

## Autonomous adaptation to droughts in an agro-silvo-pastoral system in Alentejo <sup>[1]</sup>

Image from Climate Adapt about this case study

[2]

Autor: © Herdade Freixo do Meio

Herdade do Freixo do Meio is an organic certified farm of 440 hectares located in the Alentejo region in the south of Portugal, a region characterized by the multifunctional agro-silvo-pastoral system of cork and holm oak trees, named *montado*. This farm employs about 20 people and produces cork, vegetables, fruit, wine and herbs, and holds animals (such as sheep, cows, pig, turkey and chicken) extensively. This farm has been implementing various sustainable agriculture techniques while keeping the farm economically viable and at the same time raising awareness about sustainable farming practices. The farm is also a case study for autonomous adaptation to climate change since, without top-down specific incentives, it has implemented adaptation measures to deal with a changing climate (and especially increased drought intensity and frequency) such as crop diversification and water conservation and retention measures.

### Case Study Description

#### Challenges:

The region of Alentejo, in Portugal, is characterized by a semi-arid Mediterranean climate. It is generally classified as an area of high vulnerability to climate change and high risk of desertification due to its aridity index and extension of low quality soils, combined with the climate scenarios that project for this region decrease in precipitation, increase in the frequency, duration and intensity of droughts and increase in temperatures. It is a region with a low density of population (some districts have less than 8 inhabitant/km<sup>2</sup>) and, despite being a region of agriculture and forestry, the majority of its area has no irrigation infrastructures; some areas have received investments to develop such infrastructures as in the case of the Alqueva dam. The land is typically used for rain fed agriculture of cereals and forage, grazing or agroforestry, with the cork oak and holm oak as primary trees. Herdade do Freixo do Meio is an organic certified farm located near the town of Montemor-o-novo, a municipality characterised by vast areas used for cork and holm oak *montado*, a multifunctional agro-silvo-pastoral system without irrigation.

Adapting to climate change in the region of Alentejo faces very different challenges depending on whether agriculture is supported by irrigation infrastructures or not. In majority of the areas where irrigation does not exist, the main challenge will be to deal with the decreased precipitation, increased droughts and increased temperatures. In the Alentejo region, according to RCP8.5 scenario annual precipitation is expected to decrease, of about 18%, from the present 631 mm to 519 mm in year 2100. In some municipalities such as Mértola, the precipitation is expected to decrease from present 482 mm to 288 mm in 2100. With this reduction of rainfall, pastures, cereals and forage are expected to become less productive and become less economically viable. Already in the present whenever a drought with 6-12 months of duration occurs, the cereal or forage crops are affected with sometimes 100% loss. Additionally, trees mortality is expected to rise due to increase fires and diseases occurrence, reducing their productivity as up to 50-100% for some species (e.g. eucalyptus and cork oak).

Adaptation measures such as protecting the territory and the forests against fire may have high costs. As productivity decreases and competition with European and global agro markets increases, the margin of profit of farmers decreases, often reaching loss net values already in the present. Financing of adaptation measures at the farm level is therefore a major obstacle. In the region many farms of 200-600 hectares of *montado* employ

only two people; small farms are almost impossible to manage without loss, which has contributed to land abandonment. The main products of these farms are normally cork and sheep or cattle. The grain and forage produced without irrigation is no longer economically viable except integrated with animal production. Crop diversification, is also a big challenge, first due to water scarcity and secondly due to the low density of population and difficulty of commercialization. Cork trees are typically the main added value product of this type of farm but this has a fluctuant price. Moreover, cork oaks are now subject to more and more diseases (e.g. the fungus *p. cinammomi*) and in climate change scenarios are projected to decrease their productivity by 50%.

### **Objectives:**

Since 1990, Herdade do Freixo do Meio farm has been implementing a production model aiming to restoration of soil and diversification of its uses, in particular maintaining forest, bush and grass and at the same time enabling sustainable economic activities as: production of animals, fruits, vegetables; transformation of products; renewable energy generation, tourism, restoration and research. The measures implemented by the Herdade do Freixo do Meio aim to reduce its water needs, reduce desertification and soil erosion, and increase resilience to climate change and climate extremes, while sustaining an economically viable agro-forestry system.

### **Solutions:**

The farm has implemented a wide number of measures aiming at reducing water needs, increasing resilience to droughts, diversifying crop products and increasing awareness on sustainability and climate change adaptation.

Measures to improve water retention and reduce water needs:

- Creation of small dams;
- Drip irrigation (to reduce water consumption) with organic fertilizer (farmer-made organic liquid fertilizer rich in bacteria introduced in drip irrigation);
- Use of renewable energy for water pumping to reduce irrigation costs;
- Mulch, i.e., use of straw, leaves, shredded wood, other natural fibre or even compost to cover soil and prevent evaporation;
- Tilling on contour line and no tilling in steep areas, aiming to prevent soil erosion and increase soil's water retention;
- Keyline design of terrain, trees and crops. This practice increases water infiltration and water soil retention, preventing erosion, increasing pastures productivity and water availability in a larger area and increasing the depth of roots and carbon sink;
- Increasing organic matter of soil to improve soil's water retention;
- Preparation of terrain with swales and boomerang shapes to increase soil's water retention;
- Planting trees and crops in areas with particular microclimates within the farm (e.g. northwest slopes have higher levels of humidity).

Agroforestry and crop diversification measures (i.e. measures that increase the resilience, efficiency and productivity of the farm in moments of reduced production and forage due to drought and water scarcity):

- Maintaining or creating the traditional *montado* multifunctional landscape, i.e. cork oak or holm oak trees combined with pastures and grazing sheep, goat, pig or cow as well as cereal or forage agriculture;
- Diversification of crops and using autochthone animal breeds (e.g. introducing turkey as a pastoral species in the agroforestry system);
- Supporting the commercialisation of the diversification of products through CSA – Community Supported Agriculture.

Diversification is considered one of the main strategies to adapt to agroforestry systems to climate change and uncertainty of seasonal patterns. However, one of main challenges for the farmer is then to compete in the international markets based on price, since marginal costs are higher for diversified, seasonal products. This farm has 34 horticulture products, 5 species of animals (cow, pig, lamb, goat, turkey), olive oil, honey, mushrooms, wine, transformed products, etc. While this diversification brings climate resilience, the marketing is

hardly done through conventional channels. Establishing a CSA and a direct link and trust relationship with consumers is a strategy that has been implemented with success by this farm. Different types of box schemes have been experimented and are being implemented. These schemes consist of delivering boxes with different products adapted to the consumers' needs (e.g. vegetables, meat, etc.) directly to the consumers' doors. One particular scheme that strongly supports the farm is the establishment of a group of consumers that sign a three month contract in advance to receive a weekly box.

This scheme also includes awareness raising events, visits and courses organised at the farm, in particular:

- Awareness raising campaigns developed by the farm contribute not only to improve consumers loyalty, but also to create a larger pool of consumers that support sustainable climate adapted farms as well as to inspire other farmers to adopt climate adaptation solutions.:
- Training courses on: ecological management of *montado* ecosystem, permaculture (Permanent Agriculture) design and ecological landscape design (i.e., landscape design methods and approaches that are based in working with nature and its patterns, thus reducing the need for external input and therefore increasing the efficiency of the agricultural system, which is important in case of increasing pressure of climate variables);
- Visits to the farm and on-farm courses to raise awareness on environmental friendly management of organic, permaculture and agro-ecological farming.

#### **Importance and relevance of the adaptation:**

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#### **Additional Details**

##### **Stakeholder engagement:**

The main stakeholders of the farm are its workers, neighbours and consumers. Stakeholders participation is relevant to achieve a more effective and lasting adaptation to climate changes. As mentioned above, involving consumers is essential to be able to market the farm diversity and pay for the added ecosystem services provided by the farm (organic farming, reduced pollution, increased biodiversity etc.). Consumers are directly involved in the farm life and to some extent influence the farm production by joining the Community Supported Agriculture scheme that involves both farmers and consumers together in contracts of three months in advance of consumption of farm products. Consumers that embrace this scheme are called co-producers and have a closer relation to the farm having the possibility to visit the farm, provide suggestions and be involved in other participation events. More in general, the farm is open for tourist visits and courses many times throughout the year. Two smaller areas inside the farm are being used with free 50 year contracts by young farmers initiating their organic farm projects.

##### **Success and limiting factors:**

The main general barriers to climate change adaptation for Herdade do Freixo do Meio were identified through questionnaires and interviews; i.e.:

- Policy and agriculture regulations and bureaucracy (e.g. it is very difficult to have permission to build a dam or off-stream water catchment);
- Lack of information about climate adaptation measures and methods;
- Present economic situation of Portugal;
- Availability of and access to new technologies.

A relevant factor determinant for the success of the Herdade do Freixo do Meio is the innovative approach used by the farm to reach a market niche that is growing in Portugal, looking for ecological, organic and responsible farm production. Another relevant factor is the motivation, knowledge and human capacities of the owner, Alfredo Sendim, the main promoter and keeper of the vision for the farm. His knowledge of agro-ecology combined with more expert knowledge of consultants and workers on agro-ecology and permaculture have played a key role in the success of the farm and its approach.

The fact that many of the adaptation measures were implemented autonomously without subsidies or incentives specifically focusing on climate change adaptation and sustainable development is mostly due to the motivation mentioned above but also to the financial capacity of the farm. Nevertheless this farm has been able to use and benefit from some general farm subsidies to reach some of its vision and goals.

#### **Budget, funding and additional benefits:**

A proper cost-benefit analysis of climate change adaptation measures was not done as it is difficult to isolate these measures from the overall set of implemented actions aiming in general to more sustainable production; climate change adaptation interventions have not been separated in the farm yearly financial reports.

The Herdade do Freixo do Meio yearly net income is about 500.000 € and about 40% of this value is from European Common Agriculture Policy (CAP) subsidies, namely in basic payment scheme and agro-Environmental measures. The farm employs 22 full-time workers and 4 seasonal workers, also involving an average of six permanent (rotating) volunteers.

The economic benefits of the implemented measures can be seen especially when compared to neighbouring farms and in regions with the same conditions. Typically farms with 400 ha of *montado* without irrigation facilities employ 1 to 5 workers. Herdade do Freixo do Meio employs 4 times more people which is a good indicator of employment promotion. Further, some of the neighbouring farms have gone bankrupt due to big financial investments and loss in global market competition. Diversification of products (over 150 different agro-silvo-pastoral products) has guaranteed an increased resilience to extreme events such as droughts as well as to potential fluctuations in market prices. The landscape mosaics created also promote benefits for biodiversity preservation and sustainable tourism.

#### **Legal aspects:**

Herdade do Freixo do Meio is a limited company with one owner. Furthermore there are some parts of the land with free-leased agreements for young farmers to implement organic farming and innovative adaptation measures such as keyline design.

#### **Implementation time:**

Implementation of sustainable and climate change adaptation measures is considered a continuous practice and is not limited in time. Some measures are very fast to implement (e.g. mulching, takes minutes for each tree/plant), while others take decades (e.g. establishing a cork oak multifunctional forest takes 40 years to become profitable).

#### **Reference Information**

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##### **Websites:**

<https://herdadedofreixodomeio.pt> [4]

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