

Satellite monitoring of quantity and quality of available biomass in pastoral livestock systems

Pastoral farming contributes 46% of GDP and is key to food and social security in LAC. Tools that improve their efficiency are needed to increase their profitability and sustainability.





3
PhD theses in progress



79
Researchers and technicians involved in biomass sampling



18
Training and field days



1
Protocol and App for standardized field sampling



0.56
R2 of predictive models for pastures (preliminary)



2
Satellite tools developed being validated



Remote sensors allow monitoring large areas and have information in almost real time

Initiative

- i) Generate and calibrate real-time prediction models of forage quantity and quality from remote sensors for relevant forage resources in 4 LAC countries with cold, temperate, subtropical and tropical, semi-arid and humid climates,
- ii) Validate the models generated in demonstration units and commercial farms, and
- iii) Manage the knowledge generated, training both technicians and producers as well as those responsible for national GHG inventories in order to ensure technology transfer.

Lower the cost of estimating in real time and with adequate precision the quantity and quality of forage in pastoral livestock systems through a satellite tool

Tech solution

A platform comprised of the national agricultural research and innovation institutes and other actors in the sector will be formed which, thanks to their regional presence and the extension, transfer and technological development activities that they carry out, will be key to achieving the objective and reaching all beneficiaries: family and business producers, livestock advisors, software developers and public officials.

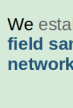
Satellite monitoring project workflow



We aim to reduce the cost of assessing **forage availability** (quantity and quality) in grazing systems through **satellite-based tools**.



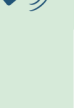
80 technicians



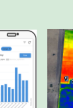
We established a **field sampling network**.



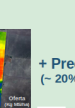
We compiled a large database to calibrate and validate satellite-based estimation models.



We developed methods that integrate field and satellite data.



+ Precision (~ 20% error)



+ 3500 beneficiaries reached through outreach and training activities.



+ 3000 data



Tropical pasture
Temperate pasture
Annual pasture



Evaluaciones en sitios piloto



MORE INFO

Impacts and Results

A regional monitoring network was consolidated across Argentina, Colombia, Costa Rica, and Uruguay, resulting in an open-access metadata database containing approximately 3,600 records (1,600 collected directly under a standardized protocol and 2,000 obtained through indirect methods), integrated within an automated digital workflow. Using these data, Sentinel-based machine learning models (Random Forest) were evaluated. The relationship between biomass and satellite-derived variables exhibited strong spatial and temporal variability, resulting in paddock-scale prediction errors (RMSE) of 820 and 612 kg DM/ha (~41% and 32%) when considering all forage resources and temperate pastures in Balcarce, respectively. In contrast, the relationship with forage quality (crude protein content) proved to be more consistent and generalizable. These advances supported the development of two simplification tools that integrate satellite and field data. The first is a spatial simplification approach that optimizes sampling through measurements at strategically selected locations corresponding to extreme spectral index values. The second is a temporal simplification approach that estimates real-time forage stocks by integrating residual biomass measurements with forage growth models. Both tools were validated under real farming conditions, achieving operational errors of approximately 20%, and contribute to sustainable livestock management based on scientific evidence. Dissemination and training activities reached more than 3,500 participants.

Main Donors

Organizations