

# RAINWATER HARVESTING IN MEDITERRANEAN SILVOPASTORAL SYSTEMS

Swales and small ponds: tools for rainwater catchment under climate change



## THE WHAT AND WHY

### The importance of water harvesting and retention in Mediterranean silvopastoral systems

In dry areas such as the ones found in the Mediterranean region, water availability is a critical issue that requires the promotion of sustainable management practices and tools. These issues are even more relevant under current climate change scenarios. Rain may also be a cause of soil erosion. This happens, for example, in the cases where the land is not suitably designed to store water, and/or when extreme events such as intensive rainfall, occur in short periods of time. Some stakeholders

have implemented *swales* and small ponds to maximize water catchment. Ponds can be bigger or smaller depending on the size of the farm and the soil topography. The way they are built depends mostly on climate and soil conditions. *Swales* on the other hand, are ditches that go along contour slope lines and are used to reduce the flow of the water, and make it slowly infiltrate the soil. These features are relatively inexpensive and very effective as water management tools.



Small pond at Herdade das Cebolas, Campinho, Portugal. (Janeiro, 2018).  
Axel Gosseries



Swale at Herdade das Cebolas, Campinho, Portugal. (Janeiro, 2018).  
Joana Paulo

## HOW IS THE CHALLENGE ADDRESSED

### Most important criteria for creating small ponds and swales

There are two types of criteria to take into consideration for the selection of suitable sites for installation of rainwater harvesting structures: biophysical and socioeconomic. The most important from these two are, respectively: slope, land use/cover, soil type and rainfall regime; and distance to settlements, distance to streams, distance to roads, and cost. Frequently the sites are selected using geographic information systems, in combination with hydrological models and multi-criteria analysis. Selecting the most relevant criteria

requires a good insight into local conditions. The success rate of the projects tends to increase when these variables are considered.

Slope can be frequently considered the most important factor, since it also plays an important role in the quantities of runoff and sedimentation, the speed of water flow, and the amount of material required to construct a dyke. FAO (2003) guidelines are presently the most comprehensive for the identification of potential rainwater harvesting sites (Ammar, 2016).



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727872.

Keywords: rainwater catchment; runoff; rain; water conservation; shallow soils; soil conservation; drought; climate change

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## HIGHLIGHTS

- Ponds and *swales* help to improve water catchment and infiltration, keeping rain water in the system and decreasing soil erosion.
- Ponds and *swales* increase soil nutrient levels and organic matter content in the surrounding soil.
- Ponds and *swales* increase water availability for irrigation, livestock and wild animal populations.
- Ponds and *swales* are relatively inexpensive landscape features, a climate-smart way of water management, and are very important in semi-arid regions.



Pond under construction at Herdade das Cebolas, Campinho, Portugal. (Janeiro, 2018).

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## FURTHER INFORMATION

### Literature:

Ammar,A. et al. (2016). Identification of suitable sites for rainwater harvesting structures in arid and semi-arid regions: A review. *International Soil and Water Conservation Research* 4:108-120. doi.org/10.1016/j.iswcr.2016.03.001

Falk,M.W. et al.(2013). Striking the Balance between Nutrient Removal, Greenhouse Gas Emissions, Receiving Water Quality, and Costs. *Water Environment Research*.85(12):2307-2316

FAO (2003). Land and water digital media series, 26. Training course on RWH (CDROM). Planning of water harvesting schemes, unit 22. Rome: Food and Agriculture Organization of the United Nations, FAO

### Inspiring movies:

<https://youtu.be/nak-UUZnvPI> (Regreening Ethiopia's Highlands: A New Hope for Africa)

<https://www.youtube.com/watch?v=OpUI00vUsAk> (Green Ethiopia Planting Hope with Trees)

<https://www.youtube.com/watch?v=4UwCC8Nlly4> (Building a 4.5 acre farm pond. FarmCraft101)

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APRIL, 2019

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## ADVANTAGES AND DISADVANTAGES

# Building *swales* and ponds in the farm: how and where

## Ponds

Ponds can be used on slopes up to 5% usually using a backhoe and being relatively cheap to build. In arid and semi-arid areas ponds need to be deeper, and in sandy soils they need to be sealed. Ponds can be made by: i) building an embankment or dam across a stream or watercourse; ii) digging a pit in an almost level area; iii) excavating and building a dam in gently to moderately sloping areas.

The pond bottom may need to be sealed, and this can be made using several materials.

Cement or plastic liners can last a long time, but are very expensive. An easier way is to use a mixture of clay and animal manure or other compostable material, and cover it with cardboard. This will mimic the natural gleying process.

There are many advantages to building ponds on farms: increased water infiltration and catchment; increased available water for farming, households or livestock; the possibility of raising ducks or fish; it is beneficial to wildlife.

## The following conditioning aspects should be considered:

the distance to buildings in order to guarantee that damage to foundations does not occur is generally 3.5 m, but it may be more; rainwater might be polluted by bacteria, chemicals or animal waste, requiring treatment before usage. Slow sand filtration and solar technology are available methods to reduce the pollution.

## *Swales*

*Swales* can be built in almost every case as long as slopes are 5% or less, usually using a backhoe. When building a *swale* you should remember: a) They should be approximately 1m wide, between 0.5 and 1.5 m deep, and usually can have any length. b) The earth removed from the digging is generally collected on mounds that can slow erosion. These piles are also used to plant trees, increasing soil depth available for root growth.

*Swales* can be filled with *mulch*, pruning or wood residues to decrease evaporation and increase organic matter content. Soil fauna will decompose these materials and increase nutrient levels.

Building *swales* improves water catchment and helps prevent flooding by delaying stormwater surface runoff, and also contribute to the retention of pollutants. Nevertheless, the following conditioning aspects should be considered: a) They are not needed in wet landscapes, deep and well drained soils; b) In some cases they can even be dangerous, like steep slopes where they can cause mudslides (Falk 2013).