Implementing agroforestry practices to restore degraded areas in Spain (LIFE Operation CO_2 project)

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Summary

There are more than 10 million hectares of degraded agricultural land in Spain in need of immediate solutions (MAGRAMA, 2016). The "Operation CO_2" project is co-financed by the European Union through the LIFE programme and is focused on implementing agroforestry and other sustainable agricultural practices in order to increase biodiversity, repopulate arid land with plant life and lower Greenhouse Gas (GHG) emissions.

Why?

The objective is to design and build agroforestry systems on degraded soils in semi-arid areas as a tool to improve the surrounding ecosystems and grow crops in an environmentally sustainable manner.

Expected results include an increase in harvest yields, improvements in soil quality and larger potential for carbon storage capacity in the soil.

How was it done?

1. Designing the agroforestry plan

- ✓ The agroforestry plan was designed based on the specific characteristics of the designated areas and a variety of species was selected to cover a wide range of uses (e.g. wood, biomass, fruit trees, aromatic herbs, border protection, annual crops, amongst others)
- ✓ Soil revitalization began with sowing cover crops

2. Plot division

- ✓ Each demonstrative area was divided into 3 zones in order to compare the effect of different mycorrhizal treatments: **Zone A** (40% of the land using 100% of the mycorrhiza product), **Zone B** (40%.50%) and **Zone C** (20%.0%)

3. Sowing crops and green cover (Year 1)

- ✓ Vertical ploughing for soil decompaction
- ✓ Sowing was done on cultivation ridges
- ✓ The soil was inoculated with a product based on mycorrhizal spores, beneficial bacteria and humus.

4. Adding the forestry system (Year 2)

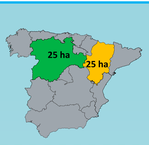
- ✓ In each demonstrative area, approximately 3,000 trees and bushes were planted according to a specific scheme (i.e. *C. sativa* (10*6m), *P. vera* (10*10), *P. dulcis* (25*5), *P. pinaster* (6*5), *Q. suber* (2*2). Some of the trees were inoculated with ectomycorrhizas (i.e. *P. pinea* con *Lactarius deliciosus*, el *C. ladanifer* con *Boletus edulis* y el *Q. suber* con *Pisolithus tinctorius*)
- ✓ Some trees were planted with an innovative water deposit system (Cocoon).
- ✓ Cereal and/or legume crops were sowed between the forestry rows, in order to sustainable manage the soil. The use of moldboard plow was strictly avoided along with any tilling that could damage the mycelium of the mycorrhizae.

Conclusions

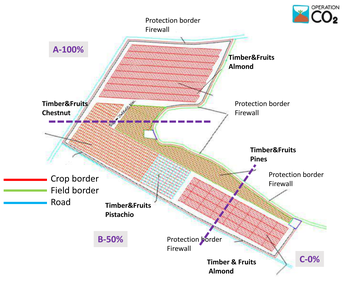
Annual crops have demonstrated that the production in the A Zones (areas with higher percentages of mycorrhizal treatment) tend to be significantly higher compared to the other Zones (B & C). The experiment gave very positive results such as the increase and longer depths of crop roots, leading to improved yield and better water retention capacity in the soil. Survival rates were over 80% in the case of Almond and Service trees in both demonstrative areas, while at Ayoó de Vidriales saw a total tree survival rate of over 90%.

Implementing an agroforestry system in these semi-arid areas may have contributed to reduce the vulnerability of these ecosystems, serving as an adaptation measure to combat the negative effects of climate change. This model can be replicated to other areas classified as arid or semi-arid in Spain as well as other Mediterranean countries that also suffer from dry and excessively hot summers.

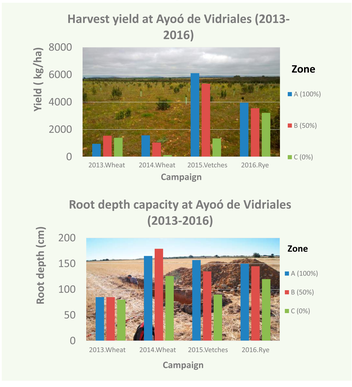
Characteristics of the demonstrative areas



- Abandoned area with high risks of wildfire
- Max. 500 mm/year of rainfall
- Acidic soil suffering from compaction
- At risk of desertification



Results



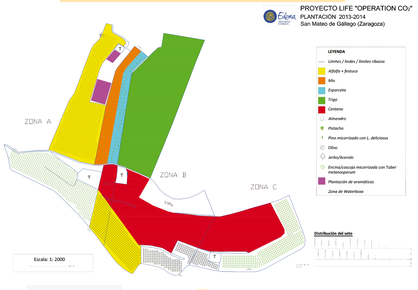


Ayoó de Vidriales (Zamora)

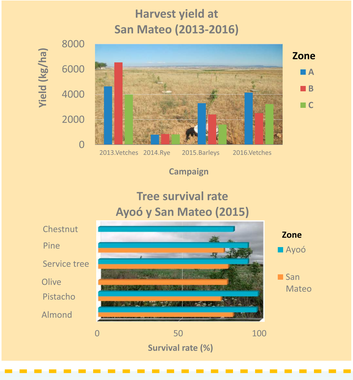


San Mateo de Gállego (Zaragoza)

- Typical cereal production area suffering from an elevated evapotranspiration rate due to the drying effect of the wind
- Average ineffective rainfall of 396 mm/year
- Eroded and compacted soil
- At risk of desertification



Results



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