



# ENHANCE CALL

Financial Support for Third Parties

## Final Report Part A (Public)

*AGROJACK — From Farm to Visitor: JackDaw for Agricultural Decision-Support and Tourism Services*

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|                    |                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------|
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## Document History

This section records every change introduced in each version of this document, so that a complete audit trail of modifications is preserved. Changes are classified by the requirement raised in the PoliRuralPlus review e-mail of 17 August 2026, “Final Report Review & Required Adjustments: AgroJack”.

| Ver. | Date       | Requirement (review e-mail, 17 Aug 2026) | Section / Page                       | Description of change                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Status |
|------|------------|------------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1.0  | 31/07/2026 | —                                        | Whole document                       | Initial submission of the Final Report, Part A (Public), within the deadline of the Enhance Call.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | OK     |
| 2.0  | 31/08/2026 | 1. Visibility & funding acknowledgement  | Ch. 6, p. 9                          | Verified that the produced materials carry the full funding acknowledgement and disclaimer together with the “Funded by the European Union” emblem.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | OK     |
| 2.0  | 31/08/2026 | 2. Beneficiary website                   | External + Ch. 6, p. 12              | AGROJACK project page on espaciosoa.com updated (EN and ES) with correct funding logo and PoliRural Plus logo                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | OK     |
| 2.0  | 31/08/2026 | 3. GDPR & data protection                | Ch. 10, pp. 17–18; Ch. 11, p. 19     | New chapter “GDPR and Data Protection” added: data-minimisation approach adopted in WP2, personal data actually processed in each validation activity and the reasons why no DPIA or written consent forms were required. Former Chapter 10, “Conclusions”, renumbered as Chapter 11 (content unchanged).                                                                                                                                                                                                                                                                                                              | OK     |
| 2.0  | 31/08/2026 | 4. Version & audit trail                 | Doc. History, p. 3; cover, p. 2; ToC | This “Document History” section added before the Table of Contents to preserve the audit trail; document relabelled as Version 2.0 keeping the internal revision reference; Table of Contents updated; all evidence screenshots in Chapter 6 replaced or added to reflect the corrected online channels.                                                                                                                                                                                                                                                                                                               | OK     |
| 2.0  | 31/08/2026 | 5. Social media                          | External + Ch. 6, pp. 9–11           | Both X threads completed with a closing post carrying the full funding acknowledgement and disclaimer, the EU emblem and the PoliRuralPlus logo (appended as replies, as X does not allow editing published posts). Direct links to both threads and updated full-thread screenshots, including the closing posts, added in Chapter 6.                                                                                                                                                                                                                                                                                 | OK     |
| 2.0  | 31/08/2026 | 6. App & platforms                       | External + Ch. 6, pp. 13–15          | Funding acknowledgement, EU emblem and PoliRuralPlus logo added to the AgroSens web interface, to the Aires de la Vera website (public pages and JackDaw monitoring panel) and, through the web content it packages, to the mobile application; evidence screenshots added to Chapter 6. Direct links to the news article and the two blog posts published through the PoliRuralPlus Hub added, with their publication dates.                                                                                                                                                                                          | OK     |
| 3.0  | 07/09/2026 | 3. GDPR & data protection                | Ch. 10, pp. 17–18                    | Wording of Chapter 10 refined and clarified at the reviewers' request (second review round, September 2026) to avoid the impression that absolutely no personal data was involved: the chapter now describes minimisation to the strict minimum, states that staff professional accounts and the farmers' access credentials involve limited personal data, notes that photographs of consented individuals constitute personal data, and addresses the possibility of personal information entered in free-text queries (participants were verbally instructed not to do so; logs analysed only at aggregated level). | OK     |

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## Executive Summary

AGROJACK (“From Farm to Visitor: JackDaw for Agricultural Decision-Support and Tourism Services”) validated the JackDaw GeoAI conversational agent in a real, dual-purpose rural environment: the Aires de la Vera estate in La Vera (Extremadura, Spain), an operational fruit farm and agrotourism destination managed by Espacio SOA. The project ran from February to July 2026 under the PoliRuralPlus Enhance Call.

The project pursued two complementary use cases. In the tourism domain, JackDaw was integrated into the existing Aires de la Vera mobile application as a geo-contextualised assistant, recommending nearby activities to visitors, answering their questions about the area, providing additional information on the estate's trees when their QR codes are scanned, and monitoring visitor satisfaction.

In the agricultural domain, JackDaw acted as a conversational decision-support agent fed by AgroSens, Espacio SOA’s multi-user environmental sensing platform, which at the estate operates six LoRaWAN probes at two depths (pH, EC, NPK, moisture, temperature and salinity), delivering irrigation and fertilisation advice and interpreting agronomic data in plain language.

Technically, AGROJACK delivered a self-hosted Model Context Protocol (MCP) server exposing the estate’s data as callable tools, registered with the JackDaw Chat API. This architecture allowed JackDaw to autonomously query farm data — QR point content, nearby activities, visitor profiles and live sensor readings — and blend it with its native geospatial services to produce contextual, natural-language answers.

During the validation period the project ran three tourism internal validation sessions, yielding around 50 analysed tourism interactions and exceeding the KPI target of 30 (in total over 200 interactions have been registered counting farm personnel and internal Espacio SOA personnel tests).

In parallel, informal on-farm sessions were held with more than a dozen neighbouring farmers, three of whom requested a demonstration deployment of the sensor network on their own farms, and more than 15 (only in Aires de la Vera farm) validated agricultural interactions were registered in the system (KPI target: 10). Technical reliability was achieved on the Espacio SOA side, with some hiccups on the JackDaw API, and the agronomic recommendations proved extremely useful as judged by the farm manager.

AGROJACK demonstrates that JackDaw can serve both non-technical audiences (visitors) and operational decision-makers (farm managers) from a single integration, and documents two clear replicability pathways — one for agrotourism SMEs and one for sensor-equipped farms — supporting wider adoption of JackDaw across rural Europe.

# 1. Project Overview

Aires de la Vera (<https://airesdelavera.com>) is an estate in La Vera (Extremadura, Spain) hosting more than 1,500 fruit trees (cherry, fig, plum, chestnut and olive) where sustainable farming and rural tourism coexist. Espacio SOA (ESOA), the SME behind the estate, operates a digital ecosystem — website and mobile app — through which visitors can visit the farm and get to know more of agriculture and La Vera area. This dual setting (active agrotourism plus operational fruit farming) offered an ideal living lab to test JackDaw's geo-contextual conversational capabilities with both non-technical and professional users.

The Enhance Call funds targeted validation projects that apply, test and improve the JackDaw AI chat agent. AGROJACK directly fulfils the call objectives by (i) applying JackDaw in real-world settings, (ii) enabling diverse stakeholders to engage with spatial data through natural-language interactions, and (iii) delivering actionable insights for improving JackDaw's robustness and future adoption.

Two use cases have been validated throughout the current AGROJACK project:

**Use Case 1 — Tourism experience enhancement.** JackDaw acts as an AI-powered, geo-contextualised assistant inside the Aires de la Vera app, offering visitors three services: recommendations of nearby activities, tailored to the user's profile, location and contextual factors such as time of day or weather; answers to free-text questions about the area, grounded in JackDaw's native geospatial knowledge of the surroundings (terrain, land cover, climatology); and additional information about the estate's trees when a visitor scans the QR codes placed next to them. Visitor interactions were monitored throughout to assess clarity, responsiveness and satisfaction. The feedback is made available to the user in the app itself.

**Use Case 2 — Agricultural decision-support.** JackDaw interprets real-time data from AgroSens, Espacio SOA's multi-user sensing platform, on which each farm manages its own probes; at Aires de la Vera it operates six LoRaWAN soil probes installed at two depths, measuring pH, electrical conductivity (EC), NPK, soil moisture, temperature and salinity, to advise on irrigation timing, volume and frequency; provide fertilisation guidance based on measured nutrient levels, crop needs and season; flag anomalies in environmental data; and translate raw agronomic readings into actionable, plain-language recommendations. The JackDaw analytic feedback is made available to the user in the same control panel that they access in order to check their sensor data.

The targeted users have been aligned to the use cases:

- estate tourist visitors (and other tourists' stakeholders)
- nearby farmers (and other agriculture related stakeholders).

JackDaw is the conversational and analytical core of the solution. The Aires de la Vera backend consumes the JackDaw Chat API as an authenticated client, while a self-hosted MCP (Model Context Protocol) server exposes the estate's own data — QR points, activities, visitor profiles and live sensor readings — as tools that JackDaw can call autonomously during a conversation. JackDaw combines these farm-level data with its native geospatial services (terrain, land cover, climatology) to answer visitor and farmer questions in natural language, in Spanish and English.

# 2. Progress Against Objectives and Work Plan

As set out in the approved proposal, AGROJACK aimed to validate JackDaw in a real dual-purpose rural environment, generating structured, diverse validation evidence aligned with the Enhance Call: at least 30 analysed tourism interactions, at least 10 validated agricultural interactions, a technical reliability of 85%, 70% agronomic recommendation alignment, and two documented replicability pathways (KPIs 1–5). JackDaw's expected role was

to act as the single conversational interface for both use cases, tested under operational conditions with real visitors and farm staff.

The project progressed through the six work packages approved in the proposal (coordination, design, implementation, testing, validation and communication results). As a minor deviation, some delay occurred due to the decision, taken during the WP2 design phase, to run the AGROJACK deployment in a separate environment from the existing one, so that testing and validation would happen under a controlled scenario. It was also decided to minimize the amount of personnel data to avoid GDPR issues, forms and consents and users' distrust. WP3 (Technical implementation) delivered the MCP server, the Chat API integration, the sensor-network connection and the integration with the two Aires de la Vera platforms. In WP4 (Internal testing), prompts, tool descriptions and agronomic thresholds were refined. WP5 (Real trials) executed the controlled validation trials of both the tourist and agronomic parts. Finally, WP6 (Dissemination) produced the news article, blog posts and social-media outputs described in Chapter 6.

Key results: in the tourism use case, the 24 session participants completed an average of two analysed interactions each (some three), yielding around 50 analysed interactions (KPI 1, target 30 — exceeded). In the agricultural use case, more than 15 validated interactions have been registered in the system (KPI 2, target 10 — exceeded). JackDaw correctly interpreted and answered all queries without errors of spatial context, sensor-data interpretation or response generation (KPI 3, target 85%). JackDaw feedback of irrigation and fertilisation suggestions were judged reasonable or aligned with expert practice by the farm manager (KPI 4, target 70%).

Functionalities used: JackDaw Chat API (/chat/v2/chat and streaming variants) with WKT geometry injection; native geospatial services (terrain, land cover, WorldClim climatology); and four custom MCP tools developed by the project (see Chapter 3). Data used: estate QR-point and activity databases, visitor profiles and reservation history, and live AgroSens sensor readings (pH, EC, NPK, moisture, temperature, salinity at two depths) served by ChirpStack.

The main feedback collected and partially implemented from the users, especially other farmers, was that it would be good to be able to detail the exact geolocation of their farm. Currently we have incorporated a POLYGON specification that can be used by technical trained users, but to incorporate a standard SIGPAC reference as used in Spain remains pending (since it needs to connect to external government servers).

The current main identified issue is that from time to time the JackDaw API is not responsive and returns a 502 error. Currently we have not been able to investigate the issue further and its cause remains unknown. **For the current updated v2 document this issue no longer appears and JackDaw API is fully functional.**

### 3. Solution Developed and Technical Results

The solution consists of two distinct operating environments that run fully separately and are connected to JackDaw through a shared integration layer. The **tourism environment** is the Aires de la Vera digital ecosystem: the mobile app — the interface where a visitor asks a question (free text or after scanning a QR code) together with their location currently fixed in Aires de la Vera — and its backend, which acts as an authenticated client of the JackDaw Chat API and exposes the estate's content data (QR points, activities, visitor profiles) via REST.

The **agricultural environment** is AgroSens, Espacio SOA's multi-user environmental sensing platform. AgroSens is an independent system with its own backend and its own web interface (it has no mobile app version), which manages each farm's LoRaWAN probes through a ChirpStack server hosted on a separate machine, accessible via its

REST API. At Aires de la Vera, AgroSens operates six probes at two depths, measuring pH, electrical conductivity (EC), NPK, soil moisture, temperature and salinity.

The **shared integration layer** is a single self-hosted MCP server: an independent Python process built with FastMCP, published over HTTP (streamable-http transport) behind a reverse proxy and registered with the JackDaw Chat API (api.JackDaw.online). Although the two environments are separate, they share the MCP server integration layer: three of its four tools serve the tourism environment by querying the Aires de la Vera backend, and the fourth (get\_sensor\_readings) serves the agricultural environment by querying AgroSens/ChirpStack. JackDaw autonomously decides which tool to call, injecting the WKT geometry and CRS automatically.

Query flow — tourism: the app sends the question and location to the Aires de la Vera backend; the backend calls POST /chat/v2/chat (or /stream) with the message history and WKT geometry, authenticated via OAuth 2.0 client credentials; JackDaw resolves the question, calling the tourism MCP tools when estate data is needed, and the answer returns to the app.

Query flow — agriculture: farm staff interact with JackDaw from the AgroSens environment through its web interface, following the same Chat API path; JackDaw calls get\_sensor\_readings, which locates the nearest probe via ChirpStack, applies agronomic rules and returns an interpreted result. In both cases the MCP server is stateless — each JackDaw call opens a fresh HTTP connection — which keeps the integration simple and robust.

### **MCP tools developed**

**explain\_qr\_point(wkt\_geometry, crs, qr\_code)** — resolves a scanned QR code to its referenced element (e.g. a tree or activity) and returns bilingual content that JackDaw enriches with geospatial context of the surroundings (terrain, vegetation cover). The visitor's GPS position at scan time provides the location (currently fixed in Aires de la Vera state for validation purposes)

**get\_nearby\_activities(wkt\_geometry, crs, user\_id)** — returns upcoming estate activities ordered by distance to the visitor, cross-referenced with the user's reservation and tree-adoption history to infer interests; JackDaw complements the answer with WorldClim climatology.

**log\_visitor\_interaction(user\_id, poi\_id, question, rating)** — records visitor conversations and ratings, feeding the estate's existing aspect-based sentiment-analysis (ABSA) pipeline for satisfaction monitoring.

**get\_sensor\_readings(wkt\_geometry, crs)** — locates the nearest LoRaWAN sensor to the user's position via the ChirpStack API, retrieves the latest readings (pH, EC, NPK, moisture, temperature and salinity, at two depths), applies agronomic rules and thresholds, and returns an interpreted result (not raw data) that JackDaw presents conversationally.

### **Technical maturity and access**

The solution reached the level of a validated operational pilot: both use cases ran under real conditions with real users during WP5. Key technologies and standards: Model Context Protocol (MCP) with FastMCP; OAuth 2.0 client-credentials flow; REST/JSON; WKT geometries (EPSG:4326); Server-Sent Events for streaming responses; LoRaWAN via ChirpStack REST API. A customised app including the JackDaw tool was also developed, and the JackDaw integration tested.

## **4. Integration and Contribution to PoliRuralPlus**

AGROJACK is one of the third-party integrations exercising JackDaw's MCP extension mechanism end-to-end: the project registered a self-hosted MCP server with the Chat API (POST /mcp/connect), letting JackDaw discover and call external farm-data tools autonomously. This validates a key integration pathway of the PoliRuralPlus technical ecosystem and provides a documented, reusable pattern — FastMCP server + OAuth2 client + WKT-aware tools — that any rural SME can replicate to connect its own data to JackDaw. Moreover, this architecture also ensures that

data is continuously updated, which is of special relevance in the case of the data generated through the agricultural sensors.

Synergies: AGROJACK builds on ESOA's prior national and European R&D (National Digirural, Data Spaces Ecosystem, EU AIPA) and complements the other Enhance Call sub-projects by covering the agriculture + tourism domain in Spain.

## 5. Stakeholder Engagement and User Involvement

When discussing Aires de la Vera stakeholders and its engagement we need to refer to both the tourist and agricultural ones:

- **Tourism visitors.** Three structured validation sessions were carried out with 24 participants in total (three groups of eight) over two separate days. Participants completed real visitor journeys with the Aires de la Vera app — nearby-activity recommendations, contextualised questions about the area, and QR scanning on trees for additional information — followed by guided feedback collection. Beyond the sessions, other visitors staying at the also interacted with JackDaw organically through the app.
- **Agricultural stakeholders: the estate's team and neighbouring actors.** Farm staff and management of Aires de la Vera used JackDaw in daily operations through the AgroSens web interface, checking the sensor status and its analytics for irrigation and fertilisation decisions based on the live readings of the estate probes; their structured manual feedback — accuracy, interpretability and practical relevance of the agronomic advice — forms the core of the agricultural validation evidence (more than 15 validated interactions have been internally registered). Alongside them, informal on-farm sessions brought in more than a dozen farmers from the surrounding area, who were shown JackDaw interpreting live sensor data; three of them requested a demonstration deployment on their own farms and have been provided individual access through an expansion of the AgroSens platform, which now supports multiple users. The project was also presented informally to other regional actors — a local agricultural cooperative, the comarca's local development entity and a leading regional hospitality establishment — which now constitute qualified leads for future replication

Two major pieces of feedback have received:

- Tourist visitors would like to receive more personalised recommendations and events available in the Internet (which has been marked for future expansions)
- Farmers requested finer-grained granularity, which has been partially implemented (POLYGON coordinates, pending of a more usable interface)

As aforesaid, the strongest acceptance and interest signal came from the agricultural community: the unprompted requests to bring the sensor network to their own land are concrete evidence of perceived added value and replication demand.

## 6. Communication, Dissemination and Visibility

AGROJACK has completed all obligatory media outputs of the Enhance Call. All materials acknowledge PoliRuralPlus and European Union Horizon Europe funding (grant agreement No 101136910) and display the EU emblem where applicable.

**Publications via the PoliRuralPlus Hub.** Three pieces have been produced and published through the PoliRuralPlus platform:

- the news article “AGROJACK completes its validation of JackDaw GeoAI at the Aires de la Vera estate” (published 31 July 2026): <https://www.poliruralplus.eu/news/agrojack-completes-its-validation-of-jackdaw-geoai-at-the-aires-de-la-vera-estate/>
- the news article “When farmers ask for more: AGROJACK's neighbours want JackDaw on their own farms” (published 2 August 2026): <https://www.poliruralplus.eu/news/when-farmers-ask-for-more-agrojacks-neighbours-want-jackdaw-on-their-own-farms/>
- and the blog post “From farm to visitor: how we taught JackDaw to speak for our estate” (published 1 August 2026): <https://www.poliruralplus.eu/knowledge-transfer/blog/from-farm-to-visitor-how-we-taught-jackdaw-to-speak-for-our-estate/>

**Social media.** Two dissemination posts were published as threads on the X (Twitter) account of Espacio SOA (@EspacioSOA, <https://x.com/EspacioSOA>), which is linked from the company's corporate website. Thread 1 — project completion and tourism use case: <https://x.com/EspacioSOA/status/2082982004274901387>. Thread 2 — agricultural results and AgroSens integration: <https://x.com/EspacioSOA/status/2082980243254518268>. Both tag @PoliRuralPlus, and on 31 August 2026 each thread was completed with a closing post carrying the full funding acknowledgement and disclaimer together with the EU emblem and the PoliRuralPlus logo. Full screenshots of both threads, including the closing posts, are shown below:



Figure: full Thread 1 (tourism) on @EspacioSOA, including the closing post with the funding acknowledgement card (EU emblem, PoliRuralPlus logo and full disclaimer)



Figure: full Thread 2 (agriculture) on @EspacioSOA, including the closing post with the funding acknowledgement card

**Permanent project page.** AGROJACK is permanently presented in the Projects section of Espacio SOA's corporate website, in English and Spanish, describing the project scope, the results achieved and the formal conclusion of the project, and carrying the full funding acknowledgement, the EU emblem and the PoliRuralPlus logo: <https://espaciosoa.com/projects/agrojack.html> (Spanish version at <https://espaciosoa.com/es/projects/agrojack.html>).

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## AGROJACK.

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The AGROJACK project validated JackDaw in a real, dual-purpose rural environment — combining active agrotourism and operational fruit farming at the [Aires de la Vera](#) estate (Extremadura, Spain).

This setting provided an ideal living lab to test JackDaw's geo-contextual conversational capabilities across two distinct yet interconnected domains: (i) enhancing visitor experiences through personalised, location-aware tourism services, and (ii) supporting agricultural decision-making informed by real-time environmental data.

By integrating JackDaw into both the tourism-facing mobile app and the estate's sensor-enabled farm-management workflow, AGROJACK generated structured, diverse and high-value validation evidence fully aligned with the objectives of the Enhance Call.

Visitors to the estate now receive personalised, location-aware recommendations and contextual answers about what surrounds them, directly from the Aires de la Vera app. On the agricultural side, the farm team receives irrigation and fertilisation guidance in plain language, grounded in the live readings of its own soil sensors — an approach now open to neighbouring farms through the multi-user AgroSens platform.

The project ran from February to July 2026 and concluded on 31 July 2026. The integration remains in production at Aires de la Vera, and the project also produced replicability pathways for agrotourism SMEs and for sensor-equipped farms and cooperatives.

PoliRuralPlus has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101136910. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.




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Figure: AGROJACK project page on espaciosoa.com, with the project scope, achieved results, formal conclusion, funding acknowledgement, EU emblem and PoliRuralPlus logo

Project platforms. The AGROJACK acknowledgement is also displayed on the platforms that deliver the validated services. The AgroSens web interface, through which the agricultural use case is operated shows the full funding acknowledgement and disclaimer together with the “Funded by the European Union” emblem and the PoliRuralPlus logo on its entry page:

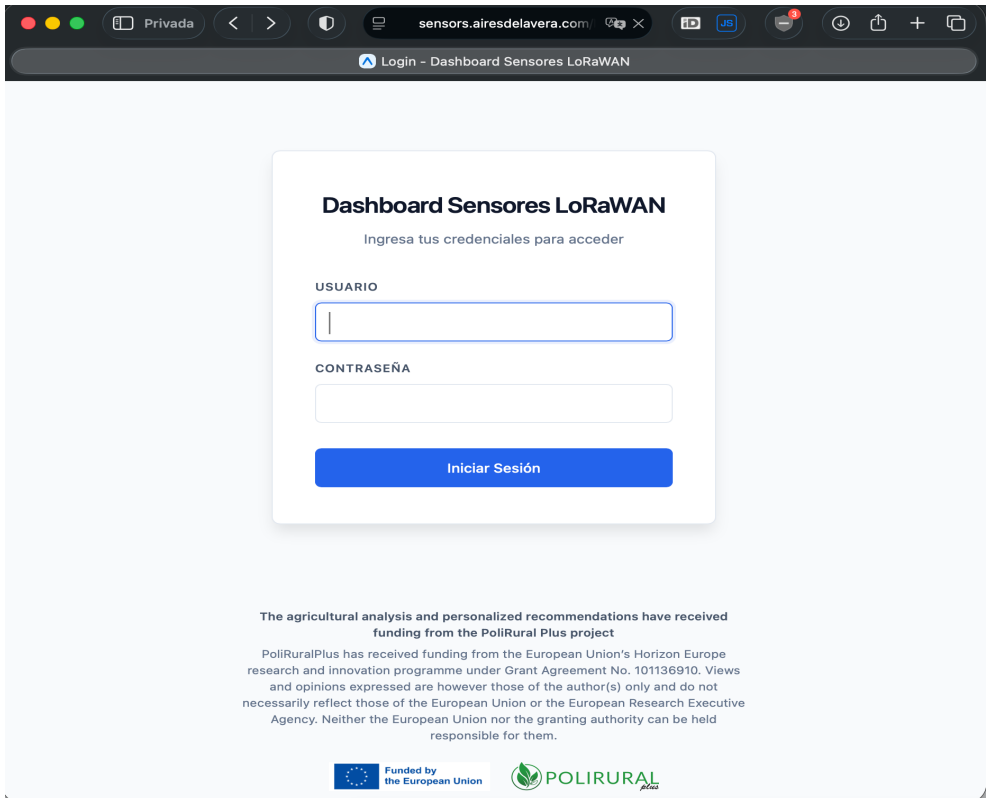


Figure: funding acknowledgement, EU emblem and PoliRuralPlus logo displayed on the AgroSens platform (sensors.airesdelavera.com)

The same acknowledgement is displayed on the Aires de la Vera website, which hosts the tourism use case, both on its public pages and on the management interface where the JackDaw interaction statistics are monitored:

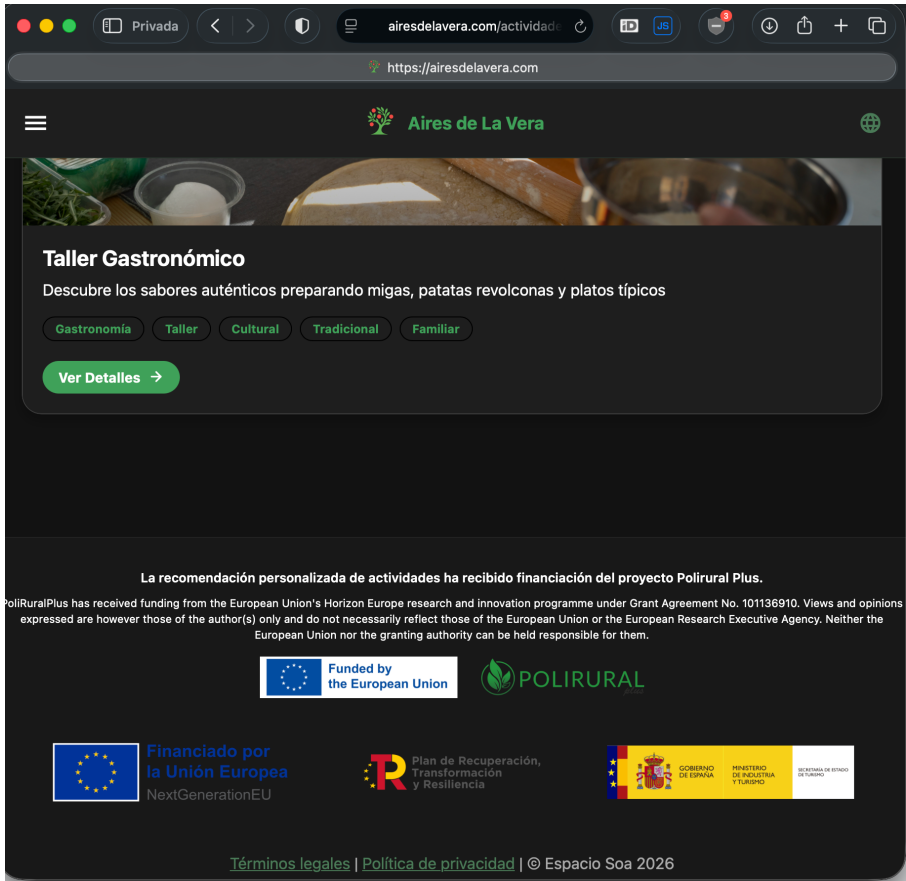


Figure: funding acknowledgement, EU emblem and PoliRuralPlus logo in the footer of the public pages of airesdelavera.com

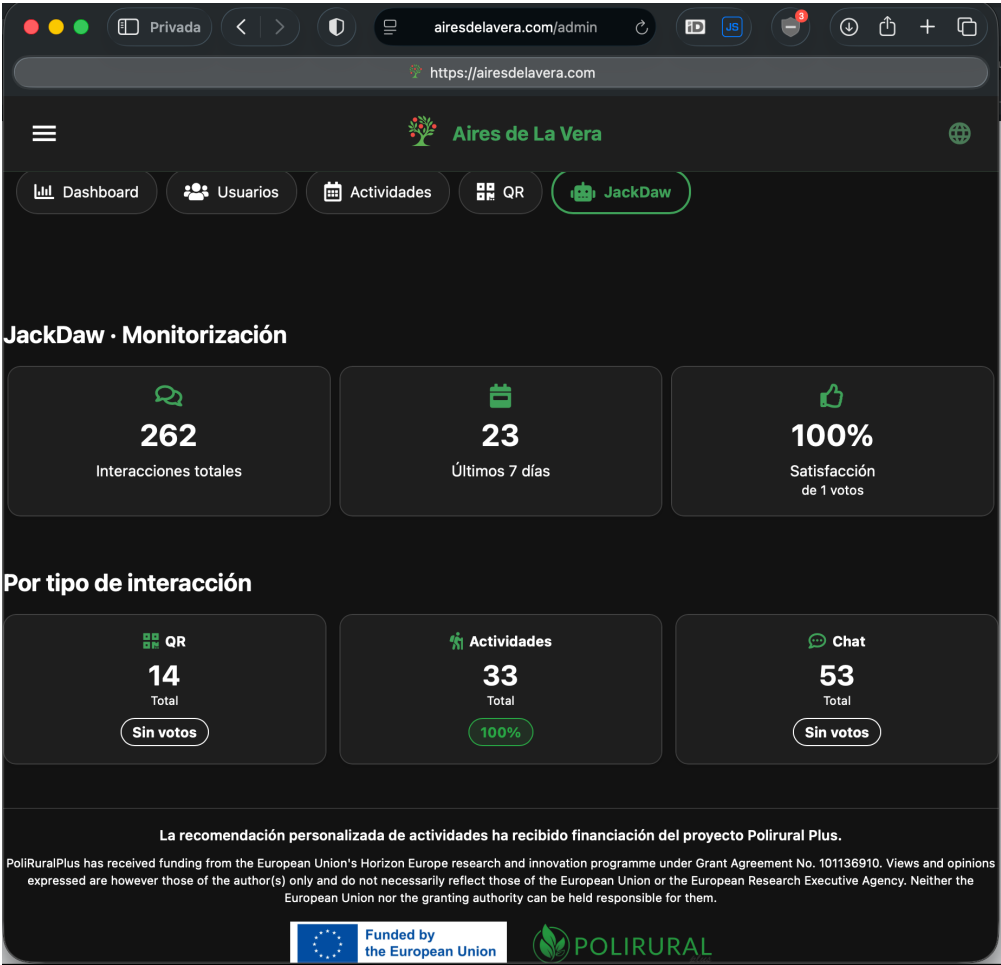


Figure: the same acknowledgement on the JackDaw monitoring panel of airesdelavera.com/admin (figures as of 31 August 2026)

**Mobile application.** The Aires de la Vera mobile application packages the same web content as the website, so the funding acknowledgement shown above forms part of the pages it reproduces. Below, JackDaw integrated in the application (activity recommendations and feedback prompts) and the acknowledgement text.

In addition, the project results were presented informally to other regional stakeholders (neighbouring farmers, a local cooperative, the comarca's LEADER local development entity and a regional hospitality establishment) as described in Chapter 5.

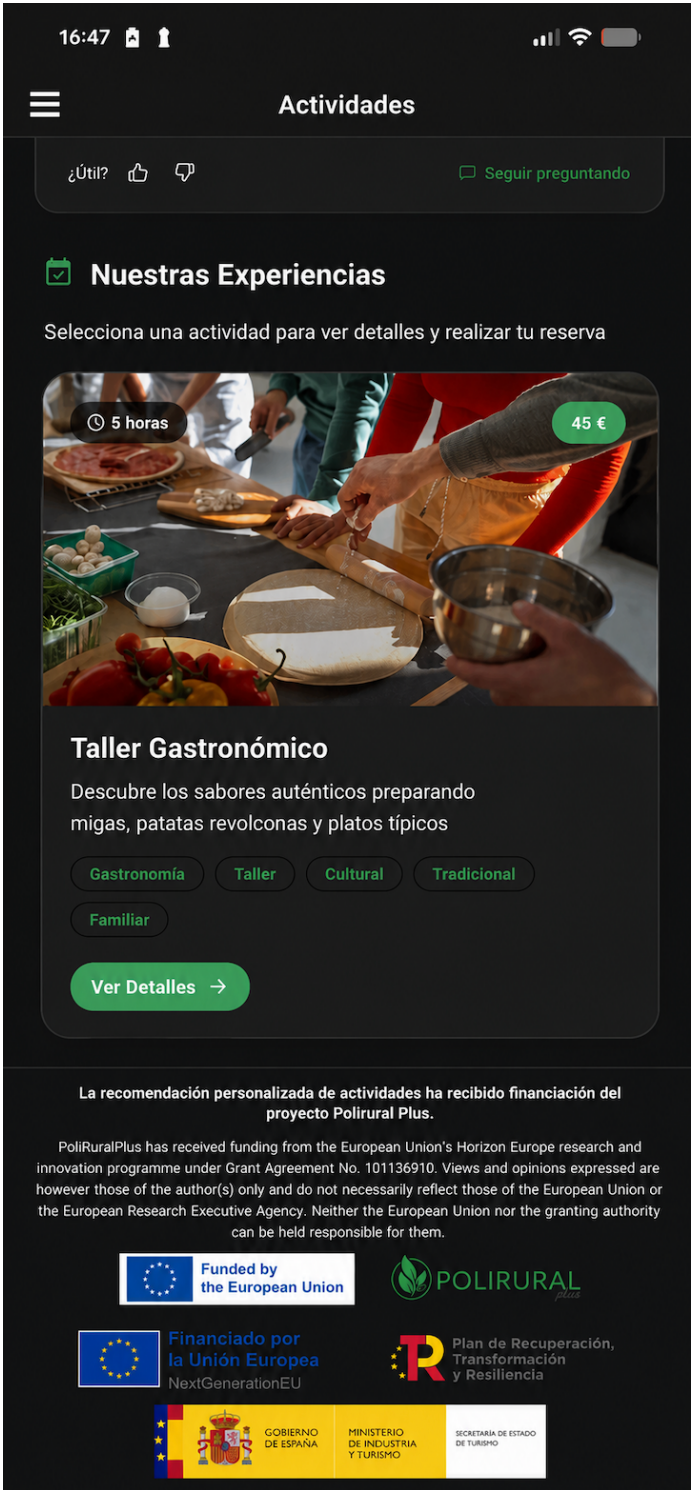


Figure: JackDaw integrated in the Aires de la Vera mobile application (activity recommendations and answer-feedback prompts) with Funding acknowledgement

## 7. Impact Assessment

The five target KPIs have been met over the project execution: KPI 1 — Tourism interactions analysed: target 30, achieved: around 50 during the specific validation days and over 200 across the total execution time — **exceeded**. KPI 2 — Validated agricultural interactions: target 10, achieved: more than 15 (only by the farm manager of Aires de la Vera) — **exceeded**. KPI 3 — Technical reliability: target 85%, achieved on the Espacio SOA platform; however,

the JackDaw platform tends to return 502 errors. KPI 4 — Agronomic recommendation alignment: target 70%, achieved based on feedback from the farm manager and independent analysis. KPI 5 — Replicability pathways identified: target 2, achieved 2 (tourism and agriculture, Chapter 9), with the agricultural pathway already activated (see Chapter 9).

### **Achieved Impacts**

**Technical:** first documented dual-domain MCP integration of JackDaw with a working farm's data systems, validating the extensibility model of the PoliRuralPlus ecosystem.

**Social:** non-technical users (visitors, farm staff) accessed spatial and agronomic data through plain-language conversation, lowering the digital-skills barrier emphasised by the call.

**Economic:** decision-support on irrigation and fertilisation supports input savings and better resource use on the estate; the tourism assistant enriches the visitor offer of a rural SME.

**Environmental:** data-informed irrigation and fertilisation directly support water efficiency and reduced over-fertilisation on a regeneratively managed estate.

**Policy:** the project demonstrates to municipal development offices and rural-digitalisation initiatives in La Vera how GeoAI can support place-based services.

### **New European Bauhaus reflection**

AGROJACK reflects the three NEB principles. Sustainability: the agricultural use case directly serves water- and nutrient-efficient farming on an estate practising regenerative agriculture. Inclusion: conversational access in Spanish and English makes spatial and agronomic information usable by visitors, families and farm workers regardless of technical skills. Aesthetics and experience: QR-triggered storytelling about trees, crops and landscape integrates digital content into the sensory experience of the estate rather than replacing it, enriching the way people perceive and value the rural landscape.

## **8. Challenges, Risks and Lessons Learned**

Key challenges were to properly determine the design and integration of JackDaw capabilities into Aires de la Vera systems in order to ensure it would be useful. At the same time the team applied a risk minimisation strategy with respect to the current production deployments, so that the technical deployment used in the AGROJACK project is a duplicate of the original existing environments.

Regarding lessons learnt, from the organisational point of view it always takes longer than expected to engage stakeholders into validation and we would recommend longer project timelines (maybe 9 or 12 months) with a mid-term technical validation and then the other half of the project fully devoted to validation with real users and during longer times. Another lesson learnt is to always properly manage expectations from users and ensure that they are aware that this is an "experiment" to see how it works, not a fully working product.

Risks were managed through WP1 monitoring: iterative internal testing (WP4) before user exposure, fallback answer paths when sensors or tools were unavailable, agronomic thresholds reviewed with the farm manager, and non-collecting and processing personal data handling defined in WP2 (which has been another design decision to minimize the amount of personal data used in the system).

## 9. Sustainability, Replicability and Next Steps

The current implemented AGROJACK systems: MCP server, app integration and sensor pipeline remain in production at Aires de la Vera beyond the project end; the estate intends to keep JackDaw-supported services available to visitors and staff subject to continued availability of the JackDaw Chat API.

For the Aires de la Vera and Espacio SoA, the AgroSens sensing platform — now multi-user — provides the infrastructure base for extending the service to neighbouring farms and open a new scalable business opportunities.

### **Replicability pathways**

**Pathway 1 — Tourism (agrotourism SMEs, tourism boards, visitor centres).** Requirements: an existing app or website, QR-enabled points of interest and a lightweight backend. Steps: expose local content through a small FastMCP server, register it with the JackDaw Chat API, and reuse AGROJACK's conversational patterns. The same approach fits protected-area visitor centres and regional tourism routes.

**Pathway 2 — Agriculture (farms, cooperatives).** Requirements: basic environmental sensors (soil probes measuring parameters such as pH, EC, NPK, moisture, temperature and salinity) on any LoRaWAN/ChirpStack-compatible infrastructure. Steps: deploy the documented `get_sensor_readings` pattern (nearest-sensor lookup, agronomic thresholds, interpreted output) and connect it to JackDaw via MCP. This pathway is already being activated: three neighbouring farmers requested a demonstration deployment of the sensor network on their own farms during the validation sessions. Crucially, AgroSens is now a multi-user platform (capability developed during the project), so neighbouring farms and cooperative members can be onboarded onto the existing platform, each managing its own set of probes without deploying further infrastructure of their own.

### **Scalability and exploitation**

The architecture is stateless and modular, so additional tools, farms or POI sets scale horizontally. ESOA will exploit the results in its agrotourism offering and its R&D service portfolio, and is open to supporting other rural SMEs in replicating the integration. The documented integration pattern contributes directly to future PoliRuralPlus development as a reference implementation for third-party MCP extensions

## 10. GDPR and Data Protection

This chapter describes how personal data was handled during the AGROJACK validation, in compliance with Regulation (EU) 2016/679 (GDPR) and Spanish Organic Law 3/2018 (LOPDGDD). Espacio SOA SLU acts as data controller for its own platforms (the Aires de la Vera app and backend, and the AgroSens sensing platform).

### 10.1 Approach: data minimisation by design

During the WP2 design phase the project took a deliberate decision, for operational and scheduling reasons and in order to reduce risk, to carry out all validation activities keeping the collection and processing of personal data to the strict minimum necessary. This follows the data-minimisation principle of Article 5(1)(c) GDPR and the data-protection-by-design and by-default obligation of Article 25: the objective of the exercise was to validate whether the technical capabilities work and how they work, which does not require identifying the participants. The approach also removed a practical barrier to participation, since several potential participants expressed reluctance to sign forms or hand over personal details for an experimental trial.

## 10.2 Personal data actually processed

**Tourism validation.** Participants accessed the JackDaw-enabled version of the Aires de la Vera app through specifically prepared anonymous accounts. No personal data was requested from participants: the accounts carried no real personal names, e-mail addresses, telephone numbers, identity documents, ages or any special category of data under Article 9 GDPR. Consequently, no consent forms were required and none were collected.

**Agricultural validation.** The estate's farm staff used JackDaw through the AgroSens web interface under their existing professional accounts, within the ordinary employment relationship and covered by Espacio SOA's pre-existing privacy framework. The use of the staff's professional accounts involves the ordinary processing of staff identification data, which pre-dates the project and is covered by Espacio SOA's existing privacy framework as employer; the three farmers who later joined the limited testing were granted individual access created with only a login name and a password (see Part B for detail).

Neighbouring farmers took part in informal on-farm sessions in which the system was demonstrated and they were invited to try conversational queries; no registration, form or data capture of any kind took place in those sessions.

**Interaction data.** Interaction logs used for the KPIs record the query, the response and a timestamp, associated with a validation account rather than with an identified natural person. They are therefore aggregated and non-identifying, and were used exclusively for counting interactions and assessing answer quality. Since queries are free text, it cannot be fully excluded that a user spontaneously types personal information into a question; participants were verbally instructed not to do so, the logs were analysed only at an aggregated level for the KPIs, and any personal information incidentally present is subject to the same restricted access and deletion commitments described in section 10.4.

**Geolocation.** No individual geolocation data was processed: for the validation the application transmits the coordinates of the Aires de la Vera estate by default, so the spatial context sent to JackDaw refers to the farm and not to the position of any particular person.

**Third-party services.** Queries are transmitted to the JackDaw Chat API, operated by the PoliRuralPlus consortium within the EU. Because the transmitted content carries no personal identifiers, no personal data was disclosed to third parties and no international transfers took place.

## 10.3 Images and audiovisual material

Only two photographs showing identifiable individuals were taken during the validation activities, both with the verbal agreement of those portrayed and on the express condition that they would not be openly published. Accordingly: no images of participants are used in any public material, news article, blog post or social-media output of the project; the images retained as internal evidence are included only in the confidential Part B of this report; and the face of the individual appearing in one of them has been irreversibly obscured. These photographs constitute personal data and were processed on the basis of the consent given, whose scope (internal use only) has been strictly respected. The photograph documenting the AgroSens session shows only a member of the Espacio SOA team, in her professional capacity as project staff.

## 10.4 Storage, retention, access and rights

The limited material described above is held on Espacio SOA's systems within the EU, with access restricted to the admin members of the Espacio SOA project team. Participants were informed verbally, at the start of each session, of the purpose of the activity, its experimental nature and the fact that no personal data would be retained.

## 10.5 Consequences and outlook

Because the personal data involved was minimal and incidental — limited to pre-existing staff account data, the farmers' access credentials, two consented photographs and the theoretical possibility of personal information entered

in free-text queries — and no special categories, profiling or automated decision-making affecting individuals were involved, the activity did not require a Data Protection Impact Assessment under Article 35 GDPR, nor the collection of written consent forms. Written consents are not held because the limited processing involved did not require them; the only consents applicable, relating to the two photographs, were obtained verbally and their scope (internal use only) has been respected and is documented in Part B.

This design decision does not limit the validity of the technical validation: the complete pipeline — app, MCP server, AgroSens and the JackDaw integration — remains deployed and operational, so a further validation round of any desired complexity, including full personal-data collection under the corresponding GDPR framework (information notice, explicit consent, records of processing activities and, where applicable, a DPIA), can be carried out at any time.

## 11. Conclusions

AGROJACK achieved its purpose: JackDaw was validated end-to-end in a real dual-domain rural setting, from farm to visitor. The project delivered a working integration (app + MCP server + sensor network + Chat API), generated structured validation evidence across tourism and agricultural real interactions, met its five KPIs, and produced feedback for improving JackDaw.

The key strategic value of the results is the demonstrated pattern: a small rural SME connected its own data to a European GeoAI agent in weeks using open protocols, and obtained services valuable to two very different audiences — tourists and farmers — from one integration. This pattern, documented in this report and in the project's public materials, is directly transferable to agrotourism SMEs, farms and cooperatives across rural Europe, supporting the PoliRuralPlus ambition of making spatial intelligence accessible for place-based rural development.

# PoliRuralPlus Technical Validation Questionnaire

Validation of PoliRuralPlus Technical Ecosystem Concepts, Tools & Components.

Questions can be given as simple statements or sentences where suitable. It is not necessary to provide a comprehensive text. Where the question is irrelevant to the project, state **N/A**.

The technologies covered under this questionnaire include:

- JackDaw GeoAI chatbot
- PoliRuralPlus Advisor
- RAG/GeoRAG
- Vulture
- Data harmonization tools and pipelines
- Data publishing concept

## **Participation in Webinars (initial Training Sessions)**

1. Which PoliRuralPlus technical sessions did members of your project attend or review recordings of?

Indicate: Attended live / Watched recording / Not reviewed.

*Team members reviewed the recordings of the JackDaw / Chat API technical sessions available on the PoliRuralPlus education-videos page.*

2. Which sessions were most relevant to your project?

*The session covering how to run JackDaw locally, since it was implemented by AGROJACK*

## **Awareness and Understanding of the PoliRuralPlus Ecosystem**

3. Were you aware of the JackDaw ecosystem and related tools before participating in the cascade funding activities in PoliRuralPlus?

*Only at a general level from the call documentation; detailed familiarity was gained during the project.*

4. Which ecosystem components are you familiar with

*JackDaw GeoAI chatbot, the Chat API (v2), its native geospatial services (terrain, land cover, WorldClim climatology) and the MCP extension mechanism.*

5. Briefly describe how you understand the purpose of the JackDaw ecosystem within PoliRuralPlus.

*A conversational gateway that makes spatial data and territorial analysis accessible in natural language to non-expert rural stakeholders, extensible with third-party data through MCP tools.*

## **Actual Testing or Validation**

6. Did your project test or experiment with any ecosystem technologies?

*Yes — extensively, in two real use cases (tourism and agriculture) over the six-month project.*

7. Which components were actively validated in your project work?

*The JackDaw GeoAI chatbot and Chat API (chat, streaming, WKT geometry handling) and the MCP server registration/discovery mechanism (/mcp/connect).*

8. Describe how the technologies were tested (internal testing, integration, stakeholder demos, pilot studies, evaluation exercises).

*Internal testing (refinement of prompts, tool descriptions and agronomic thresholds), full technical integration, and controlled validation trials with estate visitors (24 participants in three sessions), farm staff and neighbouring*

*farmers. To keep validation under a controlled scenario, the AGROJACK deployment is a duplicate of the original production environments.*

### **Technical Implementation**

9. Did you implement or configure any of the technologies provided in the form of services, custom plugins/services, local deployment, RAG/GeoRAG pipelines, data harmonization workflows, data cubes, pipelines, or data publishing?

*Yes — API-based integration plus a custom self-hosted service layer.*

10. If yes, describe the technical architecture used (local deployment, cloud deployment, integration with existing systems, API-based integration).

*Two separate environments (the Aires de la Vera app/backend for tourism, and the AgroSens multi-user sensing platform with its own backend and web interface for agriculture) connected to JackDaw through a shared self-hosted Python MCP server (FastMCP, streamable-http) behind a reverse proxy, with backend-to-backend OAuth 2.0 client-credentials authentication against the Chat API; sensor data is served by a separate ChirpStack LoRaWAN server.*

11. Did you develop new services or extensions? If yes, describe.

*Yes — four MCP tools: explain\_qr\_point, get\_nearby\_activities, log\_visitor\_interaction and get\_sensor\_readings, exposing QR content, activities, interaction logging and interpreted agronomic sensor data to JackDaw. A POLYGON-based geolocation specification was also added in response to farmer feedback.*

### **Use Cases and Policy Applications**

12. In which domain did you apply JackDaw ecosystem technologies (e.g., rural planning, agriculture, land management, climate monitoring, policy analysis, community participation, state your own sector as you see fit)?

*Agriculture (irrigation, fertilisation, soil monitoring) and rural tourism (visitor guidance and experience enhancement).*

13. Did the tools support policy intelligence or decision-making processes?

*Yes — operational decision-making: irrigation timing/volume, fertilisation planning based on NPK readings, and visitor activity planning.*

14. Did you use any of the technologies provided to analyse policy scenarios?

*No — AGROJACK focused on operational decision support rather than policy scenario analysis.*

15. Did you use any of the provided concepts for collaborative planning or stakeholder interaction?

*Only indirectly: demonstrations to regional stakeholders (farmers, a cooperative, the local development entity) explored how the tool could support local tourism and agricultural cooperation.*

16. Did you experiment with RAG or GeoRAG approaches for knowledge retrieval?

*Not directly; the project relied on JackDaw's native retrieval and geospatial services combined with live data returned by our MCP tools.*

### **Data and Knowledge Integration**

17. Did your project publish any datasets?

*No public datasets; operational data remains private, and the system was deliberately designed to minimise personal data (a GDPR-driven design decision). Anonymised, aggregated validation statistics are published in this report.*

18. Did you perform data harmonization to make datasets compatible with the ecosystem?

*Yes, at integration level: estate and sensor data was exposed with WKT geometries (EPSG:4326), including POLYGON support, and consistent bilingual (ES/EN) content so JackDaw could consume it seamlessly.*

19. Did you create or use centrality datasets for rural network analysis?

*No.*

20. Did you use the data cube or centrality measures approaches to process spatial or temporal data?

*No.*

### **Evaluation and Feedback**

21. What aspects of the technologies worked well?

*MCP tool discovery and automatic WKT/CRS injection worked reliably; JackDaw's enrichment of tool results with native geospatial context added clear value; OAuth2 integration was straightforward. On the Espacio SOA side the integration met the reliability target.*

*Specially positively valued by the farm manager has been the analysis of the sensor probes*

22. What limitations or challenges did you encounter?

*The main issue is that the JackDaw API is intermittently unresponsive, returning 502 errors; we have not been able to investigate the cause. Additionally, the behaviour of dataset artifacts (data field) with custom MCP tools is undocumented, and tool selection is sensitive to the quality of tool docstrings.*

23.

24. Did stakeholders or users provide feedback during testing? Summarize key insights.

*Yes. Tourist visitors asked for more personalised recommendations and for events available on the Internet (marked for future expansion). Farmers requested finer-grained geolocation of their plots, partially implemented via POLYGON coordinates (a more usable interface, e.g. SIGPAC references, remains pending as it requires connecting to external government services).*

### **Evidence of Validation**

25. Provide evidence if available (screenshots, demo videos, reports, evaluation results, prototypes, repositories – you may paste text or images here, supply links for documents or videos or web resources).

*Screenshots of the dissemination threads and the project web page are included in Chapter 6 of this report; app conversation screenshots, MCP server logs and sensor-reading examples are archived by ESOA and available on request. Access details for verification and some personal pictures are provided in the confidential Part B.*

*As an example, we provide below the agricultural valuation of a sensor data (in Spanish) that can be obtained and validated any time since the system is available for it.*

Enhance Final Report - Part A (Public)

Lectura agronómica del contexto local

En la zona de la Vera y alrededores de Cáceres, lo habitual es encontrar **suelos de reacción neutra a algo alcalina en muchos enclaves, con respuesta muy sensible al manejo del riego en verano**. Con calor y alta evaporación, la caída de humedad se traduce rápido en menor absorción de nutrientes, especialmente **N y K**. El patrón que muestran varios sensores encaja con una finca donde el **agua está siendo el factor limitante principal**, y donde el abonado está siendo absorbido de forma desigual según el punto.

Análisis por métrica

Humedad de suelo

- Preocupante en 03, 04, 05 y 08 por estar en valores más bien ajustados o claramente bajando con fuerza.
- La tendencia más delicada es la de **04 y 08**, que pierden humedad rápido.
- **Implicación:** si ese descenso continúa, el cultivo perderá capacidad de absorber N, P y K aunque haya nutrientes en suelo. En verano eso se traduce en estrés rápido y heterogeneidad dentro de la finca.

Riego recomendado:

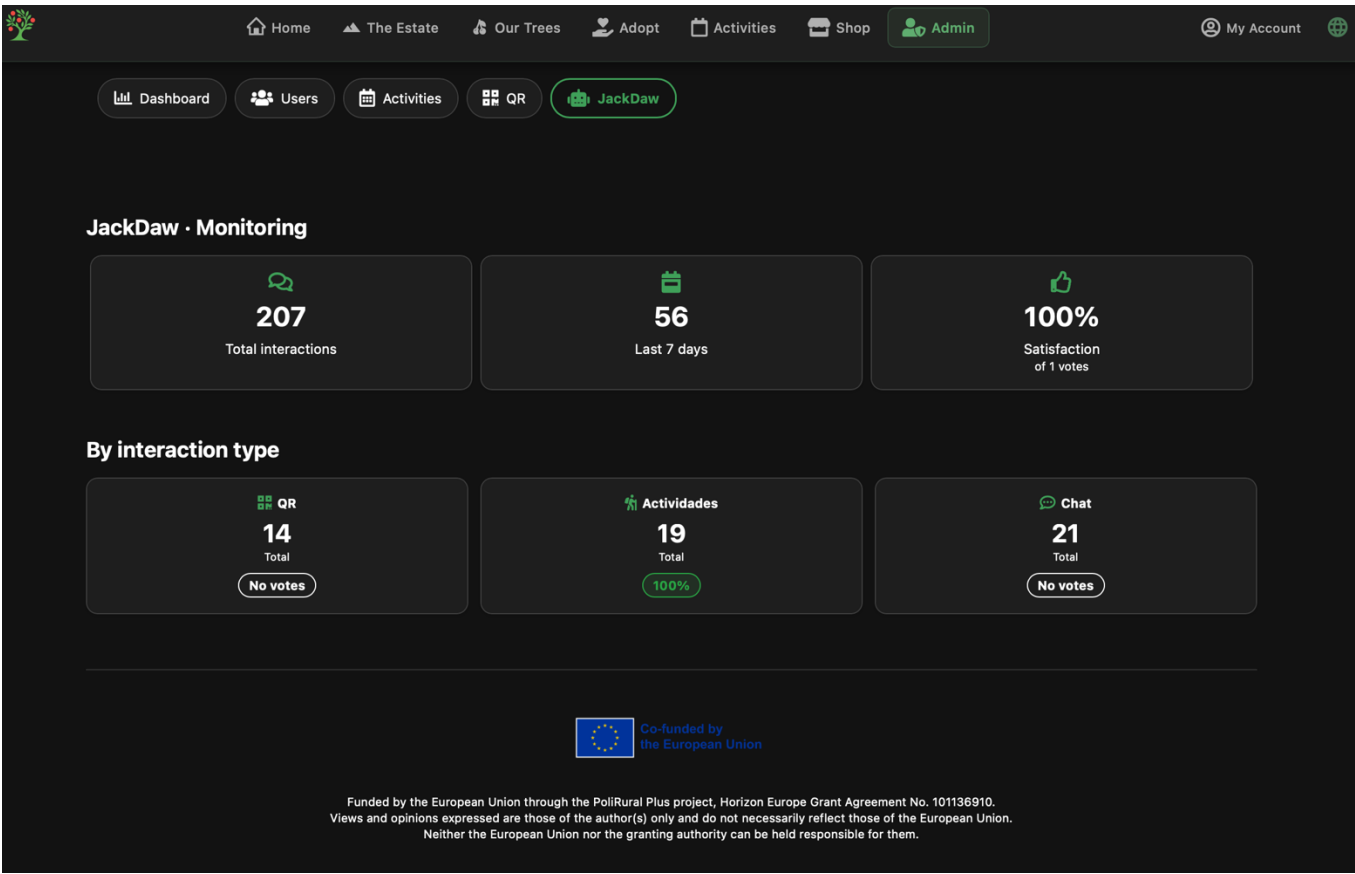
- Priorizar riegos **más frecuentes y menos bruscos** en los sectores 04 y 08.
- Evitar grandes aportes espaciados: en esta zona suelen funcionar mejor **aportes cortos para mantener la humedad estable** que picos de riego seguidos de secado.
- En 06 también conviene mantener el suelo más estable, porque la bajada de humedad puede hacer ineficaz el nitrógeno que está subiendo.
- En 02 y 07 se puede sostener un régimen algo menos agresivo, pero sin dejar que sigan secándose.

pH

- **Sensor 03: fuera de rango extremo y no fiable**

*Thanks to the provided info by AgroJack we have been able to detect that several PH probes need recalibration due to anonymous values.*

*On the other side, the touristic stats indicate that over 204 interactions have been registered with JackDaw chatbot (most of them internal tests and validations before exposing the data).*



The provided tourist app (available in Part B) allows as well to validate at any time and test the features, without the need of travelling physically to the estate, since the coordinates are currently fixed to La Vera area.

Future Potential

26. Would you consider continuing to use technologies like the PoliRuralPlus ecosystem after the project?  
(yes, no, why/why not)

*Yes — the AGROJACK integration remains in production at Aires de la Vera; continued use depends on the long-term availability and reliability of the JackDaw Chat API.*

27. Which of the components you have used or assessed have the highest potential for further exploitation?  
*The MCP-extensible Chat API: it lets any rural SME connect its own data to a GeoAI agent with modest effort, which is the strongest exploitation pathway we identified.*

28. What improvements would make the ecosystem more useful?

*Resolving the intermittent 502 errors of the Chat API; documenting dataset-artifact behaviour for custom MCP tools; a sandbox/test mode for integrators; support for standard parcel referencing (e.g. SIGPAC in Spain); and richer examples of MCP tool design.*