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PASTURES

Pastures for carbon and biodiversity - Business model(s)

About the initiative

Dryland pastures of the Mediterranean region (Montado, in Portugal and Dehesa, in Spain), with about 8 914 000 ha, occupy low fertility soils and are the main source of animal feed in extensive animal production systems. These two countries could achieve significant soil CO2 sequestration rates with a 1% increase in soil organic matter in 50% of the permanent pastures. This way, 134 million tons of CO2 could be captured into the soil. The increase of soil organic matter can occur through very simple practices available to any farmer, such as, i) soil pH correction (pasture soils have normally low pH values); ii) soil nutrients correction (pasture soils normally have low nutrient concentration); iii) pasture species biodiversity correction (balance between legumes and grasses); and iv) water management availability in the growing season. Between 2021 and 2024, a series of research and engagement activities with farmers will be implemented. The LANDMARC H2020 research project on land-based negative emission solutions will explore the potential of carbon storage in soils and Montado/Dehesa/pastures in Portugal and Spain.

Focus Area

In LANDMARC project, the delineation of the Montado/Dehesa pasture management zones will be constituted by some pilot farms in Portugal and Spain (Figure 1). At these pilot farms, in some particular management zones, soil/grass samples will be collected. In addition to field data, Remote Sensing (RS) data obtained from Sentinel-1 and Sentinel -2 imagery will be used to monitor pasture quality and support farm management decisions. These data will allow the development of differentiated prescription maps for fertilizers with variable application rate technology by capturing the variability of soil characteristics and pasture development, contributing to the sustainability of this ecosystem. This work will be geared toward LANDMARC of actions for the development and promotion of pastures business models and development of pasture transition roadmaps and toolkits for farmers and policy makers.

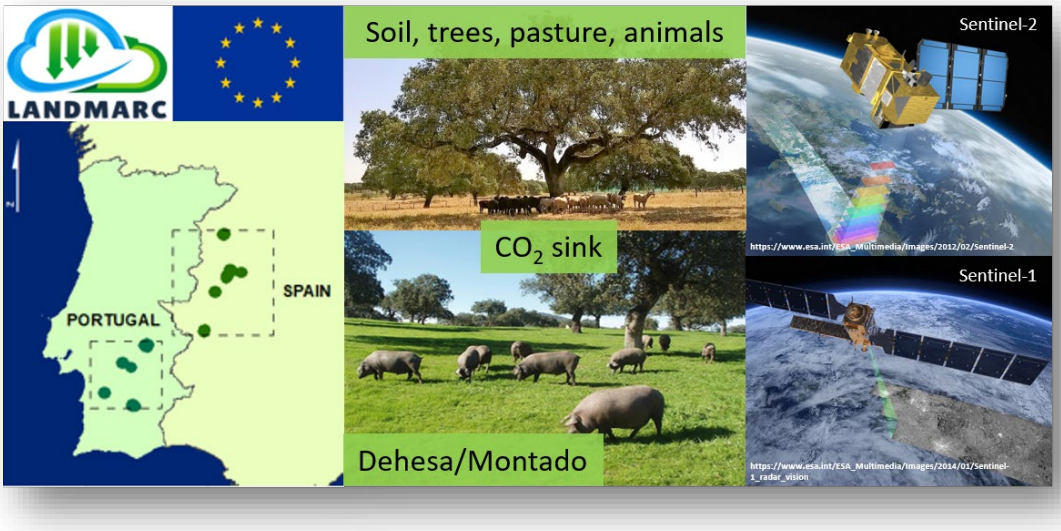

Figure 1. Montado/Dehesa pastures pilot farms in Portugal and Spain of Landmarc project.

Contact us
José Rafael Marques da Silva (AgroInsider) – rafael@agroinsider.com Patrícia Lourenço (AgroInsider) – patricia@agroinsider.com

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What LANDMARC offers

LANDMARC complements the ongoing work on Montado/Dehesa pastures in Portugal and Spain through (Figure 2):

1. **Measuring:** The work will focus in smart sampling strategies of soil/grass in particular management zones of the pilot farms based on field and RS data. The implementation plan consists in doing experiments with farmers, such as, i) delineate management zones; ii) collect soil/grass samples; iii) use RS time-series satellite data to calculate pasture productivity and water content; iv) delineate small plots to apply pH and/or plants diversity correction; v) measuring yield differences between corrected and not corrected plots and comparing the differences in terms of biomass production (CO_2 potential sink) and plants diversity.

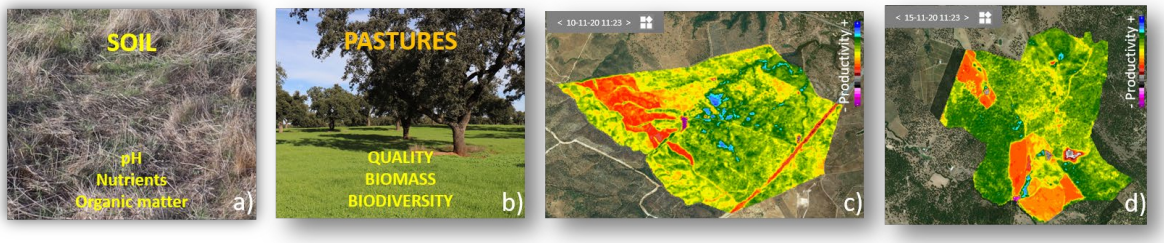

Figure 2. Soil (a) and pastures (b) samples data. Crop productivity calculated from satellite data (c and d).

2. **Business:** With low soil inputs correction, biomass production can be tripled and soil organic matter can rapidly grow in the soil. Improving the balance between legumes and grasses in the pasture, the technology will reduce nitrogen fertilization and promote floristic biodiversity to pollinators. Regarding business, a farmer can increase each year 0.1% of organic matter in the soil (pasture) by sinking approximately 3 ton of CO_2/ha. If the price of 1 ton of CO_2 in the market reaches 50 €, a farmer can make 150 €/ha per year.
3. **Adaptation:** Fertilization and soil correction will be applied to improve soil fertility and, consequently, productivity/quality of pastures. Pastures biodiversity will be assess using floristic composition patterns to monitor the recommended management practices (Section I).
4. **Scaling:** Performing this work model on a European scale, an increase of 1% of soil organic matter in 50% of European permanent pastures will lead to the sinking of 921 millions of tons of CO_2.

Section I - Additional information

Montado/Dehesa pastures are an agro-silvo-pastoral system characterized by a high complexity as a result of the interactions between climate, soil, pasture, trees, and animals. In this context, monitoring the pasture quality is a key element in the decision making process of a farm manager, since these pastures are the main source of animal feed in extensive animal production systems in Portugal and Spain. The important inter-annual variability of rainfall, characteristic of the Mediterranean region, places agricultural decision-makers in a scenario of great unpredictability regarding the availability of food for animals in an extensive regime. Montado/Dehesa pastures are generally established in low fertility and high spatial variability soils. Rational application of fertilizers requires knowledge of spatial variability of soil characteristics and crop response, which reinforces the interest of technologies that facilitates the identification of homogeneous management zones. Pasture nutritional value varies seasonally, annually, and with spatial location and is strongly related to species composition, namely abundance of legumes or grasses and overall plant diversity. Certain botanical species may even be biological indicators of ecosystem degradation situations, such as acid soils or manganese toxicity. The incorporation of Smart Agriculture technologies in the Montado/Dehesa ecosystem represents an important advancement in pasture and landscape management, carbon storage and biodiversity improvement.

Contact us
José Rafael Marques da Silva (AgroInsider) – rafael@agroinsider.com Patrícia Lourenço (AgroInsider) – patricia@agroinsider.com