Buffer Strips and Floodbreak Hedges in Lèze Catchment, France

Year of issue

2026

Summary

Sponge Scapes case study 03 FR

The Lèze is a river located in the South of France, near the Pyrenees, on the French departments Ariège and Haute-Garonne. The case study concerns the implementation of floodbreaking hedges, which are located across the flood plain of the Lèze and are regularly spaced (every 300 to 500 metres). Partially obstructing the flow, such hedges can slow down running water and dissipate its energy. The project has been financed by the SMIVAL (20%), French State, local authorities, ERDF and the Water Agency (80% for all).

SMIVAL, the case owner, is committed to fostering stakeholder dialogue to agree on a sponge strategy at sub-basin scale. Scaling-up to the whole catchment scale will then be considered. The case study thus serves as a SpongeLab, emphasizing participatory processes in the design and evaluation of sponge strategies (combinations of sponge measures at the landscape scale). Workshops will be conducted to generate spatial scenarios and collaboratively assess potential impacts. We will explore combinations of linear and area-based measures to optimize erosion reduction and improve overall landscape resilience.

Photo Gallery



Location

43.254, 1.362

Project

SpongeScapes

National ID

France_01

Sector

Agriculture

Installation Date

2009-03

Contact

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Overview

Location of the project

The Lèze catchment (350 km², about 34,000 inhabitants) in south-west France is facing a high risk of flash floods, as well as soil erosion and mudslides, damaging roads, affecting water quality, the river hydromorphology, and the agronomic potential of agricultural plots.
The Lèze catchment is located in a hilly pre-mountainous area (Pyrenees), and is part of the larger Garonne catchment. Like most of the rivers in the Pyrenean foothills, the Lèze has very marked seasonal variations in flow. In the upper part of the basin, a large irrigation dam controls the river flow to a large extent. In addition 11 small dams along the river also control the flow to some extent.

Land use has changed in recent times, from traditional cattle and sheep farming on small meadow fields bordered by hedges to large open fields of arale crops. To increase the size of fields, many hedges were destroyed and there has been a significant reduction in the length of hedges in the catchment. The slope, combined with erosion-prone soils, has resulted in increased soil erosion and related problems.

Country

France

NUTS2 Code

Midi-Pyrénées

Sponge measures implemented in the case study

Buffer strips and hedges

Objectives

SpongeScapes aims to develop a comprehensive sponge strategy for the Lèze and apply it primarily to a sub-catchment (Le Rosé, 17,000ha), located upstream of the town of Lézat-sur-Lèze, to address recent mudslides (spring 2023). The ultimate goal is to improve resilience to flash floods and erosion, and to maintain agricultural potential.

Involved partners

Authority type	Authority name	Authority role	Comments
Local water authority	SMIVAL (Syndicat Mixte Interdépartemental de la Vallée de la Lèze)	Initiation of the measure	The SMIVAL (Syndicat Mixte Interdépartemental de la Vallée de la Lèze - an association of 24 communes localised in the Lèze's valley) has been created in 2003. It is responsible for leading, for defining and for implementing actions for a qualitative and quantitative use of the Lèze and its tributaries and for preventing its floods.
Farmers	Chambres d'agriculture	Determination of design details of the measure	—
—	Technical Committee	Implementation	The Technical Committee supervises the implementation of the PAPI. It is presided by a sub-prefect and the president of the SMIVAL. Techical Committee includes the SMIVAL, local authorities, deconcentrate technical state services, public agencies for water management (Onema, Agence de l'eau Adour-Garonne) Chambers of agriculture.

Site Information

Climate Zone

Cool temperate moist

Precipitation

795.30 mm

Temperature (°C)

13.10 °C

Runoff

2.00 mm

Runoff coefficient

0.26

Slope range

5-10%

Water quality status

The Total Suspended Solids (TSS) is the main problem of water quality. The second problem is the nitrogen content of the river due to agricultural activities.

Design and Implementation

Project scale

Large

Project scale specifications

River basin of the Lèze (35 000 ha)

Project area

35000

Project area specifications

The area of the river basin of the Lèze is about 35 000 ha big. Up to now, about 6000 metres of hedges have been planted. 5000 metres are waiting for an administrative approval (DIG: Déclaration d’Intéret Général).

Area subject to Land use change or Management/Practice change (ha)

1.30 ha

Size

6000.00

Size unit

m

Principles

Principal principles followed in the design of this application have been:
- Functionality
- Acceptability
- Information to the public
- Consultation and participation of stakeholders

Factor constraints

Cooperation issues with land owners and farmers: planting of hedges questions the current agricultural model.

Constraints

Presence of irrigation or drainage equipement.
Finding voluntary farmers and land owners.

Financing

Total cost

75000.00 €

Total cost information

Financing comes from the French State, the SMIVAL, local authorities, ERDF and the Water Agency. Up to now, about 75 000 € have been spent for floodbreaks. About 20 % of the financing comes from the SMIVAL and 80 % from other financing partners.

Between 2009 and 2012, 3020 linear metres of hedgerows have been planted (including 520 linear metres for the two test hedgerows) for a total cost of 47 870 € (costs for hedgerows which have been planted later are not taken into account).
Costs are distributed as follow:
- Technical study: 9 240 € in 2007
- First test hedge (in Montaud): 4 221 € in 2008 and 3 532 € in 2009
- Second test hedge (in Artigat): 3 420 € in 2010
- Hedge planting 2011-2012: 27 456 € in 2011 and 2012

Cost of one linear metre of hedge : 11 € as planned by the PAPI. But for the test hedgerows, costs reached 45 to 60 € per linear metre.

Costs land acquisition

5000.00

Costs land acquisition unit

€/ha

Costs land acquisition information

Four types of agreements with the SMIVAL were proposed to farmers and land owners. For one option, the SMIVAL had to buy the land from the owner. The price of land depends on the crop (arable lands or permanent grasslands) and on the département. In Ariège, prices are 5000 €/ha for arable land and 2500 €/ha for permanent meadows. In Haute-Garonne they reach 6000 €/ha and 3000 €/ha, respectively.
This option was never chosen by land owners.

Administrative annual costs

55000.00 €

Administrative annual cost information

For the period 2006-2011, costs for facilitation (all actions including floodbreaking hedgerows) supported by the SMIVAL amounted to 326 336 € (ranging from 21 855 € in 2006 to 70 655 in 2009). In comparison to other actions implemented by the SMIVAL, floodbreaking hedgerows represent only a small share of SMIVALs budget (1.4 %). It can hence be assumed that facilitation costs related to floodbreaking hedgerows represent also only a small share of the total facilitation costs.

Compensations annual information

Payment depends on the agreement between farmers/landowners and the SMIVAL. In some cases, there is no payment. There may be a payment to landowners when arable land is bought or rent by the SMIVAL. There may also be a payment to farmers when new hedgerows disturb the organisation of the farmer.

Compensations number of beneficiaries information

Landowners and/or farmers. There is no number available.

Compensations scheme information

Payment depends on the agreement between farmers/landowners and the SMIVAL. In some case, there is no payment. There may be a payment to landowners when arable land is bought or rent by the SMIVAL. There may also be a payment to farmer when new hedgerows disturb the organisation of the farmers.
Farmers chose an agreement without any financial compensations (considered as simpler for farmers).

Policy and Governance

Policy description

In the Lèze river basin, within 28 years (1980-2008), 300 km of hedgerows disappeared (that is to say about 10 km per year in average). The removal of “effective” (from a hydrological point of view) hedgerows, including floodbreaks, was even faster than the removal of other hedges.
Land consolidation in the river basin is the main explanation of the removal of hedges. The change of agricultural machinery enabled/needed larger parcels of land.
The loss of “effective” hedgerows have several direct consequences such as:
- A decrease of the infiltration rate and an increase of the runoff rate;
- A concentration of the runoff and an acceleration of the water flow;
- An increased risk of soil erosion and a more frequent risk of mudslides;
- Higher and faster peak flow of flood events causing damages on human populations and activities.

Policy targets

Peak-flow reduction

Runoff control

Erosion Control

Target remarks

The primary target of floodbreaking hedges is to delay and spread out the peak-flow of the river during flood events. Floodbreaks also aim at reducing the energy of the river and its potential of erosion.

Policy pressure

Directive	Relevant pressure
Floods Directive identified pressure	Other pressure contributing to flooding/flood risk

Pressure remarks

The primary pressure targeted by floodbreaking hedges is the peak-flow of the river during flood events.

Policy impact

Directive	Relevant impact
Floods Directive identified pressure	Economic activity
Floods Directive identified pressure	Infrastructure
Floods Directive identified pressure	Property

Impact remarks

Floods may damage economic activities, properties or infrastructures.

Requirement directive

Requirement directive
Floods Directive-mitigating Flood Risk
Floods Directive-establishing adequate PoM

Requirement directive remarks

The implementation of floodbreaks is included in an action programme for the river basin of the Lèze. This programme contains actions aiming at preventing flood risks.
The action programme which includes the implementation of floodbreaks is called the PAPI of the Lèze. PAPI means “Programme d’actions de prevention des inondations” (Action Programme for Preventing Floods). At the scale of river basins, PAPIs promote integrated flood prevention.

Policy challenges requirements

Floodbreaks are part of the PAPI of the Lèze. PAPIs are action programme promoting an integrated management of flood risks at the scale of river basins. They are agreements between the state and local authorities on the implementation of actions. PAPIs are tools of the French policy for flood risks mitigation.

Part of a wider plan

Oui

Wider plan

Wider plan type	Wider plan focus	Name	Comments
Local	Water	PAPI de la Lèze : Programme d'Actions de prévention contre les inondations de la Lèze (Actions Programme for preventing floods of the Lèze river)	The PAPI is an action programme designed for fighting floods in the Lèze river bassin. Planting floodbreaking hedgerows is one of these actions. The PAPI has been approved by the French Ministry for Ecology, Sustainable Development and Territorial Planning.

Public consultation

Oui

Consultation activities

Activity type	Comments

Public meetings	Several public meetings took place from 2009. They aimed at presenting the actions programme (including hedgerows) to the inhabitants. For each meeting, about 20 participants were presents. The SMIVAL also met inhabitants and local associatiations.
Meetings with farmers	Numerous meetings took place with farmers and landowners who may be concerned by planting floodbreaking hedges. The main issue was to explain implementation of this action and to define the associated land policy.
Consultation with local authorities	In 2009, local authorities (mayors) have been met in order to know about the implementation of the actions programme (including hedges) at the villages' level. Mayors also had the opportunity to express their expectations.
Consultation with technicals	The two local Chambers of agriculture are involved in defining the protocole regarding the land policy. Technical partners (for example deconcentrate technical state services and water related public agencies) have been consulted by the SMIVAL when actions of the PAPI have been presented and implemented.
Public inquiry	A public inquiry has been carried out in 2011. The response brief has been published in August 2011.

Has contractual arrangements

Oui

Contractual arrangements

Arrangement type	Name	Comments
Organisational arrangement	Protocol for land policy	Protocol between the SMIVAL and the Chambers of agriculture defining land policy (for example purchase of arable land for hedge planting) Four options are available to farmers: agreement with the SMIVAL, servitude, renting and buying
Contractual agreement	Framework agreement	The Framework agreement has been signed in August 2008 by the SMIVAL and its partners (French State, Adour-Garonne Water Agency, Regional council, General councils of Ariège and Haute-Garonne). This Framework agreement works for the implementation of all actions included in the PAPI for the period 2008-2016.

Impacts and Monitoring

Monitoring System

Monitoring parameters

Data is available on mudslide locations from 2009 to 2016. This includes meteorological and hydrological data, observed damage, eyewitness accounts, hydrological data, etc. Our objective is to use this information to design effective sponge strategies.

Maintenance

Maintenance requirements

Maintenance scheme depends on the agreement between the farmers and the SMIVAL. Currently, only one option has been chosen : Maintenance of hedges is under the responsibility of the SMIVAL during the 3 years following the planting, then it is farmers.

Impact Assessment Methodology

Performance impact assessment method

Unknown

Performance impact estimation information

No performance evaluation

Socio-economic Impacts

Direct benefits

Reduction of flood damages in urban areas (houses, school, roads…)

Ancillary benefits

Landscape conservation, Provision of ecosystem services to farmers

Biophysical impacts: Hydrology

Information on peak flow reduction

According to a hydrological model: In the case where the flood plain of the Lèze would be covered by regularly spaced floodbreaking hedgerows, the peak flow of flood events could be reduced by 25% in comparison to the same river basin with field crops. In fact, the river basin already has hedges (about 900 km) and it will not be possible to achieve a landscape with a very dense network of hedges. The model only shows a trend.

No in-depth hydrological analysis has been carried out in order to assess the impact of floodbreaking hedges on the dynamic of flood events (flood flows, velocity, spread of peak flows, etc.). Moreover, such an analysis his difficult to carry out.

Information on ecosystem water supply

N/A info

Reducing flood risks quantity

- Flood security and protection: reduction of flood damages in urban areas (houses, school, roads...)

Biophysical impacts: Biodiversity

Improved biodiversity

Oui

Information on improved biodiversity

Habitats for auxiliary wildlife.

Increased permanent biomass

Production of biomass usable by farmers

Biophysical impacts: Water & Soil Quality

Water quality overall improvements

Not relevant for this application

Soil quality overall improvements

Not relevant for this application

Ecosystem erosion control

Oui

Information on ecosystem erosion control

Local positive impacts on soil erosion can be seen, but there is no assessment nor quantification

Biophysical impacts: Others

Ecosystem impact climate regulation

Not relevant for the specific application

Lessons Learned

Key lessons

This case study shows the implementation of floodbreaking hedges.Floodbreaks are located across the flooding plain of the Lèze and they are regularly spaced every 300 to 500 metres. Partially obstructing the flow, such hedges can slow down running water and dissipate its energy. Impacts of flooding are therefore reduced. Floodbreaking hedges delay and spread out the peak-flow of the river, reducing therefore the potential damages. It is particularly important to involve farmers and land owners as well as the local population in order to make sure than enough voluntaries can be found.

Barriers

Barrier type	Barrier role	Comments
Other	Secondary barrier	Access is difficult to data about farmers possessing land in the Lèze valley. It is therefore more difficult for the SMIVAL to target these farmers and to invite them to meetings, for example. This information is confidential and cannot be easily spread.
Attitude of relevant stakeholders	Main barrier	Implementation of floodbreaks is based on voluntary farmers. Planting of hedges questions the current agricultural model (larger filed plots, drainage and irrigation equipments, etc.). The ownership of land and the attachment of owners to their land makes it difficult.
Other	Secondary barrier	The current localisation of drainage and irrigation equipment.

Drivers

Driver type	Driver role	Comments
Past flooding events	Main driver	For example, the involvement of farmers is higher when they see mudslides in their fields than when they hear about slowing down peak flow.

Success factors

Success factor type	Success factor role	Comments
Attitude of relevant stakeholders	Main factor	An enabling factor for involving local stakeholders is the overlap of global issues and local events. For example, the involvement of farmers is higher when they see mudslides in their fields than when they hear about slowing down the peak flow.

Flexibility / Adaptability

Floodbreaking hedges can potentially be adapted to all river basins where flood events occur.

Sources

Sources

SMIVAL Rapport d'activité 2009 (Activity report 2009)

SMIVAL Rapport d'activité 2010 (Activity report 2010)

SMIVAL Rapport d'activité 2011 (Activity report 2011)

SMIVAL, Rapport d'activité 2012 (Activity report 2012)

SMIVAL Rapport d'activité 2013 (Activity report 2013)