Restoration of oxbows and floodplains on the Morava River, Slovakia

Year of issue

2025

Summary

South of Bratislava, the Morava River and its tributaries were modified at three sites to restore wetland biotic complexes and enable movements between habitat fragments isolated by land use. Under the Biodiversity Protection Project (GEF/World Bank with national funds), four oxbows and over 19 km of floodplain were restored.

Building on this, Slovakia is implementing a new, larger restoration phase funded by the national Recovery and Resilience Plan. The state water manager (SVP) is restoring a 17-km section of the Morava (river km 69–51.9) across the cadastres of Sekule, Moravský Svätý Ján, Malé Leváre, Veľké Leváre and Gajary, based on a VÚVH study (2021). Planned measures include reconnection of side arms/oxbows, local bank lowering/softening, selective removal of bank protection and targeted re-meandering with natural materials to improve floodplain inundation, groundwater storage, water quality and ecological connectivity. Completion is currently targeted for June 2026.

Photo Gallery



Location

48.0575, 17.207

Project

NWRM

National ID

Slovakia_01

Sector

Hydromorphology

Installation Date

1998-06

Contact

REC

Overview

Location of the project

Lower Morava River (Slovakia-Austria border), south of Bratislava, in the river reach km 69-51.9. Within the cadastral areas of Sekule, Moravský Svätý Ján, Malé Leváre, Veľké Leváre and Gajary; inside Záhorie Protected Landscape Area and the “Morava River Floodplains” Ramsar/Natura 2000 complex.

Country

Slovakia

NUTS2 Code

Bratislavský kraj

Sponge measures implemented in the case study

Re-meandering

Reconnection of oxbow lakes and similar features

Floodplain restoration and management

Objectives

Protect and strengthen biodiversity in three representative ecosystems incl. the Morava Floodplains; restore wetland biotic complexes and reconnect fragmented habitats.
On the Morava, the works targeted partial restoration of side-arms; the case records 4 oxbows and >19 km of floodplain restored. (These figures describe the intended/achieved scope of that phase.)
- reconnect cut-off meanders/side arms
- remove bank revetments to trigger natural lateral dynamics
- locally lower natural levees to increase frequency/duration of floodplain inundation
- optimise the scheme to respect Q100 flood-protection levels, ice regime, and habitat diversity

The active project aims to restore ~17 km of the Morava by reconnecting side arms/oxbows, restoring floodplain inundation and river processes, to improve groundwater storage/quality and ecological status/connectivity; works also entail large-scale earthworks (~360,000 m³).

Involved partners

Authority type	Authority name	Authority role
National water authority	Department of Nature and Lndscape Conservation; Ministry of Environment	Initiation of the measure
National water authority	Czech Republic Authority	—
National water authority	Austrian Auhority	—
NGO	WWF	—

Site Information

Climate Zone

Cool temperate moist

Precipitation

600.00 mm

Temperature (°C)

10.80 °C

Runoff coefficient

0.25

Elevation range

117

Vegetation class

Floodplain meadows (Cnidion dubii alliance) and softwood alluvial forests (willow–poplar; Salici-Populetum) typical of the Morava floodplain complex.

WFD Ecological status

Poor

WFD Chemical status

Failing to achieve good

Water quality status

Strong hydromorphological alteration - uniform channel, poor habitat diversity, limited lateral connectivity, bed incision and floodplain deposition - linked to past river regulation.

Design and Implementation

Project scale

Meso

Project scale specifications

Regional/river-segment project within the Lower Morava floodplain corridor (SK–AT border), not a nationwide programme nor a single local reach.

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

250.00 ha

Constraints

Some stretches of natural river beds and fluvial processes remain especially in the Morava River and its tributary, the Rudava.

Favourable preconditions

The area is theoretically protected at this time as national parks, nature reserves or landscape protected areas

Financing

Total cost

2326658.00 €

Total cost information

2300000(GEF Project Grant)+870000(Co-financing Total)= 3170000 USD
Restoration-Morava: 256000USD --> 187972 €

Administrative annual cost information

435000USD: Computerization, monitoring and Data management

Information on Economic costs - income loss

70000USD

Financing authorities

Authority name	Type of funding	Financing share
Global Environmental Trust Fund	—	—
MacArthur Foundation	Other	—
Austrian EcoFund	National funds	—
Slovak Government	—	—
European Union	EU-funds: LIFE+	75 %

Compensations

Non

Policy and Governance

Policy description

Biodiversity degradation through pollution, overuse by visitors and complex impacts from adjacent land uses. The forests have been cut, water table reduced, and spring floods interrupted and the native meadows have been converted to cropland.
The floodplain forests have been reduce. the water table has dropped and spring floods have been interrupted. Large areas of meadow were ploughed up and converted in to arable fields. the once continuous flood plain area has been transformed into a mosaic of remnant natural areas and areas of intensive management.

Land ownership

Mixed ownership : Agricultural land is mostly used by cooperatives/private firms, water bodies are state-owned, forests within the Ramsar are mixed.

Policy targets

Improved Biodiversity

Part of a wider plan

Non

Public consultation

Non

Consultation activities

Activity stage	Activity type	Comments
Design phase	Workshops	in the slovak Republic with management and research personnel and the Slovak ministry of environment Department of Nature and Landscape conservation. Designed to provide key interventios and develop institutional capacieities and the focus of activity will be on three areas.

Has contractual arrangements

Oui

Contractual arrangements

Arrangement type	Name	Comments
Contractual agreement	GLOBAL ENVIRONMENT TRUST FUND GRANT AGREEMENT	between Slovak Republic (the Recipient) and International Bank for Reconstruction and Development

Impacts and Monitoring

Monitoring System

Monitoring requirements

VÚVH/SHMÚ run the national WFD-aligned monitoring of water status, while ŠOP SR/CHKO Záhorie monitor Natura 2000 features in the Morava floodplain.

Monitoring parameters

Monitored elements include biological quality elements (fish, benthic invertebrates, macrophytes), physico-chemical indicators (e.g., nutrients, oxygen/organic load; priority substances), and hydromorphology/hydrology in line with WFD methods; groundwater is monitored in dedicated networks.

Maintenance

Maintenance requirements

SVP, as river manager, undertakes routine and project-related upkeep on the Morava reach (vegetation clearance, channel function and bank works).

Socio-economic Impacts

Direct benefits information

To protect ecological zones of substantial international importance, reduce loss of species, restore ecosystems and maintain a high level of diversity. Forested innovation by integration of various levels of biological diversity to address issues in conservation planning.
The project complements other activities such a Bank-financed forestry development loan and GEF-supported protection activities. Components of the project are also directed to integrating planning outside the strictly protected areas in consultation with affected communities and interests.
Employment / social inclusion (SK, 2025): >130 people from social enterprises are employed alongside SVP crews (clearing woody growth, improving meander through-flow). Government notes the aim is to integrate disadvantaged job-seekers and improve regional living conditions.
Land administration (SK, 2025): SVP reports ~90% of land arrangements concluded in the project area; expropriation notices state the works should not prevent continued use of remaining parcels. (Administrative/social dimension of delivery.)
Public outreach & cross-border exchange (SK–AT, 2023): INTERREG Kli-Ma project held public events and education for children/general public on Morava water-level optimisation and climate adaptation.
Agriculture & rural income (SK, Ramsar case): programme to convert ~150 ha to species-rich meadows and support management of ~1,000 ha via direct farmer subsidies; anticipated outcomes include higher hay production improving owners’ income, benefits for hunting/fishing associations, and more tourism.

Ancillary benefits information

Trough research and monitoring in these areas, knowledge will be gained as to how human activities have affected, and are affecting, different types of ecosystems and habitats, and how this actions can be changed to keep these areas and the societies that depend on them, healthy.

Biophysical impacts: Hydrology

Information on retained water

After oxbow reconnection (1990s): The rock-weir design caused side arms to behave like reservoirs (inflow > outflow), with very low velocities (<0.1 m s^{-1}) and rapid infilling: in one meander ~43,000 m^3 of sediment accumulated in 2 years—an unexpected negative impact that degraded the reconnections.
Long-term groundwater level declined ~0.9–1.2 m (1958–1994) in the central/upper border reach, linked to bed incision and regulation (context, not a measured effect of the 1990s works). Danube backwater can reach ~23 km upstream, influencing levels.
Current RRF project (r.km 69–52): aims to restore floodplain inundation, groundwater storage and water quality via side-arm reconnections and bank lowering; no published post-work impact data yet (works ongoing to 2026).

Information on increased water storage

Arable lands now are meadows where water stay for longer periods of time.

Biophysical impacts: Biodiversity

Improved biodiversity

Oui

Information on improved biodiversity

The floodplain hosts >850 plant species and valuable aquatic macrophytes; the 1990s works reopened several meanders, but no quantified change in species richness/abundance for the Slovak sites was found in accessible sources.

Biophysical impacts: Water & Soil Quality

Water quality overall improvements

N/A info

Soil quality overall improvements

N/A info

Biophysical impacts: Others

Ecosystem impact climate regulation

Not relevant for the specific application

Lessons Learned

Key lessons

Institutional stability is a key condition for project success; professional development is a vital step in building human capacity; explicit targets help managers identify the success, cost-effectiveness and basic usefulness of most components throughout implementation; involving NGOs during implementation were key to success.
Early oxbow reconnections (1990s) showed that design choices matter: rock-weir intakes created low velocities, high sediment inputs and rapid blockage of meander entrances. Nine years of eco-hydromorphological monitoring concluded the benefits were short-lived and conditions worsened without sufficient flow dynamics.
From this, practitioners derived clear technical lessons: analyse present river processes before acting; evaluate effects on flow and sediment transport with models; and avoid copy-pasting measures to dissimilar rivers.
Alternatives such as full meander integration were proposed to restore dynamics; lower-outlet reconnection alone would need continuous maintenance.
Later project phases reflect that learning: the current 17-km restoration is based on Water Research Institute (VÚVH) studies and numerical/physical modelling (“Plan of measures... km 69–51.9, Variant 2, 2021”), in line with national restoration guidance published by VÚVH/MŽP SR.
Finally, the river is transboundary. Results and acceptance improve when actions align across the corridor: Austrian LIFE works on the Lower Morava reconnected multiple side arms and islands, illustrating the benefit of coordinated, reach-scale planning on both banks.

Barriers

Barrier type	Barrier role	Comments
Other	Main barrier	The project came in the first year of on-going changes in legislative, administrative and institutional arrangements in Slovakia
Other	Secondary barrier	Ongoing re-privatization of land prevented forest restoration activities
Other	Secondary barrier	Frequent changes in high positions in the Ministry of Environment officials in Nature conservation section
Other	Secondary barrier	Some leakage of trainees occurs because of salary inequities.

Drivers

Driver type	Driver role
Organisation committed to it	Main driver

Success factors

Success factor type	Success factor role	Comments
Attitude of decision makers	Secondary factor	Qualified and very committed professionals within the PMCU
Existing staff and consultant knowledge	Secondary factor	Establishment of the Joint Scientific Advisory committes proved usefull for provideing guidance to the project activities and specially for increasing awareness of the project among the national and international scientific and academic community.

Transferability

Highly transferable to lowland meandering rivers where regulation cut off side-arms. Success depends on process-based design: secure enough through-flow to avoid silting, model hydraulics/sediment, and plan for bank lowering and selective revetment removal only where flood-safety and ice-regime remain acceptable. Address land tenure early, coordinate across borders, and budget for maintenance and WFD-aligned monitoring.

Sources

Sources

Biodiversity GEF Project

Restoration of the Lower Morava floodplains (Untere March-Auen)

Information Sheet on Ramsar Wetlands (RIS) – Morava River Floodplains

Morava River Floodplain Meadows – Importance, Restoration and Management

The Morava River Restoration: Plan of Measures ... (MoRe)

LIFE+ Restoration of the Lower Morava floodplains

Práca namiesto dávok pokračuje na Záhorí revitalizáciou povodia Moravy

Historicky prvá obnova prirodzeného tvaru rieky na Slovensku

Ministri predstavili sociálny projekt revitalizácie povodia rieky Morava

Evolution of meandering lower Morava River (west Slovakia) during the first half of 20th century

Implementation Completion Report – Slovak Republic: Biodiversity Protection Project (GEF Grant TF028644)

Keď Morave nepomôžeme, môžeme stratiť vzácne územie... (interview with T. Olšovský)

River and environmental processes in the wetland restoration of the Morava river