Natural reach of the Petite Glâne river (Nives Ramisberger)

Revitalization of Riparian Zones (Switzerland)

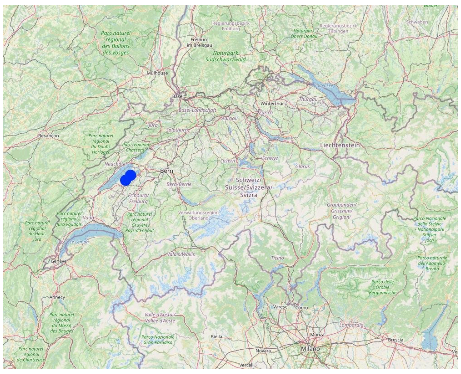
(FR) revitalisation de la zone riparienne, (DE) Revitalisierung des Gewässerraums

DESCRIPTION

The riparian zone is the buffer area between a watercourse and the adjacent land. Healthy riparian ecosystems stabilise the banks, maintain the microclimate, protect against flooding, filter chemicals and improve both biodiversity and water quality.

In the 19th and early 20th centuries nearly all Swiss rivers were "corrected" (straightened, channelised and diked) to reduce flood damage and reclaim land for agriculture. In the late 20th century the adverse effects of these corrections became increasingly clear, and there was a paradigm shift towards more sustainable river management. There are many current “revitalization” projects, among them the restoration of the Petite Glâne, which started in 2022 and is expected to be completed in 2026. The project perimeter consists of the last 7 kilometres of the Petite Glâne stream and the costs are estimated at CHF 21.5 million.
The main characteristics of revitalization are widening the riverbed and reducing the slopes of the riverbanks, thus giving the river space for meandering and changing the morphology in a natural way. Where riparian forests do not occur naturally anymore, it can make sense to re-establish them so that biodiversity can flourish. The planting of trees and bushes gives many animals a habitat and can serve as a wildlife corridor between different areas. Additionally, shading of the water reduces its temperature fluctuations which - especially in summer - is important to many species that are dependent on cold water for their survival. With climate change this threat will become even worse. The main purpose of revitalization is to recreate near-natural conditions in artificially straightened reaches to ensure provision of riparian ecosystem services.
Considerable planning is involved in implementing this technology in Switzerland partly because of legal reasons (watercourses are closely protected and land rights require negotiation) and because effects on downstream areas need to be taken into account. Depending on the length of the river segment where riparian forests are to be restored, there are many stakeholders involved, all of whom need to give their approval: this takes time and effort. Inputs are mostly in the form of trees and bushes. Depending on the degree of revitalization, built-up river sections need to be freed again and infrastructure like bridges, buildings and roads may be affected. In theory, there is no maintenance necessary because revitalized rivers are intended to reassume their natural form and be surrounded by natural vegetation. Nevertheless, in a highly modified and intensely used landscape, the cutting of grass and pruning of trees/bushes on a regular basis can be required. Wood harvesting may be an option. Driftwood might also have to be removed if there is danger of flooding or clogging of bottlenecks – for example under bridges.
Revitalization, theoretically, has larger effects on smaller rivers than on bigger ones due to a greater proportion of land draining into them compared to their size. Additionally, shading has larger effects on the water temperature of smaller rivers. Benefits accruing are mainly in regard to habitat provision and thus biodiversity enhancement, but also improvement of water quality (lower temperatures, less nutrient input) and water management in general as flooding is expected to be less frequent. A key disadvantage is that the measures are often implemented at the expense of agricultural land. Naturally, farmers are usually unhappy about the loss of land - even though alternative agricultural plots and direct payments are provided. In general, however, people appreciate the improvement in the quality of life (a pleasanter area for leisure) and improved biodiversity.

LOCATION



Location: Petite Glâne watershed, 4 communities: Vallon, Missy, St. Aubin, Vully-le-Lac, FR/VD, Switzerland

No. of Technology sites analysed: single site

Geo-reference of selected sites
- 6.95712, 46.87209
- 7.01901, 46.91089

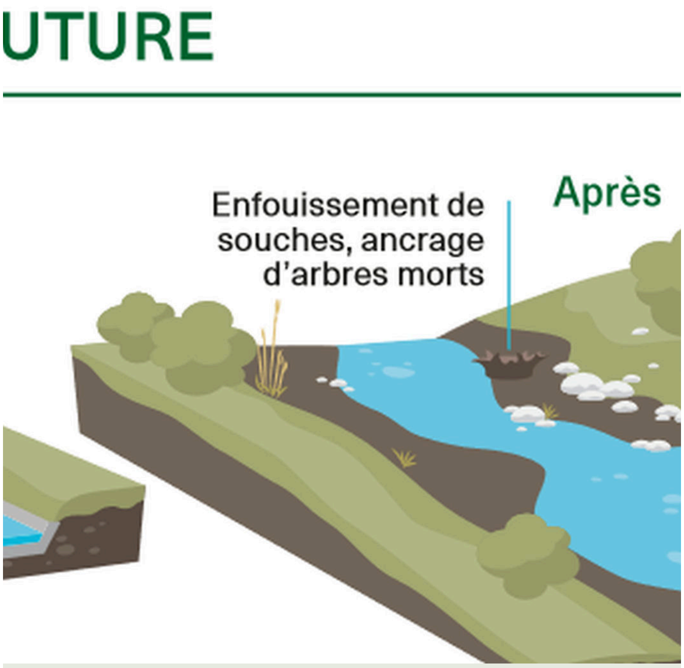
Spread of the Technology: evenly spread over an area (approx. 0.1-1 km2)

In a permanently protected area?: Nee

Date of implementation: 2022

Type of introduction
- [ ] through land users' innovation
- [ ] as part of a traditional system (> 50 years)
- [ ] during experiments/ research
- [x] through projects/ external interventions

Reach of the Petite Glâne before the implementation of riparian forests (and revitalization of the streambed) (Nives Ramisberger)



Baseline situation (now) and how it is intended to look after the implementation of the revitalization (Associadion Intercommunale Petite Glâne: La Petite Glâne - de Vallon à Vully-les-Lacs - Revitalisation 2020-2030)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ☐ improve production
- ☐ reduce, prevent, restore land degradation
- ☑ conserve ecosystem
- ☑ protect a watershed/ downstream areas – in combination with other Technologies
- ☑ preserve/ improve biodiversity
- ☑ reduce risk of disasters
- ☑ adapt to climate change/ extremes and its impacts
- ☐ mitigate climate change and its impacts
- ☐ create beneficial economic impact
- ☐ create beneficial social impact

Land use

Land use mixed within the same land unit: Nee

Forest/ woodlands

- (Semi-)natural forests/ woodlands
- Tree plantation, afforestation. Varieties: Mixed varieties

Tree types (deciduous): n.a.
Products and services: Nature conservation/ protection, Recreation/ tourism, Protection against natural hazards

Waterways, waterbodies, wetlands - Drainage lines, waterways

Water supply

- ☑ rainfed
- ☐ mixed rainfed-irrigated
- ☐ full irrigation

Purpose related to land degradation

- ☑ prevent land degradation
- ☐ reduce land degradation
- ☑ restore/ rehabilitate severely degraded land
- ☐ adapt to land degradation
- ☐ not applicable

Degradation addressed

soil erosion by water - Wr: riverbank erosion

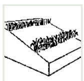
biological degradation - Bh: loss of habitats, Bs: quality and species composition/ diversity decline

water degradation - Hs: change in quantity of surface water, Hp: decline of surface water quality

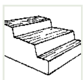
SLM group

- natural and semi-natural forest management
- surface water management (spring, river, lakes, sea)
- ecosystem-based disaster risk reduction

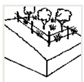
SLM measures



vegetative measures - V1: Tree and shrub cover



structural measures - S2: Bunds, banks

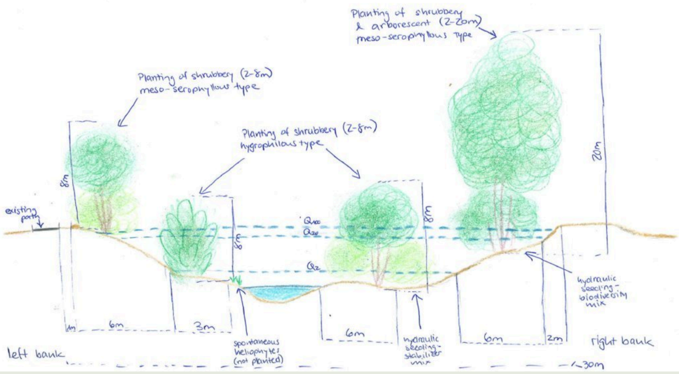


management measures - M1: Change of land use type, M2: Change of management/ intensity level

TECHNICAL DRAWING

Technical specifications

Between 2022 and 2026, the Petite Glâne is being revitalized on a length of 7 km with an average enlargement of the riparian zone of 15 m which totals in the riparian zone having a width between 35 and 60 m. 30,000 young trees and shrubs (from 37 species) and 100 larger trees are being planted. In addition, 200 small structures for wildlife will be provided. The very steep riverbanks are being reduced in their slope. Material used for the reconstruction of the river mainly comprises vegetation.



Author: Nives Ramisberger

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **33 ha (medium width of riparian area ((35+60)/2) * length of river reach (7km))**)
- Currency used for cost calculation: **CHF**
- Exchange rate (to USD): 1 USD = 0.98 CHF
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs

The most expensive feature of this project is the volume of earth that will be removed from the now steep riverbanks to widen the riverbed. The earth removed will directly be used again for small hills and what is not used directly in the riparian zone will be distributed on the agriculturally used fields next to the rivers. Also, there are several bridges that cross the Petite Glâne, and by enlarging the riverbed the bridges need to be rebuilt as well - which drives up the price greatly.

Establishment activities

1. communication (with communities etc.) and looking for sponsoring (Timing/ frequency: 2018)
2. completion of studies (Timing/ frequency: 2018)
3. survey/planning/project execution (Timing/ frequency: 2018)
4. Delays due to the Corona pandemic, start of reconstruction was originally planned for 2020 (Timing/ frequency: None)
5. search for company (Timing/ frequency: 2022)
6. implementation (Timing/ frequency: 2022-2025)

Establishment inputs and costs (per 33 ha (medium width of riparian area ((35+60)/2) * length of river reach (7km)))

Specify input	Unit	Quantity	Costs per Unit (CHF)	Total costs per input (CHF)	% of costs borne by land users
Labour					
engineers, purchase of land		1.0	3000000.0	3000000.0	
Plant material					
trees, small structures		30000.0	100.0	3000000.0	
Construction material					
terracing, bridges		1.0	15000000.0	15000000.0	
Other					
unexpected		1.0	500000.0	500000.0	
Total costs for establishment of the Technology				**21'500'000.0**	
Total costs for establishment of the Technology in USD				*21'938'775.51*	

Maintenance activities

1. Checking riverbed (Timing/ frequency: every 2-3 years)
2. Mowing of grass (Timing/ frequency: 1-2 per year)
3. Cutting/ pruning of trees (Timing/ frequency: every 5-10 years (usually around 30% of the area at once))
4. General maintenance period (Timing/ frequency: 2025-2028)
5. Follow-up, control of revitalization effects (Timing/ frequency: 2038)

NATURAL ENVIRONMENT

Average annual rainfall

- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [x] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone

- [ ] humid
- [x] sub-humid
- [x] semi-arid
- [ ] arid

Specifications on climate

Average annual rainfall in mm: 865.0
Name of the meteorological station: Payerne
average maximum temperature 14.2°C, average minimum temperature 5.1°C

Slope

- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)

Landforms

- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes

Altitude

- [ ] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.

Technology is applied in

- [ ] convex situations
- [x] concave situations
- [ ] not relevant

- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [x] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [x] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [x] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] poor drinking water (treatment required)
- [x] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to: surface water

Is salinity a problem?
- [ ] Ja
- [x] Nee

Occurrence of flooding
- [x] Ja
- [ ] Nee

Species diversity
- [ ] high
- [ ] medium
- [x] low

Habitat diversity
- [ ] high
- [ ] medium
- [x] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial)
- [x] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [ ] manual work
- [ ] animal traction
- [x] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [ ] individual/ household
- [x] groups/ community
- [ ] cooperative
- [x] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [x] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [ ] small-scale
- [x] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [x] communal/ village
- [ ] group
- [ ] individual, not titled
- [x] individual, titled

Land use rights
- [ ] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [ ] individual

Water use rights
- [ ] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor			✓	good
education	poor			✓	good
technical assistance	poor			✓	good
employment (e.g. off-farm)	poor			✓	good
markets	poor			✓	good
energy	poor			✓	good
roads and transport	poor			✓	good
drinking water and sanitation	poor			✓	good
financial services	poor			✓	good

IMPACTS

Socio-economic impacts

Crop production	decreased	✓							increased
wood production	decreased					✓			increased
production area (new land under cultivation/ use)	decreased	✓							increased
irrigation water availability	decreased				✓				increased
irrigation water quality	decreased				✓				increased

farm income	decreased	□□✓□□□□	increased	In the short term it is expected to decrease due to loss of land, in the long term not because of more resilience towards floods
diversity of income sources	decreased	□□□□✓□□	increased	State subsidies for biodiversity areas

Socio-cultural impacts

land use/ water rights	worsened	□□□✓□□□	improved	
cultural opportunities (eg spiritual, aesthetic, others)	reduced	□□□□□✓□	improved	
recreational opportunities	reduced	□□□□✓□□	improved	The landscape becomes more beautiful and new places to stay are made, but on the other hand many places are deliberately made inaccessible for the protection of flora & fauna.
conflict mitigation	worsened	□□□□✓□□	improved	Simultaneously, the threat of flooding for farmers is decreased and enhancement of habitat created which is expected to lead to improved acceptance by all stakeholders

Ecological impacts

water quantity	decreased	□□□✓□□□	increased	
water quality	decreased	□□□□✓□□	increased	
harvesting/ collection of water (runoff, dew, snow, etc)	reduced	□□□✓□□□	improved	
surface runoff	increased	□□□□✓□□	decreased	Will be slightly improved through reducing the gradient of riverbanks
excess water drainage	reduced	□□□✓□□□	improved	
groundwater table/ aquifer	lowered	□□□✓□□□	recharge	
evaporation	increased	□□✓□□□□	decreased	Less evaporation but more evapotranspiration expected
soil moisture	decreased	□□□✓□□□	increased	
soil cover	reduced	□□□✓□□□	improved	
soil loss	increased	□□□□✓□□	decreased	
vegetation cover	decreased	□□□□□□✓	increased	
biomass/ above ground C	decreased	□□□□□✓□	increased	
plant diversity	decreased	□□□□□□✓	increased	
invasive alien species	increased	□□□✓□□□	reduced	
animal diversity	decreased	□□□□□✓□	increased	
beneficial species (predators, earthworms, pollinators)	decreased	□□□□□✓□	increased	
habitat diversity	decreased	□□□□□□✓	increased	
flood impacts	increased	□□□□□✓□	decreased	
drought impacts	increased	□□□✓□□□	decreased	It is not known yet if there will be any difference for after the implementation but it is expected that the difference will be negligible
impacts of cyclones, rain storms	increased	□□□✓□□□	decreased	
emission of carbon and greenhouse gases	increased	□□□✓□□□	decreased	
wind velocity	increased	□□□✓□□□	decreased	
micro-climate	worsened	□□□✓□□□	improved	

Off-site impacts

water availability (groundwater, springs)	decreased	□□□✓□□□	increased	
reliable and stable stream flows in dry season (incl. low flows)	reduced	□□□□✓□□	increased	
downstream flooding (undesired)	increased	□□□□□✓□	reduced	
downstream siltation	increased	□□□□✓□□	decreased	
groundwater/ river pollution	increased	□□□□✓□□	reduced	
buffering/ filtering capacity (by soil, vegetation, wetlands)	reduced	□□□□□✓□	improved	
wind transported sediments	increased	□□□✓□□□	reduced	
damage on neighbours' fields	increased	□□□□✓□□	reduced	
damage on public/ private infrastructure	increased	□□□□✓□□	reduced	

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	✓ (positive)	very positive
Long-term returns	very negative	✓ (positive)	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	✓ (positive)	very positive
Long-term returns	very negative	✓ (positive)	very positive

The short term benefits (1-3 years after implementation) are considered positive as the technology shows positive effects on ecosystem services (e.g. flood protection) within a short period of time despite the high establishment costs.

CLIMATE CHANGE

Gradual climate change

annual temperature increase	not well at all	✓ (moderately)	very well

Climate-related extremes (disasters)

local thunderstorm	not well at all	✓ (well)	very well
local hailstorm	not well at all	✓ (moderately)	very well
heatwave	not well at all	✓ (moderately)	very well
drought	not well at all	✓ (moderately)	very well
general (river) flood	not well at all	✓ (very well)	very well
flash flood	not well at all	✓ (very well)	very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- [x] single cases/ experimental
- [ ] 1-10%
- [ ] 11-50%
- [ ] > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- [ ] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- [ ] Ja
- [x] Nee

To which changing conditions?

- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Less flooding
- Small improvement in soil quality

Strengths: compiler's or other key resource person's view

- Biodiversity
- Positive measure against warming waters
- Improvement of the landscape and therefore of the quality for recreational purposes
- Flood protection

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- Loss of agricultural land Exchange of plots (next to river taken; elsewhere, another given)
  Financial compensation

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- High costs Sponsoring/subsidies needed

REFERENCES

Compiler
Nives Ramisberger

Editors
Joana Eichenberger
Tatenda Lemann
Nadja Kollbrunner

Reviewer
Rima Mekdaschi Studer
William Critchley

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Resource persons
Julien Devanthéry - SLM specialist
Audrey Friedli - SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_6248/

Linked SLM data
n.a.

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Project

- OPtimal strategies to retAIN and re-use water and nutrients in small agricultural catchments across different soil-climatic regions in Europe (OPTAIN)