTOR** consortium, which will continue to exploit and evolve the digital advisory ecosystem developed in the project.
The Alliance consortium has been created with 7 public entities: IFAPA, INTIA, ITAP, IRTA, NEIKER, IMIDRA and CR Riegos Alto Aragón, to provide services in 7 Autonomous Regions. A collaboration agreement has been signed that regulates the management of the digital ecosystem created and provides legal coverage for the maintenance and evolution of the platforms.
The whole process has culminated in the signing of the regulatory agreement on 24/12/2021, which assures all partners the freedom to continue to evolve and develop the platforms, and the willingness to cooperate in joint development.

Monitoring of the impact of the project actions

➢ Action C1. Monitoring the environmental impact of the project

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:
C1	Completed	01/04/2018	01/04/2018	01/06/2021	01/10/2021

In this report we have collected the analysis of the indicators monitored in the environmental pilots of action B5, during the 2018, 2019 and 2020 campaigns: in Navarra (INTIA), Castilla la Mancha (ITAP) and Catalonia (IRTA). The 2018 campaign has been considered the initial scenario, to establish a baseline for comparison with the final indicators of the 2020 campaign. The strategy itineraries have been proposed based on the analysis of the 2018 and/or 2019 campaign and have been proposed to the actors of the pilots to be implemented in the 2020 campaign.

In action C1, the values for the initial indicators included in the proposal of the project have been established. The indicators are classified in 3 groups:

a. Improvement of Environmental and climatic behavior: Reduction of GHG emissions and dangerous substances that bioaccumulate in soil (heavy metals).
b. Better use of natural resources: Water use reduction, hydric foot-print, water quality indicators, electrical energy consumption, consumption of petrol, decrease of P levels in soil.
c. Sustainable use of soil: N and P surpluses.

Optimization has been observed in terms of CO2 emission values, the final value of the project is 26,656,934 kg CO2 equivalent/year emitted on 4,367 ha, which corresponds to 0.438 kg CO2 equivalent/kg of product in 2020, compared to 0.580 in 2018.

Regarding the best use of natural resources, water consumption was reduced when referring to the production unit, from 403 to 314 m3/t between 2018 and 2020. However, consumption per unit area was higher in 2020, due to higher crop yields. Furthermore, in the project in different pilots, the Water Footprint per crop and pilot was assessed by comparing the values per crop with the references provided by Mekonnen and Hoekstra (2010) for Spain. As a water quality indicator, the basin of the Robo River has been monitored in the environmental pilot of Navarra, and we have not registered clear improvements. However, it must be borne in mind that improvements in irrigation efficiency cause a lower flow to the river by reducing the water from excessive irrigation. This can cause an increase in the concentration of nitrate that is discharged into the river, although the total mass of N supplied is lower. Another indicator monitored, in this case in Castilla la Mancha, is electricity consumption, which went from 1,577 kwh / ha in 2018 to 1,744 kwh / ha in 2020, due to a greater need for water caused by higher yields. On the other hand, water consumption is highly influenced by the weather conditions of the season. Lastly, in the three pilots, diesel consumption was calculated. In general, diesel consumption was lower in the 2020 campaign, except in the case of ITAP, where it rose from 72 to 116 L / ha.

To monitor the sustainable use of soil, N-surplus and P-surplus have been selected to evaluate the nutrient balance. The N and P surplus values have improved in all three pilots if we compare the 2018 values with the 2020 values. Virtually all crops in the ITAP and IRTA 2020 pilots have a negative N and P balance. This means that in general the nutrient input through fertilization is lower than what the crops take up. Therefore, the results of the pilots in terms of phosphorus are more sustainable than those provided by the European statistics which detail a positive phosphorus balance for both Europe and Spain

(EUROSTAT, 2021). In the Navarra pilot, the average N surplus was lower (28 kg N/ha) than that specified by EUROSTAT (2021), which was 49 kg N/ha for Europe and 44 kg N/ha for Spain (EUROSTAT, 2021).

As a final result of the evaluation of the project's indicators, we selected three that environmentally reflect the efficiency of water and fertilization management:

Pilot comparative 2018-2020	% Improvement in water consumption (m3/t)	% Improvement in emissions (kg CO2 eq/t)	% reduction N surplus kg/ha
INTIA	-11	24	29
ITAP	24	27	7
IRTA		35	122
Project	**22**	**25**	**110**

❑ **Action C2. Monitoring socio-economic impact of the actions in the project.**

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:
C2	Completed	01/07/2018	01/04/2018	01/06/2021	01/09/2021

In this Action, the final values of the proposed indicators were established and the evolution of indicators measured in the initial phase of the project was analyzed. These indicators are classified in 4 groups:

1. Involvement of the primary sector in the Project: Number of farmers included in the collective management platform, included area in the platform for collective management, number of individuals that change their agronomical behavior due to recommendations from AGROgestor, level of satisfaction of farmers regarding their job. More than 11,000 ha have been managed within the AGROgestor platform, corresponding to 266 farms and 21 agricultural associations. While farmer surveys showed fairly similar results at the start and end of the project, there is a greater reliance on R&D-based solutions to address environmental issues.
2. Economic impact: Productivity of irrigation water, productivity of applied N, gross margin. The surface area of the 3 pilots managed according to the guidelines of the AGROgestor project managed to improve the gross margin by 20% and the productivity of the N by 41%. Water productivity remained unchanged.
3. Communication, dissemination and increase of awareness: Regarding the perception of society about farmers, although practically all those surveyed considered the sector important, 78% believed they did not know the situation, needs, problems and future prospects of the sector in the 2019 survey, and 66% in the one carried out in 2021. Approximately 95% of the respondents are unaware of the LIFE program in both surveys. But when respondents are informed about the objectives of the LIFE program, almost 90% rate it positively in the 2019 survey and 80% in 2021. 7% of respondents have heard about the LIFE AGROgestor project in the survey of 2019 and 3% in the 2021 survey. Two hundred and forty farmers and 21 collective managers joined dissemination activities of the project.

4. Replication: Four replications have been carried out in as many regions. Namely, Extremadura, Madrid, Aragon and Castilla León. In addition, the pilots from Andalusia and Euskadi were also implemented to add to the pilots from Navarra, Catalonia and Castilla la Mancha, who begun their third campaign in autumn 2019.

Public awareness and dissemination of results

❑ Action D1. Dissemination plan

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:
D1	Completed	01/11/2017	01/11/2017	01/08/2021	31/10/2021

The main goal of this action is to maximize the impact of the project in the society at regional, national and European scales.

D1.1 – Networking with other projects

Meetings for information exchange with 24 entities, projects and universities have been organized. Each one of the organized networking activities is reported in an activity sheet.

D1.2 – Communication plan and development of communication measures

Since January 2018 the web page of the project is available in https://www.agrogestor.es (Spanish/English) and the twitter account @lifeagrogestor. The webpage was visited by 8,090 new users and 11,673 sessions, until October 2021. The twitter account has 597 followers; we follow 558 accounts in twitter with similar topics to the ones dealt with in this project. We shared 609 tweets.

The official image of the project was created at the beginning of the project (January 2018) with the logo and the style manual.

A communication plan for the project was elaborated for use as a guideline for dissemination of the project.

Information panels, posters for the headquarters of partners and pilots, field panels and project roll-ups have been designed, and 24 information panels have already been set up.

The project organized 22 days of national, supra-autonomous, regional and pilot impact, for the dissemination of the project. The project has been presented in 44 national and international seminars, conferences and workshops, related with the management of hydric resources in agriculture, water quality and its efficient use in the farming sector; more than 4,000 people have been informed about the project. The final seminar was organised online on october 14th, 21
Link on the project website:
(https://www.agrogestor.es/en/october-22-2021-final-seminar-and-video-of-the-life-agrogestor-project/)

The advertising materials were 360 mouse pads, 870 cloth bags, 950 USB sticks and 500 cans. Have been edited also 1 general project brochure with 900 copies and 1 presentation video.

To disseminate the project, we published 21 publications: 14 articles with low technical profile, dissemination in press at regional and national level, 3 technical articles in regional magazines, and 4 scientific publications. 18 press releases have been published with 54 appearances on the media, and 55 news items have been made to post on the project website. The Layman report summarizes the work carried out in the LIFE AGROgestor project (https://www.agrogestor.es/en/wp-content/uploads/2022/02/LAYMAN-REPORT-ENG.pdf). The report clearly describes the project achievements and the environmental benefits addressed in the project. It is written to attract the interest of the general public, journalists and legislators, along with experts and stakeholders who focus on issues similar to those addressed by the project**.**

❑ Action D2. Environmental awareness and training program

Action	Status	Foreseen Start Date:	Actual Start Date:	Foreseen End Date:	Actual End Date:
D1	Completed	01/11/2017	01/11/2017	01/08/2021	31/10/2021

D2.1 – Environmental awareness

In the AGROgestor project, we have developed instruments and materials to promote environmental awareness in the collective management of Environmental Programs. In the project, three demonstration Environmental Programs have been developed, in which synergies between actors have been encouraged, to evaluate the governance systems, and which elements are valid to support the governance of these programs, BBPP Manuals, and use cases.

A special section in the web page has been created to show all activities carried out related to environmental awareness: https://www.agrogestor.es/en/awareness/

The materials for environmental awareness were 3 BBPP Manuals, 2 Demo and 10 use cases

See deliverable D36_D2_ Materiales sensibilización

D2.2 – Advisory services

Throughout the project, in the development of action D2, we have supported the promotion of the use of the new Ecosystem of digital platforms created, through different channels, with an advisory protocol that we have been able to test in the demonstrative pilots.

This protocol has been built and adapted according to the degree of development of the platforms throughout the project, and the management carried out in the different pilots.

D2.3 – Training

The training program started in 2018, during the construction of the AGROasesor and AGROgestor platforms. 45 courses were held with 240 assistants aimed at first learning

about the functionalities of the AGROasesor platform, in 2018, 2019 and 2020, and in 2021, when the AGROgestor platform was already active.

Training materials have been prepared: 20 manuals, 2 Demo, and 5 tutorials videos for all the different functionalities of the AGROasesor platform and AGROgestor platform. Printed copies were distributed in organized courses. All training materials were updated and they can be downloaded via the web page of the project: https://www.agrogestor.es/plataformas/plataforma-agroasesor/formacion/; https://www.agrogestor.es/plataformas/plataforma-agrogestor/formacion/

Evaluation of Project Implementation

A1	**Objectives**	Formalization of agreements with target groups related to water use and water quality
	Expected results	Multiactor groups and replicators.
	Achieved	Work has been done on the creation of management groups in 9 pilots to involve identified actors among 3 working groups. Protocols to be followed by replicators have been established. Entities were hired to provide necessary data.
	Evaluation	It was considered that the creation of 7 working groups at the beginning of the project should be done for the planned pilots in action B5. Throughout the development of the project, the same idea was used for pilots in action B6. Interaction with all selected action groups was targeted in 2020-2021 for the basin workshops and in the EU replication workshops,
A2	**Objectives**	Definition of indicators to characterize environmental programs.
	Expected results	To define indicators for three environmental programs (PA) objectives, and define itineraries per PA.
	Achieved	A list of 31 indicators was created that includes the equations to calculate each indicator with variables from AGROasesor platform. All indicators can be calculated to characterize a PA. In each PA, attributes that define the itineraries that execute that PA are defined.
	Evaluation	Indicators that were included already in AGROasesor have been revised to adapt them to new legislation requirements (for example carbon footprint has been adapted to ISO14067). It The analysis of data validation for collective calculation of indicators is also important.
B1	**Objectives**	To develop a module for creation of scenarios and analysis of indicators.
	Expected results	In actions B1 and B2 the AGROgestor platform will be built and integrated with the AGROasesor platform.
	Achieved	The final result is a **Digital Platform Ecosystem** with integrated modules: an indicator module and an itineraries module in a new AGROgestor framework. Both modules are integrated in the analysis and planning of strategies. In this action we adapt the AGROasesor platform to the new AGROgestor framework, in the requirement analysis and user cases. -**AGCs creation module**, which includes 12 multi-criteria filters to select the crop management units (UGC). -Module for the evaluation of scenarios with 31 indicators. -Module for the creation of Strategy Itineraries in AGROasesor.

	Evaluation	The programming of itineraries and indicators modules was finished on time. However, the programming of the AGROgestor platform was finish in March 2020. The end date was planned to be June 2019, but due to the complexity of the planned programming all work was delayed. Since January 2019, a chronogram with biweekly planned tasks has been followed. The chronogram was readjusted as the work done went forward.
B2	**Objectives**	To analyze simulation scenarios and propose strategies via PAs.
	Expected results	In actions B1 and B2 AGROgestor platform will be built and integrated with the AGROasesor platform.
	Achieved	The query mode of AGROasesor DSTs was modified to analyze representative real years of climate change scenarios or medium-term scenarios. The analysis of strategy itineraries according to the PA of each of the pilots and simulations of scenarios in action B5 was completed. -Module for the creation of an environmental program with strategy itineraries. -Module of simulation of a strategy scenario. -Module on evaluating climate projections and selecting climate change scenarios.
	Evaluation	It has been difficult to conceptually analyze how the evaluation of scenarios that are simulated should work. Several ideas were considered but at the end the most realistic option regarding its integration in the AGROasesor platform was chosen. However, the historical data model had to be modified in order to use the HADs in past campaigns and to be able to choose typified years. Finally, a very useful tool for assessing water and nutrient balances with climate projections was programmed.
B3	**Objectives**	Governance of environmental programs for collective management. Motivation of farmers.
	Expected results	Governance manual, manuals for use of HADs for governance and Module for Governance training.
	Achieved	Collaborative governance teams have been created in the pilots in action B5. A manual for governance in three B5 pilots has been written for collective management using irrigation, nitrogen and remote sensing HADs. A manual for supporting Collective Managers in Governance has been elaborated as a tool to manage a PA in an AGC. A set of Farmer Management and Strategies: 3 governance manuals and 3 good practice manuals, in relation to the three environmental issues addressed

	Evaluation	Training and awareness-raising actions in the AGCs were delayed to the ending of the first version of AGROgestor in September 2020 and to the dissemination activities organized with farmers in each of the replication pilots in 2021. A governance methodology has been developed, to achieve efficient resource management and to improve the economic and environmental performance of the environmental pilot farms.
B4	**Objectives**	Development of Information and Communication Technologies (ICTs) and functionalities for collective management during the campaign.
	Expected results	Operational version of tools for collective management and PAs implementation.
	Achieved	Remote Sensing images and index values service has been programmed from an on-time server of Sentinel data: Sentinel HUB. The functionalities of HADs that need remote sensing data have been reviewed from the collective management point of view. In the pilot of vulnerable zones, a model for collective management of soil sampling in the area to manage nitrogen fertilization strategies has been developed. The best model to provide meteorological warnings has been analyzed. A new module to include Itineraries in warning and alert service. A functional module of indicators per UGC was programmed to compare with global indicators of an AGC. A new AGROasesor traceability app (Android and IOS) to simplify data entry
	Evaluation	A big effort was made to adapt existing tools for collective management. Our digital solutions support farmers in generating knowledge as well as in taking better farm management decisions (for instance related to plant nutrition and health, irrigation, etc.).
B5	**Objectives**	Validation of the platform in 3 environmental pilots for collective management.
	Expected results	Analysis of the base scenario in each pilot and validation of selected PA strategies.

	Achieved	The project has developed three demonstrative Environmental Programs, through the implementation of a demonstrative pilot in each of them. In these pilots we have been able to encourage synergies between actors, through the evaluation of governance systems, and to develop valid elements to support the governance of these programs: Governance Manuals, BBPP Manuals and Case Studies. In the three pilots we have implemented the scenario analysis model created in the AGROgestor platform, based on the information managed in the AGROasesor platform by the farmers who took part in the pilots. 18 governance actions, 31 training and advisory actions and 18 awareness raising actions have been carried out, attended by 1,127 participants.
	Evaluation	The three programs have allowed us to promote the application and reinforcement of appropriate practices in the use of water resources, favoring an increase in the efficiency of water application and encouraging environmentally and economically sustainable use through technical assistance from the AGROasesor and AGROgestor platforms.
B6	**Objectives**	Replication of the project.
	Expected results	Operational demonstration in 6 national pilots of how the AGROgestor platform works.
	Achieved	Through the development of 9 demonstration programs in 9 regions, we have been able to address replicability, validation and transfer objectives. The LIFE program promotes the demonstration of transfer in the EU and through the pilot programs of this project the tools developed have been validated, with an agro-climatic diversity, different types of crops and production structures through the collaboration of irrigation communities, cooperatives and farms, in 9 ccaa at national level.
	Evaluation	Demostration pilots provided an opportunity to speed up farmers' uptake of digital solutions Transnational replication provided an analysis of the requirements for the nutrient balance tool at parcel level mentioned in the new CAP (FaST Farm Sustainability Tool for Nutrients.). It also enabled analysis of how to manage advisory tools for collective management of irrigation and of the new European policies following the Green Deal and the Farm to Fork strategies and Sustainability strategy.
		A sustainable management and exploitation model has been established in 7 ccaa, from public services, through the creation of the AGROGESTOR ALLIANCE. The AGROGESTOR ALLIANCE will allow the entities to continue working to promote new advisory models, supported by digitalization, with the aim of promoting good agricultural practices, and is an opportunity to support the incorporation of indicators in the environmental management of farms.
	Objectives	Monitoring of environmental and socio-economic impact of the project.

C1 and C2	**Expected results**	A complete list of environmental and socio-economic indicators of all pilots is expected at the end of the project.
	Achieved	Baseline environmental and economic indicators have been obtained for agro-climatic zones by crops, in three environmental programs, which serve as a basis for further evaluation in these zones or for comparing results in other areas.
	Evaluation	The KPI values proposed in the application form, considered as the baseline, were corrected according to the pilots of 2018. Besides, other economic indicators were calculated such as gross margin, water and nitrogen productivity. It is worth highlighting the large number of farmers and associations adhering to the platform as a result of this project, and the large agricultural area involved. The correction of the indicators was done taking as reference the AGCs created in each pilot and gathered information to analyze the base scenario. The calculated indicator values might change when sensitive information such as raw material prices are completed.
E1	**Objectives**	Coordination and administrative management of the project,
	Expected results	To finish the Project with all actions executed and justifications according to the foreseen plan.
	Achieved	To coordinate development of all actions in the proposal, especially the actions related with Development of Information and Communication Technologies (ICTs) due to the high technological development of AGROasesor and AGROgestor platforms.
	Evaluation	During the project development, needs in the programming tasks arose which were not previously considered in the proposal. These tasks have been tackled in each action when needed. Prodevelop has been actively working on the programming of all detected needs and tasks. Partners have elaborated technical documents for the conceptual design, studied user cases and tested the programming done by Prodevelop.
D1	**Objectives**	Dissemination plan.
	Achieved	The web and social networks have been very useful for disseminating the work done in the project. In addition, the conferences and seminars and networking carried out have enabled a large number of project stakeholders to be informed. The activities with the media have reached the general public.
	Evaluation	Perhaps the biggest problem in 2020 was not being able to carry out the face-to-face sessions, but online sessions were a success. The target audience for the project's dissemination activities was very active. Perhaps the general public had greater difficulties in understanding the project.
D2	**Objectives**	Environmental awareness raising and training

	Achieved	A web space was created for awareness raising and materials. A space was also created on each platform for the course, with materials and tutorial videos.
	Evaluation	We had difficulties organizing the face-to-face training courses. On the other hand, very good materials have been created that can be downloaded.

5.2. Analysis of benefits

Thanks to the actions in this project, recommendations that could be taken into account in regional, national and even European legislation may be proposed:

A. Environmental benefits:

Life AGROgestor sets out to demonstrate the reduction of GHG emissions, dangerous substances that bioaccumulate in soil (heavy metals), reduction in water use, reduction in the hydric footprint and on hydric stress foot-print, improvement of water quality in the catchments were the pilots are located, reduction in nitrate concentration in water, reduction of total energy used and in consequence a reduction in GHG emissions derived from energy consumption and reduction of P content in soil.

We measured a reduction in water consumption per ton produced of 22% and 24% in CO2 eq emission per ton. In addition, it was observed that in the pilot areas both N and P surplus improved the EUROSTAT indicators for Europe and Spain.

The development of LIFE AGROgestor project has launched a demonstration of Collective Management of crop information. This project has demonstrated the development of Sustainable Services in irrigated agriculture that are focused on water governance, the efficiency of the use of irrigation water and the quality of water bodies. AGROgestor is a specialized instrument for the Management of Environmental Programs by means of the development and maintenance of indicators in irrigation agrosystems.

The digitization of information at the agricultural parcel level promoted by this project facilitates the collection of data and the creation of reference indicators and continuous evaluation, to monitor environmental monitoring in the agricultural sector

B. Economic benefits:

Life AGROgestor aims to demonstrate the optimization of inputs and use of economic and environmental indicators. In addition, Life AGROgestor will allow for better control of expenses in farms monitored with the AGROgestor platform. Thus, the surface area of the 3 pilots managed according to the guidelines of the AGROgestor project has improved the gross margin by 20% and productivity of the N by 41%. Water productivity has remained unchanged.

C. Social benefits:

We believe that the digitalization technologies and planning proposed by this project will result in social benefits, related to technification and involvement of youth in farming activities and in advisory services in the agrarian sector. More than 10,000 ha have been managed within the AGROgestor platform, corresponding to 266 farms and 21 agricultural associations. While farmer surveys showed fairly similar results at the start and end of the project, there is a greater reliance on R&D-based solutions to address environmental issues.

D. Policy implications:

The AGROgestor platform is an example of a digital system that integrates farmer´s agricultural activity registration and evaluation and a digital advisory system using target itineraries. All partners involved in the AGROgestor project, believe that development of digital platforms are relevant, to support strategic plans that aim to promote sustainable practices, such as precision agriculture, organic agriculture and conservation agriculture among others.

This Project, developed by public advisory and research entities, allows to analyse the viability of digital services for knowledge integration, advisoring and evaluation in agro-systems from the public sector and the administration of all regions involved. This project aims for multi-actor management enabling both, public information and self-knowledge, to be integrated and used collectively.

The European Water Framework Directive (WFD) unites all the actions on water management in the European Union. Since European Union water bodies are under increasing pressure from continuous increase in water demand, good quality and sufficient quantity for all users, there is a need to protect all water bodies qualitatively and quantitatively and to guarantee their sustainability. This is the challenge for the WFD and for Life AGROgestor project in the use of water for irrigation crop systems.

Governance in irrigation water use implies several key points: i) Improvement of water use efficiency and ii) transparency in water management and governance systems.

- Life AGROgestor proposes an improved methodology for evaluation of irrigation water efficiency use by simple indicators. **These indicators could be a simple reference model for public evaluation of irrigation water use.**
- Life AGROgestor is designing a collective management tool for private and public managers. The tool uses information on farming activities at agricultural parcel level. This information is complementary to existing public data bases for governance of Irrigation Communities and for managers of water basins.
- Life AGROgestor contributes to the creation of new territorial monitoring tools using Sentinel satellite images. Data monitoring is a continuous goal in the WFD.

The **Directive of Vulnerable Zones to nitrate pollution** tackles the problem of water quality conservation after commercial use, such as irrigation water. One of the most frequent pollutants are nitrates coming from mineral and organic fertilizers.

Within the framework of the Directive of Vulnerable Zones to nitrate pollution, each state member has declared widespread polluted areas that need a recovery program. The recovery program should be applied through Regulated Action Plans and controlled by authorities of each Autonomous Community (region in Spain).

- Life AGROgestor sets out to improve the evaluation methodology by means of simple indicators of nitrogen use efficiency of the crop, using nitrogen balances. **These indicators are a simple reference model for public evaluation of fertilizer use in crops.**

- The AGROGESTOR tools have been integrated into the development of the FaST NAVIGATOR platform, which is a tool of the European FaST Program for nutrient balances of the new CAP created by DG-AGRI. .
- Life AGROgestor aims to highlight the relevance of measuring nitrate mass discharged in water, since this indicator is not yet included in the Directive. This indicator could complement the monitored nitrate concentration values in water.

The new CAP has proposed that each state member should develop a strategic plan that supports environmental Eco-Schemes in activity areas or sectors that have most impact in each state member. Thus, one of the Eco-Schemes that can be considered is the management of Vulnerable Zones to nitrates pollution.

- Life AGROGestor had developed a model for environmental program management that can be used as a reference model for public collaborative management of Eco-Schemes.

One of the aspects highlighted by the European Commission in the Farm to Fork Strategy is the need for producers to have access to objective and impartial advisory services within the framework of effective **agricultural knowledge and innovation systems (AKIS)**. The proposal for a Regulation for the strategic plans to be drawn up by the Member States under the CAP positions the AKIS in a relevant way in the new programming period. The Digital Platform Ecosystem provides tools for on-farm best crop decision in fertilization, irrigation, crop management, GHG and economic assessment, with sustainability objectives, and can be considered a model to support a digital AKIS.

E. Innovation and demonstration value:

One of the goals of the new CAP is to enhance digitalization of agriculture to: i) improve transparency of production processes and ii) to embrace data processing as a tool of knowledge improvement.

- Life AGROgestor is a platform that shares the scope in collective management that the new CAP is looking for. AGROgestor is a collective management tool that uses large amounts of data and includes involved actors. The AGROgestor platform provides transparency and data of real production systems**.**
- The Life AGROgestor has developed tools to enhance digitalization at farm, farm technical advisor and collective manager levels. It can promote interconnection between these actors through Governance plans that focus on promoting technical advisory consulting as a catalyst for innovation and adaptation to climate change.

F. Replicability, transferability, cooperation:

The project has launched 9 pilots at national level in 9 Autonomous Communities (regions in Spain). Each pilot was a demonstration experience for digitalization and implementation of an Environmental Program, through the interaction of different groups of interest: Managers, farmers and advisers. In the post LIFE partners decided to manage a joint exploitation model through the ALIANZA AGROGESTOR

In the After-LIFE plan, work will continue with the selected groups through the ALIANZA AGROGESTOR on the following objectives.

- Establishment of communication channels between private and public platforms for the management of actions and farm logbooks.
- Group of experts in the development of FaST tools for nutrient balance.
- Establishment of working groups with the SARs of Castilla La Mancha, Andalusia and Navarre, to make progress in irrigation management systems for woody crops and in the automation of sensors.

Thanks to the collaboration with DG-AGRI in creating a FaST platform, collaboration with EU countries has been boosted by the open publication of the new platform.

G. Best Practice lessons:

Project partners involved in managing public advisory services in the 9 Autonomous Communities involved believe that the analysis and data management tool at parcel level is key for improving advisory services. Both the AGROasesor and the AGROgestor platforms allow us to be in a key position for data analysis. During the project we found that it is a challenge to obtain reliable data at parcel level. Therefore, efforts should be made to promote the use of platforms such as AGROasesor for entering data at parcel level or in developing sensor methodologies that automatize data input. These lines are planned to be implemented through the evolution of the platforms in the AGROGESTOR ALLIANCE.

The AGROGESTOR ALLIANCE was born in 2021, within the framework of the LIFE AGROgestor project, with the aim of continuing to promote knowledge management through digital tools.

In this line, ALIANZA AGROGESTOR is a commitment to generate knowledge and sustainability in the sector, with the collaboration of public entities and administrations, through the evolution of the digital ecosystem created in the project, the AGROgestor and AGROasesor platforms. This ecosystem has been designed to support the advisory and transfer objectives promoted by the new CAP:

- Comprehensive advice (incorporating digitization and Decision Support Tools and indicators for diagnosing farms).
- Transfer methodologies with the greatest impact for the sector (group dynamization, face-to-face advice and new advice technologies).
- Monitoring of ECO-SCHEMES to support the transition towards the objectives of the Green Deal.

6. Key Project-level Indicators

The KPIs assessed in the project are individually described below. We have made significant changes to the indicators presented in the proposal that refer to water consumption and CO_2 emissions. The changes made concern the units used to express each indicator, and to the estimated baseline data and the data presented in the mid-time report. At the end of the project, an in-depth review was carried out of all the inputs evaluated in the environmental pilot plots in the 2018 and 2020 seasons, which were used to refer to the initial and final status of these indicators in the project.

The indicators referring to the project area and to the people influenced by the project, we have referred to the entire project area, and not only to the environmental pilots. As the description of the KPI database indicates, these indicators refer to the total spatial extension of the project (expected) directly influenced by the actions of the project that aim to achieve the main objective of the project. In other words, it is the area in which the actions of the project have been developed, so we have included the area of all the demonstration pilots, of the 9 regions of Spain developed within the framework of the project. The influence in the next 3 years is estimated on the regions that, at the end of the project, join the platform exploitation consortium: a total of 7 regions in Spain, although the consortium is open to adding new regions.

However, for the indicators related to water management and to evaluate emissions, we use the three environmental pilots, since in these indicators, it is in the project that we have carried out an initial evaluation (year 2018) and a final evaluation (year 2020), and we make an estimate over the next three years, considering that we will continue to implement the

strategies promoted by the project in the specific context of the three environmental pilots, which will continue after the completion of the project.

- Area indicator at the end of the project, 10528 ha, correspond to the sum of the surface area, in the 9 demostrative pilots in Navarra (1438 ha), Albacete (4442 ha), Girona (40 ha), Andalucía (2423 ha), Pais Vasco (49 ha), Aragón (309 ha), Comunidad de Madrid (702 ha), Castilla y León (125 ha) y Extremadura (1000 ha) have been counted. The data beyond the 3 years (43282 ha) is an estimate of the increase in surface area due to the increase in users in in 7 of these 9 regions, that have joined the AGROGESTOR ALLIANCE exploitation plan (Navarra, Albacete, Catalonia, Andalusia, Euskadi, Madrid and Aragon). In order to estimate the surface area beyond the 3 years, the average surface area of the 9 pilots (1170 ha) has been considered as a reference for the new collective management areas that we believe can be created. It has been estimated the creation of 4 new management areas in each of the 7 regions involved in the AGROGESTOR Alliance created in the project.

- For the humans influenced by the project, the statistics relating to CAP rights (2020) were used as a reference, specifically the number of farm owners per region of Spain. This information has been extracted from table 1 of the document: https://www.fega.gob.es/sites/default/files/Informe_sobre_la_aplicacion_del_regimen_de_pago_basico-C2020.pdf.

  To estimate the population influenced at the end of the project (25,067 persons), taken the reference of CAP owners by region (column 1), we estimate that for the regions in which we have carried out environmental pilots during the project, we have influenced 10% of the farm owners, while in the rest of the six regions we consider 2.5%.

  To estimate the data beyond 3 years (44,485 persons) 20% of the farm owners have been influenced in the regions where we carried out environmental pilots, while 5% were influenced in the other regions.

- In the proposal to explain water consumption in agricultural production, we include m3/ha and total m3 per year consumed. For this indicator, as a unit of production per year, the tons of agricultural product sold have been used, referred to the area of the environmental pilots of the project (Navarra, Albacete y Girona).The irrigation water consumed in this área refers to the unit of production (tons). The values at the beginning (404 m3/t) and at the end of the Project (314 m3/t) correspond to the real measurements in the plots of the three environmental pilots carried out in the project in the initial year 2018 and in the final year 2020. The reduction in water consumption per unit of production (m3/t) is due to both the use of the platform and the increase in yield due to climate effect /to the climatic conditions of each agronomic campaign. Three years after the end of the project it is expected to reduce this water consumption by 2%, and therefore go from applying 314 m3/t to 308 m3/t. We have not considered that the use of the platforms was the only cause of the yield increase, as climatic components also play a role. The reduction in water consumption per unit of production (m3/t) is due to both the use of the platform and the increase in yield due to climate effect, and corresponds to the actual measurements in the plots of the three environmental pilots carried out in the project in the initial year 2018 and in the final year 2020.

- In the proposal to explain CO_2 emissions, we include kg CO_2/kg produced and kg of CO_2/ha consumed. In the final report, we include kg CO_2/kg produced and total kg CO_2 emissions per year. GHG emissions are calculated for the whole crop growing cycle:

tillage, sowing, fertilization, application of phytosanitary products, harvesting, etc. Taking into account crop monitoring on all agricultural plots that have been part of the three environmental pilots. The kg CO2 eq/kg product was estimated on every plot of the environmental pilots in 2018 and 2020. The calculation methodology used was PAS 2050-2011 (Specification for the assessment of the life cycle greenhouse gas emissions of goods and services, https://goo.gl/Lpxwjs). Thus, the greenhouse gasses emitted by direct or indirect effect, from the main product of each farm, have been calculated, considering scopes 1, 2 and 3 (direct emissions, indirect emissions and other direct emissions, respectively). CO2 calculations are aggregated in CO2eq, i.e. CO2 + CH4 + N2O. For this purpose, the 2007 global warming potential was used (CO2=1; CH4=25; N2O= 298). We estimate for the next three years a reduction in the GHG emissions of 3.5%, with the actions foreseen in the after LIFE plan. More information on the calculation methodology: https://www.agrogestor.es/wp-content/uploads/2021/06/19_MANUAL-2021-HAD-Indicadores-def.pdf

- To calculate the involvement of non-governmental organizations (NGOs) and other stakeholders in project activities, at the end of the project we have included all the entities that actively participated in developing the national and European pilots during the project. Finally we refer to 46 entities.

  To estimate the data beyond the 3 years, it is expected that each of the 7 communities that will be part of the AGROGESTOR ALLIANCE will add 3 new entities, which would mean 21 new entities involved.

- Regarding dissemination of the project webpage, 11,673 unique visits were registered, and we consider an increase of visit of 10% of the end value.

- To calculate the members of interest groups or lobby organizations in project activities, the values provided refer to Spain (all regions), and include the interest groups targeted, such as farmers' cooperatives, irrigation communities, etc. Finally, we refer to 88 entities.

  To estimate the data beyond the 3 years, we count the contacts made at the end of the project and add 4 new entities for each of the 7 regions that are part of the AGROGESTOR ALLIANCE. Finally, we refer to 116 entities.

- The value of 17,54 jobs created at the end of the project refers to the assistants who have worked with the farmers, maintained the platform and other tasks related to development of the project. The value of 35 jobs to be created 3 years later refers to the jobs that will be created as a result of the Action Plan forecast in the AGROGESTOR ALLIANCE, to increase the use of the platforms in 7 regions of Spain. It has been calculated that we can double the number of jobs created in the project.

- To estimate the evaluation of total costs during the three post-project years, annual personnel cost expenses have been included for each of the 7 entities that will be part of the new action plan after the project, and which was estimated at an annual cost per entity of €35,000. On the other hand, the cost of maintenance and evolution of the created platforms, as well as the rental of hosting servers and support infrastructure, was estimated at € 55,000 for each of the three years.

- Regarding the estimation of the evaluation of total costs during the three years post-project, it was calculated that the public entities that will be part of the AGROGESTOR

ALLIANCE will obtain 50% of the 900,000 through financing. This funding would come from funded projects, sponsors, or new entities that want to finance the AGROGESTOR ALLIANCE.