OPTAIN : Pesnica river catchment [Austria/Slovenia]

Year of issue

2025

Summary

The Pesnica river catchment is characterized by intensive agricultural production, mainly cattle/pig breeding and arable farming. In spring and summer, the catchment is exposed to drought, while in autumn and winter to severe precipitation events. Soils with a high proportion of clay, which are subject to rapid surface runoff, erosion and nutrient leaching, are further contributing to unfavourable conditions. Market requirements regarding quality and reliability of production are leading towards changes in the tillage technology, but also towards searching for reliable water sources and economically efficient, yet sustainable measures for the longest possible retention of water in the soil.

Photo Gallery



Location

46.59989, 15.72467

Project

OPTAIN

National ID

EU_02

Sector

Agriculture

Installation Date

2020-2026

Implementation status

Completed

Contact

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Overview

Location of the project

Podravska region/Pernica/Jareninski dol

Podravska region/Pesnica/Gačnik

Country

Slovenia

NUTS2 Code

Osrednjeslovenska regija

Sponge measures implemented in the case study

Minimum tillage

Ponds and scrapes

Cover crops

Buffer strips and hedges

Mulching

Crop rotation

Forest riparian buffers

Involved partners

Authority type	Authority name	Authority role	Comments	Authority responsibility
Other	Ministry of Agriculture, Forestry and Food (Ministrstvo za kmetijstvo, gozdarstvo in prehrano)	Initiation of the measure	Responsible for strategic planning and policy development	Responsible
Other	Agency for Agricultural Markets and Rural Development (Agencija Republike Slovenije za kmetijske trge in razvoj podeželja)	Implementation	Responsible for administrative oversight, implementation, and payment of CAP measures.	Responsible
Other	Chamber of Agriculture and Forestry of Slovenia (Kmetijsko gozdarska zbornica Slovenije)	Other	Provides technical advice and direct support to farmers regarding the adoption of sustainable practices and the use of CAP instruments	Supporting

Site Information

Climate Zone

Cool temperate moist

Precipitation

1000.00 mm

Temperature (°C)

9.50 °C

Evapotranspiration

600.00 mm

Runoff

300.00 mm

Slope range

14%

Soil type

Cambisols

Luvisols

Groundwater level

5-50 meters

Vegetation class

arable crops, permanent grasslands, and mixed forest vegetation

WFD Ecological status

Poor

WFD Chemical status

Failing to achieve good

Design and Implementation

Project scale

Meso

Project area

137 km2

Project area specifications

Rural area

Basis of design

The design relied on local knowledge and was adapted to field conditions, using funding instruments already available to Slovenian farmers.

Principles

Individual farm households are average in wealth and they are basically mechanized/motorized. The examined farm household, as all housholds in the region has good access to all services and infrastructures. Farm is medium in scale with land owned partly by the farmer and partly leased from other private owners.
Cropland area was converted to permanent grassland or pasture land by sowing of grass and by a fence as protection. Grazing is organized in a rotation system between suckler cow's pasture and paddocks.
The purpose of the technology is to use the natural potential of the soils. As soils are shallow with low water holding capacity permanent grassland is much more resilient and adapted to the drought; permanent grassland needs not only less water, but as well less nutrients. Grass has the capacity to grow well after any rainfall event at any time of the growing period. During drought when, maize fields get dry, grasslands subsist and just wait until the rain falls. While maize yield is lost in drought years, grassland can sustain and nurrish animals until mid-autumn. Another advantage of grassland is its building up of organic matter in the soils.

Mulch-till: (also called “conservation agriculture” or “minimum tillage”) is a method of land management with modified, less intensive tillage, where land is covered with plant residues year-round (at least 30% cover) or grass, energy consumption is reduced, and there is less trampling/ compaction of the soil because of fewer machine passes and the protected surface. Under mulch-till, special agricultural machinery and attachments are required. Disc harrows and chisel ploughs are used to loosen the soil, and direct drills are employed for seeding.

Retention ponds: “Retention ponds” comprise both simple, small ponds (up to 2000 m3, up to 4 m deep) and larger, more complex reservoirs (greater than 2000 m3). Retention ponds are designed to provide storage capacity to attenuate surface runoff during rainfall events. Each consists of a permanent ponded area with landscaped banks. Retention ponds achieve both storm water attenuation and water quality treatment through supplementary storage capacity of runoff. Water is then released at a controlled rate once the risk of flooding has passed. The technology can be applied in a natural or human environment. Before construction of a pond it is essential to follow legislation, which covers conditions and restrictions for the given location. Once a site is selected, technical documentation is prepared: first the conceptual design, then documentation for obtaining opinion, consent and a building permit. Later there is also project documentation for implementation. If the water is to be used for other purposes as well (e.g. for irrigation), it is necessary to plan for usage and environmental impact. Retention and still water promotes pollutant removal through sedimentation, while aquatic vegetation and biological uptake mechanisms offer additional treatment. Retention ponds are effective in removing urban pollutants and improving water quality.

Financing

Total cost information

Total costs were divided into initial investment costs and annual operational (maintenance) costs. They include basic design, construction (retention ponds, buffer strips), low tillage equipment use, green cover seeds, and basic site adaptation/preperation.

Costs investment information

Grazing : land preparation, equipment purchase and plant material procurement : 1 535 EUR
Mulch till : equipment procurement : 63 500 EUR
Retention pond: Document preparation, planning permission, construction of pond: 73 600 EUR

Costs operation maintenance information

Retention Ponds: Desilting of retention ponds; re-seeding costs every few years.
Riparian Buffer Strips and Hedges: Periodic mulching, mowing, or manual cutting (chainsaw work); removal of invasive species; occasional replanting or gap filling.
Green Cover / Cover Crops: Annual seed purchase and sowing; field preparation; potential herbicide or mowing costs for cover termination. These are recurring agronomic costs, varying by crop type and seasonal conditions.
Low Till Agriculture: Ongoing costs are related to specific machinery operations (e.g. disc harrows, no-till seeders). Costs depend on field size, soil condition, machine maintanance and fuel/labor inputs.
Crop Rotation:
No direct maintenance costs, but crop selection and planning must consider nutrient needs, pest cycles, and market viability. Minor administrative or advisory costs may apply.
Crop Rotation: Ongoing costs depend on the specific crop grown in each rotation year. These include variable production costs such as seeds, fertilizers, plant protection products, labor, and machinery use — all considered standard farm operational expenses.

Costs operational information

Retention Ponds: Pond inspection; occasional re-seeding; vegetation management around retention ponds.
Riparian Buffer Strips and Hedges: Regular inspection; vegetation control through mulching; selective cutting and trimming with chainsaw; removal of invasive species.
Green Cover: Monitoring of cover crop establishment; re-sowing if cover is insufficient; control of unwanted species; soil condition checks.
Low Till Agriculture: Annual review of soil structure and compaction; equipment maintenance; occasional weed pressure monitoring (especially where herbicide use is reduced).
Crop Rotation: Planning and documentation of rotation cycles; monitoring nutrient balance and soil health; adjusting rotation based on market and ecological feedback.

Financing authorities

Authority name	Type of funding	Comments	Financing share

Ministry of Agriculture, Forestry and Food of the Republic of Slovenia	National funds	Provides funding through agricultural subsidies and non-refundable investment support under national and EU rural development programs.	Public support covered approximately 70–80% of total costs, depending on the measure and funding instrument. Ponds are eligible for 50–90% investment co-financing, but their maintenance/operation is not funded.
Slovenian Regional Development Fund.	Sub-national funds	Offers returnable financial instruments such as soft loans and guarantees to co-finance sustainable rural and environmental investment projects.	—
Common Agricultural Policy	Other	For agronomic measures (e.g. low till, green cover, buffer strips), annual maintenance is supported through CAP subsidies	—

Policy and Governance

Land ownership

Land partly owned and partly leased from private owners. The area is used for sedentary mixed or commercial agriculture, with <10% off-farm income. Farms are medium-scale and mechanized, with good access to services and infrastructure

Policy targets

Runoff control

Peak-flow reduction

Groundwater Recharge

Increase Water Storage

Pollutants Removal

Requirement directive

Requirement directive
Water Framework Directive (WFD) 2000/60/EC
Nitrate Directive (NiD) 91/676/EEC

Part of a wider plan

Yes

Public consultation

No

Has contractual arrangements

No

Impacts and Monitoring

Maintenance

Maintenance requirements

several maintenance activities are needed like occasional re-seeding; vegetation management around retention ponds, routine farming operations,

Impact Assessment Methodology

Performance impact estimation information

Measures have impacted different elements of their environment.

The application of mulch-till on farm plots has had significant ecological impact, decreasing surface run-off and evapotranspiration. Soil moisture and cover has also been improved while reducing soil compaction, soil loss and crusting. Finally, it is thought to have a beneficial impact in decreasing the impact of droughts.
The installation of retention ponds in the agricultural landscape has resulted in both socio-economic and ecological impacts. In socio-economic terms, their presence increases crop production and reduces the risk of crop production failure. It is also thought to contribute to improving irrigation water quality. In ecological terms, retention ponds increase water quantity by harvesting and collecting water and surface run-off. It is also anticipated that they will reduce climate change risks associated with flooding and drought events,

Biophysical impacts: Water & Soil Quality

WFD ecological status obj quantity

Poor (2021)

Information on WFD ecological status obj quantity

According to WFD Article 4 assessments, the ecological status of the water bodies is rated Poor (2021).

Lessons Learned

Key lessons

Implementation was simple, cost-effective

Barriers

Barrier type	Barrier role	Comments
Lacking financing sources	Main barrier	High initial investment costs
Legal obligations / restrictions	Main barrier	Long procedures for obtaining water permits
Attitude of relevant stakeholders	—	Change in management practices Need for farmer adaptation and training
Other	Main barrier	Limited short-term economic return from some measures

Drivers

Driver type	Driver role	Comments
Public pressure	Main driver	Visibility of local hydrological issues
Public pressure	Main driver	Eutrophication of Lake Pernica
Other	Main driver	Soil erosion control Climate resilience Soil conservation Water retention in the landscape Biodiversity improvement

Success factors

Success factor type	Success factor role	Comments
Other	Main factor	Low-impact requirements
Available support tools	Main factor	Simple design, minimal land use change
Attitude of relevant stakeholders	—	Awareness of local water and soil management challenges