Erosion control by agricultural and forestry techniques and soft hydraulics in the Bas-Rhin

Year of issue

2025

Summary

Bas-Rhin is highly exposed to muddy runoff during spring–early-summer storms, impacting villages downstream of cropped slopes. Since 2008, the Chamber of Agriculture and local authorities diagnose erosion risk at commune scale and co-design preventive measures (concerted crop rotations, a gradual shift to no-till) and curative “soft hydraulics” (dense hedges and live/dead fascines, grass or miscanthus strips), implemented by municipalities or intermunicipal bodies.

Since 2018, the Eurométropole de Strasbourg holds competence for runoff/erosion control. With BRGM, it uses the WATERSED model to rank 96 catchments across 14 at-risk communes and update priorities each year; modelled sediment reductions are typically 50–95% (and >60% for a 10-year storm once devices are in place). Implementation is formalised through 10-year contracts with farmers, with standard annual compensation per area. By 2019–2023, about 129 devices (~9.9 km) were (re)installed under 53 conventions. Recent municipal programmes combine agronomy with hedges/fascines/miscanthus and resized swales (e.g., Eckwersheim), while other communes report site-specific packages (e.g., Lampertheim: 600 m of live fascines and 200 m of grass strips). Regional guidance (DREAL Grand Est) and AERM support frame the approach at departmental/basin scales.

Photo Gallery



Location

48.682818, 7.686808

Project

NWRM

National ID

France_12

Sector

Agriculture

Installation Date

2008

Implementation status

Completed

Overview

Location of the project

The Bas-Rhin department is located in the North-East of France. The Rhine plain land-use is mostly dedicated to Spring crops with no landcover during winter. Crops are located on the top of the hills and on the slope, while villages lie in the lower land.

Country

France

NUTS2 Code

Alsace

Sponge measures implemented in the case study

Buffer strips and hedges

Minimum tillage

Crop rotation

Objectives

Reduce muddy-flood risk and sediment delivery; increase winter cover/no-till: e.g., Willgottheim planned non-till area growth from 4%→12% in 2019; some communes already 10–>75% no-till; implement linear soft-hydraulics at priority outlets.

Involved partners

Authority type	Authority name	Authority role	Comments	Authority responsibility
Local water authority	SDEA	Initiation of the measure	Local authority responsible for watershed management.	Responsible
Farmers	Alsace Agriculture Chamber	Implementation	—	Supporting
Regional / sub-national water authority	Agence de l'Eau Rhin Meuse	Financing	—	Supporting

Site Information

Precipitation

635.70 mm

Temperature (°C)

11.40 °C

Elevation range

154 m

Vegetation class

Dominated by non-irrigated arable land (cereal/maize rotations) on fertile loess; hedgerows relatively scarce; small vineyard fringes on the “Couronne d’Or”.

WFD Ecological status

Bad

WFD Chemical status

Failing to achieve good

Water quality status

Diffuse agri pressures: suspended solids from erosion/muddy floods; nutrients (nitrates) and pesticides in surface & groundwater; local hydromorphological alterations near urban fringe.

Design and Implementation

Project scale

Large

Project scale specifications

The policy was conducted over a long period in the region.

Project area

33

Project area specifications

33 ha with soft hydraulics implemented (2020).
Over 36 000 m of hedges, fascines, miscanthus strips or grass buffer strips.

Principles

Combination of prevention and curative measures :
- Erosion prevention through concerted crop rotation and converting to no-till farming techniques.
- Soft hydraulics vegetal curative measures (hedges, bufferstrips, fascines).

Constraints

Prevention methods are based on the voluntary participation of farmers.

Financing

Total cost information

Eckwersheim (2018): €32,762; AERM 80% (€26,210), commune 20% (€6,552).
Willgottheim (2008): €47,500; AERM 80% (€38,000), commune 20% (€9,500).
Willgottheim (2019–20): €104,886; AERM €97,578, SDEA €7,308.
Lampertheim (REx 2022 cases): €14,943; €12,789; €56,600, with AERM co-funding (40–80%) and Region 20% in one case; EMS project owner in later phase.

Financing authorities

Authority name	Type of funding	Comments
Municipalities	Local funds	Eckwersheim , Willgottheim , Lampertheim
Water Agency (AERM)	Sub-national funds	—

Compensations

Yes

Compensations basis information

SDEA compensates farmers for the loss of land used for soft hydraulics measures.

Policy and Governance

Policy description

The Bas Rhin department is regularly subject to muddy water flows. These occur during Spring and summer storms on silty hills with Spring crops (beets, corn, etc.).
Silt mobilized by rainfall on bare plots is carried downstream, where there are sensitive issues such as villages in the valleys (Figure 1). Mudflows impact both the receiving area (villages and local residents) and the emitting area (loss of soil for farmers).
Several factors have led to an increase in the risk of this phenomenon occurring since the 1950s:
Climate changes favouring heavier rains earlier in the season.
The decrease in grassland (-44% cattle between 1979 and 2000) and the increase in agricultural areas with little coverage during Spring and early summer.
Theimplementation of land consolidation actions leading to an extension of the field size and the removal of landscape elements (hedges, rural roads, embankments, etc.).
Urbanisation is also accompanied by the artificialisation of soils (+1047 ha/year between 1984 and 2000) and the progressive removal of buffer zones such as orchards and meadows.
As a result, the frequency of muddy water flows has increased, and they occur earlier and earlier in the season.

Land ownership

Mostly private farmland (individual farmers). Devices are installed via farmer–authority agreements on private plots, with some on municipal land/rights-of-way; works led by communes/intercommunalities, SDEA and Eurométropole.

Policy targets

Erosion Control

Peak-flow reduction

Target remarks

Prevention of erosion through agricultural practices.
Curative measures against mudslides through soft hydraulics.

Part of a wider plan

No

Public consultation

No

Has contractual arrangements

Yes

Contractual arrangements

Arrangement type	Responsibility	Name	Comments
Contractual agreement	SDEA implements the measures and compensates the surface loss. The farmer provides the field and complies with the agreed land management measures.	Collective agreement between SDEA and individual farmers	200 collective agreements signed as of 2020.

Impacts and Monitoring

Monitoring System

Monitoring parameters

Annual inspection by the sites managers.

Maintenance

Maintenance requirements

Hedge trimming and replacement of dead fascines.

Biophysical impacts: Hydrology

Information on retained water

Modeling for the EMS area (96 catchments) shows ~50% theoretical reduction in sediment loads with networked soft-hydraulics; BRGM also reports potential ~80% reduction if all planned and existing devices operate optimally. Field observations confirm sediment trapping.

Information on runoff reduction

The effectiveness of soft-hydraulic measures has been demonstrated by modelling of watersheds concerned with muddy casting phenomena. The visual observation of the various carriers of project confirms the retention of sediments by the soft hydraulic developments. The co-benefits of this work are landscape improvement, restoration of habitat for small wildlife, and softening of tensions between farmers and inhabitants of villages that have been impacted by past muddy water flows. The measures are also considered less expensive in the short term than the construction of mud ponds.

Lessons Learned

Key lessons

The combination of preventive measures (crop rotation, no-tillage cultivation) and curative measures have reduced the risk of mudflow. Although how much is still unknown as there has not been massive erosion and mudslide events since the implementation of these measures.
Dead fascines are not durable enough; live fascines or hedgerows are preferable. Good management of the hedges growth (particulary the first trimming) is necessary for their efficiency against mudslides. The plant species to be selected should be local species that propagate easily through suckering.

Barriers

Barrier type	Barrier role	Comments
Attitude of relevant stakeholders	Main barrier	Converting agricultural practices to No-Till is slowed down by the limited number of willing farmers.

Drivers

Driver type	Driver role	Comments
Past flooding events	Main driver	Historical regular massive mudslides events in the region conviced the authorities and farmers alike of the necessity of these measures.

Success factors

Success factor type	Success factor role	Comments

Attitude of relevant stakeholders	Main factor	The recurrence of mudslides in the department and the impacts on the inhabitants and the search for solutions to the problems faced by local residents. The work done by the Agriculture chamber as a result of the departmental regrouping facilitated the choice and the location of development measures. The multiplicity of actors involved in this departmental approach is important: communes, metropolis, unions, agriculture chamber, farmers, researchers, etc. The project managers note a positive development of the acceptance of soft hydraulics measures by the agricultural profession over the last ten years. In the short term, these works are also cheaper alternative measures compared to the implementation of conventional retention basins (but In the long term, the costs of compensation and maintenance are important).

Transferability

Highly transferable to loess/cereal plateaus: pair cropping changes with distributed soft-hydraulics; design at sub-basin scale. Critical: farmer buy-in, legal timing for hedge works, long-term maintenance & compensation, and iterative siting using flow modeling.

Sources

Sources

Muddy water runoff: tackling the source – Feedback and lessons learned

Une approche agronomique territoriale pour lutter contre le ruissellement et l’érosion des sols en Alsace

SDEA 2020 Activity Report