

GPS collars to record information on PG use and livestock behaviour

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- **DESCRIPTION:** Global Positioning System (GPS) collars automatically record the location and all the movements of an equipped animal and send all the collected data to a cloud. Then, a digital platform processes and stores all the information and notifies the owner of all relevant events.

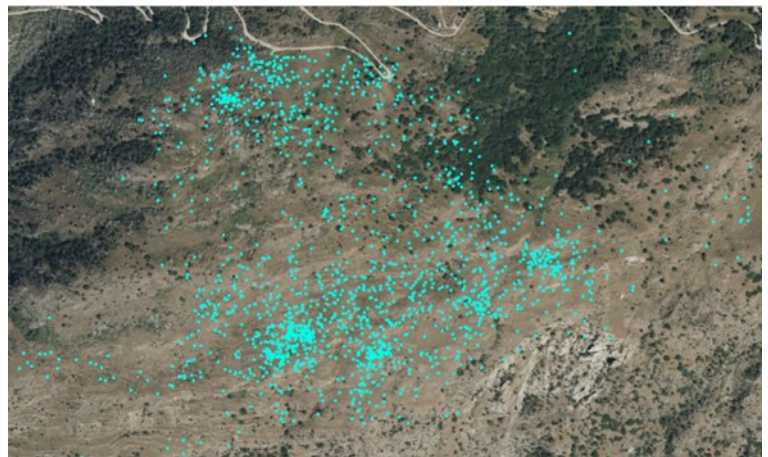


Fig. 1: Sheep equipped with a GPS collar (left) and site frequentation map of the sheep flock (right) in an Alpine rangeland

- **RATIONALE:**

The GPS collars can be effectively used for animal tracking with advantages for farmers, consumers and public authorities. If properly implemented, GPS collars can monitor the position of each animal in a herd, which is essential when animals graze in remote areas. Some systems send a notification when an animal leaves an area, although unlike virtual fencing systems, the animals are not discouraged from leaving with an audio cue. Locating the position of livestock is useful to plan veterinary checks for sanitary treatments or to weigh animals. Consumers can track the position of the milk or meat they buy, which is important to support feed origin when high-price pasture-fed products are sold. The work of payment agencies for calculating stocking-rates and to check compliance with CAP requirements, and of veterinary services to follow herd movements is easier when animal position is known. Commercial GPS collars for scientific purposes are expensive, although positioning is accurate.

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Fig. 2: Highland cattle equipped with a GPS collar (left) and real-time positioning of the cow and the herd (right) in an Alpine summer pasture

• MECHANISM OF ACTION:

The GPS systems are designed specifically for many livestock categories (sheep, goats, and cattle) and detect and analyse any movement of the animals. To fulfil farmers' needs they should work in any location by gathering precise and frequent geolocation data, while their battery life should be optimised to last until livestock need to be moved or inspected. Three main systems are available:

- 1) low-cost stand-alone GPS (300-500 € vs 1500-2500 € for a standard device). GPS locations are stored on an internal memory for a period depending on battery life (generally six months or more). Storage is never a problem at intervals of 30 minutes or higher. Geolocations have to be downloaded connecting the device to laptop via USB.
- 2) Stand-alone GPS at very low cost (70 €). Devices have short life batteries (rechargeable often with a small solar panel) and storage is limited. Devices are equipped with a GSM (Global System for Mobile Communications) used to notify the farmer when the animal leaves a virtual fence, falls or is potentially injured (an accelerometer is needed in this case) or is stationary for a long time. Positions are not stored. One GSM sim card is needed for every head.
- 3) GPS at low-medium cost (70 €) plus one antenna (receiver) equipped with GSM / Wi-Fi to connect with a server and transmit positions. The battery has a long life (3-6 months or more), but storage is limited since it is supposed that the device can connect to antenna frequently and data is recorded in real-time on a server. An antenna is expensive (about 4000 €) and its placement may be expensive depending on where it is located.

Farmers should be guided to identify the most suitable system depending on the conditions that their herds graze in, by explaining the advantages and disadvantages of each solution.



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Fig. 3: Piemontese beef cattle equipped with a GPS collar (left) and portable station for herd data downloading (right) in an Alpine summer pasture.

- **POTENTIAL FOR APPLYING THE MANAGEMENT OPTION:**

GPS collars can be used in all grassland grazing farming systems, especially on farms with remote pastures. The devices are very small (a 10-15 cm box attached directly to the collar) and are therefore not an obstacle for the animals. They can be implemented in any biogeographic region, but steep topography (e.g. in the Alpine region) can limit data gathering and reliability. GPS collars have the potential to increase farmers' knowledge of livestock movements at pasture, providing useful information to optimise PG exploitation at farm scale, through the grazing season.

- **PRACTICAL CONSIDERATION FOR ALPINE BIOGEOGRAPHIC REGIONS:**

The extreme topography of mountain pastures exploited by livestock in the Alpine biogeographic region can seriously impact GPS usability, since the device signal can be frequently lost and geolocation may be less accurate (especially close to steep slopes), while heavy cloud or forest canopy cover can impact GPS functioning. A few systems have been adapted for such specific conditions, while most of them have been developed for the plains of Continental or Atlantic biogeographic regions. However, such systems can optimise the management of Alpine farms, since they can partially replace the direct supervision by shepherds (which is obviously still necessary). GPS collars can be used as a business support tool able to reduce the time (and cost) of constant herd monitoring. They can be particularly effective for extensive contexts (free grazing or on large fences) and for areas with difficult access. This is with a view to reducing the time (and costs) associated with herd management, since in many cases some hours on foot are needed for a farmer to reach mountain pastures.



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• SUPPORT:

Farmers and advisors can select the best solution depending on farm resources and peculiarities, including herd/flock dimensions and pasture localisation. However, the system is more efficient if all adult animals are collared. This obviously affects the total cost. One of the major costs is the antenna, in systems requiring it. In this case, the investment would be more economically sustainable for medium to large herds, including at least 50 head upwards. Given the fixed cost of the antenna, the costs per animal decrease as the number of animals increases. Incentives should be provided to farms adopting tracking systems for CAP requirement controls or within the framework of 'traceability of origin' grass-fed products.

• EXAMPLE OF GOOD PRACTICE:

In the Alpine biogeographic region, the number of farms using a GPS system on the herds/flocks is still limited, but the few farms that have implemented such a system are reporting that they are very satisfied with the experience. Knowing the precise location of animals while grazing in heterogeneous mountain pastures, and having site frequentation maps at the end of the grazing season helped farmers in their decision making, particularly for the set-up of grazing paddocks. Indeed, they were able to adjust paddock dimensions and duration to optimise fine-scale stocking density with the aim to increase the evenness of pasture exploitation.