

# AGROFORESTRY

Evaluation and monitoring of carbon sequestration capacity and degraded agricultural lands reforestation program in Extremadura, Spain (1993-2008) and synergies with other social challenges including depopulation and masculinisation of rural areas.

## ***About the initiative***

Between 1993 and 2008, the Agrarian Degraded Land Reforestation Program was executed in Extremadura, Spain, which basically consisted of the reforestation of abandoned agricultural lands or those with very poor economic productivity. This meant, therefore, the change of use from agricultural to forestry of these lands, more than 70,000 hectares. After several years of that experience, LANDMARC wants to focus its research on the inventory and monitoring of some of these farms, and the evaluation of the potential of these lands which, apart from other ecosystem benefits, have the advantage of storing carbon in biomass and soil above the pre-program values.

## ***Focus Area***

With the support of the General Directorate of Community Agrarian Policy of the Regional Government, Junta de Extremadura, three representative farms of the Agrarian Degraded Land Reforestation Program will be evaluated. To this end, meetings are held with the regional Administration, and the farms are chosen which, due to their special characteristics, both in the afforestation and subsequent maintenance work, have led to a successful implementation of the measures.



**Figure 1:** Ecosystems restoration and the Agrarian Degraded Land Reforestation Program translate into environmental benefits in the form of improving biodiversity indices, soil conservation, combating desertification and mitigating the effects of climate change.

Once the farms have been selected, all the technical, administrative and economic documentation of the files related to the Program is compiled. Likewise, the cartographic documentation is compiled and organized and a Geographic Information System is elaborated where all the shapefiles necessary for the monitoring, evaluation and analysis of the evolution in time of the pilot farms are stored.

The works also combine a compilation of coverage and analysis on georeferenced information from remote sensing and LIDAR mapping, taken in different years, to assess the growth of the forest mass. It is complemented with field measurements and monitoring with in situ forest technologies (Field Map and drones) for the inventory of trees and shrubs, and of all current forest vegetation, biodiversity

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indices are estimated, and the entire existing forest mass is characterized. This allows validation of satellite monitoring and comparison with current and previous orthophotos and maps. Along with the initial edaphological documentation and the soil maps, new soil samples are extracted and analyzed to evaluate the edaphological variables of organic matter, carbon and nitrogen, among others.

### **What LANDMARC offers**

LANDMARC complements the ongoing work on agroforestry in Extremadura (Spain) through:

1. **Measuring:** The work focuses on the monitoring and evaluation of the carbon stored in the forest mass and in the soil by these pilot farms in recent years. This ecosystem service is also an added value that can be valued in addition to soil conservation, improvement of biodiversity indices, or the fight against erosion and desertification. The application of new technologies for this monitoring will improve the accuracy of the measurements and reduce the costs of the inventory of natural resources. New inventory and measurement methodologies are designed that combine in situ measurements with remote sensing analyzes.



**Figure 2:** Forestry in situ monitoring can be supported by new technologies, which improve accuracy, reduce costs, and expand the territory that can be assessed.

2. **Business:** Monetization and the economic value of ecosystem services continues to be a challenge. There are opportunities in the mitigation potential of degraded lands that are transformed into forest lands with high levels of biodiversity. New technologies, and technology consulting services, are also employment niches and new lines of business that can attract young and female talent to rural areas.
3. **Adaptation:** Reforestation of degraded agricultural lands is a real and viable solution in many territories in which the advance of desertification, erosion, or the loss of biodiversity are problems that are exacerbated by climate change. They are very degraded lands whose adaptation to the climate goes through a correct territorial planning that considers ecological, economic, social and climatic variables. The direct and indirect benefits in terms of ecosystem services are multiple and must be evaluated.
4. **Scaling:** Scalability in Mediterranean degraded agricultural areas in South of Europe and North of Africa. Linked with new CAP objectives.

**Section 1 - Additional information.** Many of Europe's rural regions have serious depopulation and masculinization problems. In the towns of Extremadura, where there are vast degraded agricultural territories, the social problem has a negative influence on the conservation of resources. Drought, desertification and forest fires are compounded by the loss of young people of working age who migrate to urban areas. Forest restoration, and new technologies, offer opportunities to attract youth and female talent to these areas, in the form of new jobs that offer solutions to urban societies.

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