Keyline Design for a Permaculture Farm in Cairo Montenotte, Italy

Year of issue

2025

Summary

This project is a permaculture-based regenerative agroecological farm and agritourism initiative located in Cairo Montenotte, Italy. It integrates syntropic planting, swales, and keyline water management to create a resilient, productive farm that harmonizes with the natural Mediterranean mountain environment. The design focuses on water infiltration, soil fertility, biodiversity enhancement, and establishing a low-stress, small-scale business producing organic food and offering educational workshops.

Photo Gallery



Location

44.338, 8.14

Sector

Agriculture

Installation Date

2020

Implementation status

Completed

Contact

Pietro Zucchetti – Italian Permaculture Istitute

Overview

Location of the project

Cairo Montenotte, Loc. Moglie Bertei (SV), Italy — foothills of the Apennines. Approx. 44.338° N, 8.140° E (Cairo Montenotte, SV, Italy)

Sponge measures implemented in the case study

Keyline design

Ponds and scrapes

Agroforestry

Swales

Objectives

Capture and infiltrate 20 to 30 mm rainfall events per occurrence
Reduce surface runoff and erosion on clay loam slopes Increase soil organic matter, microbial activity and humus
Stabilise microclimate and drought resilience for agroforestry
Support agritourism, education and diversified production

Involved partners

Authority type	Authority name	Authority role	Comments	Authority responsibility
Research institute / University	Italian Permaculture Institute	Implementation	Design and technical implementation	Responsible
Farmers	Land owner and client	Financing	Agritourism, farm management, maintenance	Responsible
Architects / Engineers	Local contractors	Implementation	Earthworks and fencing Supporting Excavation of swales and valley dam, fence installation	Supporting

Site Information

Climate Zone

Cool temperate moist

Temperature (°C)

12.70 °C

Elevation range

431 m

Vegetation class

Mixed agroforestry with coppices (oak, chestnut, hazel), fruit and nut orchards, berries, wild herbs, and ground covers.

WFD Ecological status

Good

WFD Chemical status

Good

Water quality status

Oxygenated water, no anaerobic biological life, clean rivers, water

Design and Implementation

Project scale

Micro

Project scale specifications

specific site focused on permaculture farm and water retention systems.

Project area

2 ha

Principles

Multifunctionality: combining water retention, food production, biodiversity, and education.
Restoration: rehabilitating degraded soils and landscape.
Community involvement: workshops and agritourism.
Storm design: systems handle moderate Mediterranean rainfall events (e.g., 1-year and 2-year storms).
Design capacity: swales and keyline designed to capture and infiltrate up to 20-30 mm rainfall events per occurrence, enhancing groundwater recharge and reducing erosion.

Factor constraints

Clay loam soils with moderate compaction in some fields limit infiltration but improved via subsoiling and mulching.
The shape of the land to be considered, ridge, slope is important,
Microclimate factor is fundamental, annual rainfall, exposure, winds

Slope, shape of the valley, travels more in length than on flat ground
Favourable conditions:
Presence of diverse native and cultivated vegetation enhancing infiltration.
Availability of organic materials for mulch and compost.
Private land ownership facilitating flexible design and management.

Financing

Total cost

30000.00 €

Total cost information

Earthworks (swales, terraces, keyline): €7,000
Fencing, plants, planting, labor, compost/manure: €23,000

Financing authorities

Type of funding	Comments	Financing share
Private funds	Private investment only	100 %

Compensations

Non

Policy and Governance

Policy description

To develop a self-sufficient agroecological farm and agritourism, with food production for family and guests, selling fruits, nuts, berries, mushrooms, honey, and offering workshops. The project aims to harmonise life with nature while running a small, low-stress business.

Land ownership

Privately owned land with direct management by client.

Target remarks

Enhance sustainability of rural land use; promote ecological farming; foster local economic diversification.

Pressure remarks

Soil erosion on slopes

Low soil organic matter and weak soil biology

Seasonal water stress on ridges

Part of a wider plan

Non

Public consultation

Oui

Consultation activities

Activity stage	Activity type
Implementation phase	Educational workshops and agritourism during implementation and operation

Has contractual arrangements

Non

Impacts and Monitoring

Monitoring System

Monitoring parameters

Soil health monitored via microbiological testing; water infiltration observed visually; plant health and biodiversity periodically assessed.

Informal, project-led observations and soil tests; no formal public reporting system.

Maintenance

Maintenance requirements

Swales require no ongoing maintenance post-establishment. Mulch replaced periodically by living ground covers. Tree pruning seasonal. Compost tea applications intermittently.

Impact Assessment Methodology

Biophysical impact assessment method

Qualitative assessment supported by soil microbiology data and field observations; resilience to drought, floods, and fire demonstrated.

Socio-economic Impacts

Direct benefits

Support for agritourism business and education.

Biophysical impacts: Hydrology

Information on retained water

Enhanced water retention and reduced erosion : Improved infiltration, reduced surface runoff, water retained invisibly in soil.

Biophysical impacts: Biodiversity

Improved biodiversity

Oui

Information on improved biodiversity

Increased biodiversity (flora and fauna). Increased humus and microbial activity

Biophysical impacts: Water & Soil Quality

Information on water quality overall

Reduced erosion, increased humus and microbial activity.

Biophysical impacts: Others

Information on other biophysical impacts

Improved soil carbon storage and fertility.
Microclimate regulation.

Lessons Learned

Key lessons

Integrating permaculture design with water harvesting creates resilient agroecosystems.

Private initiative is crucial where public support is lacking.

Combining synthetic and natural methods (swales, keyline, syntropic planting) yields effective results.

Barriers

Barrier type	Barrier role	Comments
Legal obligations / restrictions	Secondary barrier	Restrictive Italian legislation
Lacking financing sources	Main barrier	Dependence on private financing, no public ones.

Drivers

Driver type	Driver role	Comments
Organisation committed to it	Main driver	Client vision for self-sufficiency and low-stress business.

Success factors

Success factor type	Success factor role	Comments
Financing possibilities	Main factor	Funding, long-term perspective

Cost effectiveness

Moderate investment (€30k/2ha) yielded high ecological and economic returns in resilience, productivity, and business foundation.

Transferability

Highly replicable in Mediterranean climates with similar topography; may require adaptation for local soil and legal conditions.

Sources

Sources

Observation Cairo

Permaculture Design for Cairo Montenotte

Analysis – Cairo Montenotte