

How does digital technology contribute to pastoral livestock farming?

From data to decision



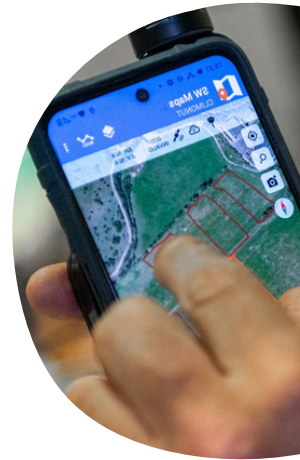
INTERNATIONAL YEAR OF
**RANGELANDS AND
PASTORALISTS**
2026

INTRODUCTION

When we think of pastoralism, we often picture a shepherd leading his flock across vast mountain pastures. We are less likely to picture sensors, GPS collars, monitoring stations and data analysis using artificial intelligence. And yet, these tools are extremely useful for informing decision-making and adapting practices.

On the Larzac plateau, at an altitude of 800 metres, the La Fage experimental unit uses digital tools to better characterise and understand the animals, resources and their environment.

How is data collected in the field? What happens to it? And how can it help to manage a herd more effectively in agropastoral conditions and contribute to more sustainable farming?



DID YOU KNOW?

The word 'pastoralism' comes from the Latin '*pastor*', which refers to a herdsman or shepherd, derived from the verb '*pascere*', meaning to graze or to feed. The word '*pastor*' subsequently came to mean one who guides a people.

LA FAGE, A FIELD OF EXPERIMENTATION

The La Fage experimental unit (INRAE) is home to 250 suckler ewes of the Romane breed and 550 dairy ewes of the Lacaune breed. The suckler flock is unique in that it is kept outdoors all year round on 280 hectares of pasture. The dairy flock complies with the Roquefort PDO specifications, and the ewes are put out to pasture from spring onwards.

On the estate, the animals and their environment are monitored using a range of devices: autonomous scales, motion sensors, water consumption measurements, animal tracking devices, camera traps, a weather station, measurements of plant resources and soil characteristics, etc.

The challenge: to transform the data collected in the field into useful information to better understand and manage the livestock farming system.

"Data collection is at the heart of experimentation. Our job is to collect, verify, organise and validate data, and to ensure it is secure."

**Séverine Deretz, Director of
the La Fage Experimental Unit**



PASTORALISM: MAKING THE MOST OF THE RESOURCES OF ECOSYSTEMS WITH A FRAGILE BALANCE

Pastoralism is based on the grazing of wild forage and on rangelands, depending on the seasons and environmental conditions. It offers numerous benefits: the maintenance of open habitats, the utilisation of plant resources in areas unsuitable for cultivation, carbon storage in the soil, the preservation of biodiversity and cultural heritage, and the maintenance of economic activity on uncultivated land.

However, these balances are fragile, with increased vulnerabilities, linked in particular to changes in the social, economic, health and climate context: water supply, the regeneration of food resources, the vulnerability of boxwood (shelter for herds) to pests, emerging animal diseases and predation.

Making the most of the resources of pastoral systems whilst preserving the balances on which they depend **requires a better understanding and monitoring of the interactions between the animal, the herd and the environment.**

This is precisely where digital technologies provide new and useful information to aid decision-making and improve practices.



DIGITAL TECHNOLOGY... FOR BETTER RESOURCE MANAGEMENT

THE ISSUE

Pastoral systems depend on natural resources, **the availability of which varies with the seasons**. The challenge is to preserve, and where necessary regenerate, these resources over time.



USEFUL INFORMATION

Geolocation data enables the herd's movements to be tracked. When combined with data on weather conditions, plant diversity and biomass on the grazing land, it provides a better understanding of how herds use and impact plant resources.

The aim is to measure the effects of weather events and adjust the herd's movements according to the availability of resources, to allow time for the vegetation to regenerate.



Ewe movements → Tracking via GPS collars → Equations for modelling and simulating movements → Analysis
→ Adjustment of grazing routes

THE IMPACTS ON AGROECOLOGY

Controlling overgrazing • Conserving sensitive plant species • Adapting to climate events

DIGITAL TECHNOLOGY... TO MONITOR THE HEALTH OF THE HERD

THE ISSUE

In open country, a sick ewe can sometimes be difficult to spot. She may stray from the flock or find it difficult to move around. It is therefore essential to be able **to detect any abnormalities quickly and automatically**.

USEFUL INFORMATION

Weight is a key indicator of animal wellbeing and health.

A **self-service weighing station**^{1,2} enables ewes to be weighed automatically whilst grazing. They are trained to walk through the self-weighing device on their own.

Automating the weighing of animals – a task that is usually time-consuming and stressful – helps to simplify the work and improve the monitoring and welfare of the herd.



Identifying the animal, measuring its live weight and recording the date and time → Processing the data in an application → Monitoring daily changes in the animals' and the herd's weight



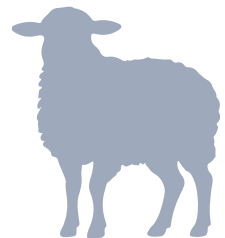
Collars fitted with **accelerometers**³ (motion sensors) placed on the animals enable their activities to be recorded and then described in detail: walking, grazing, resting, fleeing, etc.



Animal movement → The accelerometer records a signal for each movement → Analysis of behaviour over time → Detection of abnormal behaviour

THE IMPACTS ON AGROECOLOGY

Monitoring animal health • Animal welfare indicators • Improving working conditions



¹ González García Eliel, Irene Llach, Isabelle Sanchez, Bertrand Cloez. Le WoW : une plateforme intégrée, un algorithme (Kfino) et una web app (ORIOLE) pour l'autopesée des ovins dans un éventail de systèmes. JAS-2024 Journées d'Animation Scientifique du Département PHASE (INRAE), 5-7 Novembre, Poitiers, France, pp.90-91, 2024. <hal-04775293>

² González-García, E.; Sanchez, I.; Llach, I.; Decandia, M.; Giovanetti, V.; Cloez, B. Validating kfino algorithm (Kalman filter with impulse noised outliers) to filter liveweight outliers produced by the walk-over-weighing (WoW) platform in a large spectrum of farming systems. Smart Agric. Technol. 2025, 12, 101374.

³ Emilie Cobo, Mathias Aletru, Christian Durand, Sébastien Douls, Gaëtan Bonnafe, et al.. Observer sans déranger : des accéléromètres pour plonger dans le quotidien d'ovins élevés en plein air intégral. J2M, INRAE, Oct 2025, Saint-Jacut-de-la-Mer, France. 16 p. <hal-05398948>

DIGITAL TECHNOLOGY... TO PROTECT HERDS WHILE PRESERVING BIODIVERSITY

THE ISSUE

A pastoral system is not limited to the flock of sheep. Alongside them, guard dogs, vegetation and wildlife all share the same territory. Understanding how they interact is essential for **preserving the balance of the environment**.

USEFUL INFORMATION

Guard dogs are fitted with **GPS collars linked to barking sensors**. **Camera traps** placed around the estate then make it possible to observe what may have triggered the dogs' movements and barking: the passage of a human or an animal, the presence of a predator, and so on...

In the long term, artificial intelligence could help to automatically classify different types of barking according to the trigger and generate alerts tailored to the situation.



Barking → Locating the source of the barking and analysing images from camera traps → Analysing the cause of the barking → Understanding the interactions

THE IMPACTS ON AGROECOLOGICAL

Managing the risk of predation • A better understanding of the interactions between domestic herds and wildlife

TESTIMONIAL: THE VALUE OF DATA IN THE FIELD



Interview with Séverine Deretz,
Director of the La Fage Experimental Unit

1. What role does data collection play in the work carried out at La Fage?

A wide variety and a very large volume of data are generated daily on the estate. Everything produced at La Fage provides research data, including images and videos, geolocated data, soil characterisation data and biological analyses, etc. This data can then be combined (e.g. weather data and data on ewe water consumption) and form the raw material for new scientific insights.

2. How has digital technology affected the way experiments are carried out at La Fage?

Experiments are conducted on an ongoing basis and not necessarily in response to a one-off request from a scientist. Data is generated at a higher throughput and requires the management of large files, which must be verified, secured and transmitted. More time is spent on managing, processing and securing data.

New equipment must be developed, and servers, a high-speed network or Bluetooth devices must be installed. To this end, the units receive support from INRAE's CATI (Automated Information Processing Centres). More regular maintenance and metrological checks must also be carried out on the instruments. Staff skills must evolve accordingly.

3. How has this changed the way researchers and animal breeders interact?

Today, with the arrival of engineers at experimental units, an increasingly significant proportion of data generation relies on experimental expertise. The result is that experimental units are becoming more closely integrated into scientific projects as partners. Animal production technicians are the first link in the data collection chain: they are the ones who take the measurements, identify any anomalies and check the equipment.

4. What links do you have with other stakeholders in the agricultural sector?

Experimentation lies at the interface between basic science and practical applications. An experimental unit is a key place for interaction, for raising issues encountered in the field, and for transferring research findings to the relevant sectors.

The unit therefore has strong regional roots through its links with livestock professionals (UPRA Lacaune, OS Romane, CNBL), agricultural education establishments (Agricampus La Roque in Rodez, La Cazotte professional college in Saint-Affrique, MFR Valrance in Saint-Sernin-sur-Rance, LPA Narbonne), animal health organisations (AVEM, GDS), cheese-making businesses (Société, Vieux Bergers), cooperatives (NATERA), technical institutes and trade organisations (Idèle, *Chambre d'agriculture de l'Aveyron*), associations (*Association des lieutenants de l'ovélevage*, APABA) and other organisations based in the region, such as the Regional Nature Park (PNRGC) and the French Biodiversity Agency (OFB).



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