Dyke relocation on the river Elbe near Lenzen, Germany

Year of issue

2025

Summary

In the framework of the large-scale nature conservation project "Lenzener Elbtalaue", a dyke along the river Elbe (in Germany) has been relocated. This created a new retention area with a diverse floodplain, including alluvial forests, half-open pasture landscapes and other typical habitats of lowland floodplains. With 420 ha it is the biggest application of this type of measure in Germany so far. The project successfully combines flood protection and nature conservation objectives. Since the cutting of the old dyke in 2009, the measure could proof its effectiveness during several high water events.

The specific measures applied include:

- Construction of a new, 6.1 km long dyke which has been shifted backward up to 1.3 km

- Opening of the old, 7.2 km long dyke, situated close to the river, in sections of 200-500 m length

- Planting of 160 ha of alluvial forest, with further 130 ha of succession areas for alluvial forests

- Establishment of half-open pasture landscapes on 85 ha

- Profiling of 45 ha of flood channels in the area concerned by the relocated dyke

- Implementation of a land re-organization process in order to make areas available for the project

Photo Gallery



Location

53.097326, 11.478521

Project

NWRM

National ID

Germany_01

Sector

Hydromorphology

Installation Date

2002 - 2011

Implementation status

Completed

Contact

Verena Mattheiss, ACTeon

Overview

Location of the project

The measures are applied on a stretch of the Elbe river in Germany, next to Lenzen, between the Elbe kilometers 473.5 and 489.5.

Country

Germany

NUTS2 Code

Brandenburg

Sponge measures implemented in the case study

Floodplain restoration and management

Forest riparian buffers

Channels and rills

Removal of dams and other longitudinal barriers

Objectives

Restore 420 ha of floodplain for retention and biodiversity

Reduce flood peaks on the Elbe River

Improve ecological connectivity and water quality

Support EU WFD and Natura 2000 objectives

Involved partners

Authority type	Authority name	Authority role	Comments	Authority responsibility

NGO	Trägerverbund Burg Lenzen e.V.	Implementation	Association responsible for running the large-scale nature conservation project.	Responsible
Other	Biosphere Reserve "River Landscape Elbe-Brandenburg"	Initiation of the measure	Management of the biosphere reserve.	Responsible
Regional / sub-national water authority	Brandenburg State Office of Environment, Health and Consumer Protection	Implementation	Regional authority with different responsibilities (nature conservation, water management, etc.). Supported the project from the early beginnings. The state office carried out the construction of the new dyke	Responsible
Farmers	Large-scale farmer	Initiation of the measure	Manager of a large-scale farm (about 3600 ha) situated in the area. Interested by promoting regional development activities. Early initiator of the reflections (together with the Biosphere Reserve).	Supporting
Research institute / University	Federal Waterways Engineering and Research Institute (BAW)	Monitoring	Research institute accompanying the project. Scientific support since 1995, in particular with regards to effects on navigation (e.g. share of discharge between Elbe and the dyke relocation area, impacts on sediment transport) and measuring the hydraulic effectiveness of the dyke relocation during flood events.	Supporting

Documents

cs-de-01-elbe-final_version.pdf (1.03 MB)

Site Information

Climate Zone

Cool temperate dry

Temperature (°C)

9.00 °C

Runoff

704.00 mm

Slope range

0-1%

Soil type

Fluvisols

Groundwater level

Shallow (<1.5 m)

Vegetation class

Prior to the project implementation, the area was subject to agricultural use. After implementation it was converted to alluvial forests and half-open pasture landscapes (Salix, Alnus, Carex).

WFD Ecological status

Moderate

WFD Chemical status

Failing to achieve good

Water quality status

Limited self-purification, channelization impacts, disconnected floodplain

Design and Implementation

Project scale

Meso

Project scale specifications

Regional river floodplain restoration along 6.1 km of dyke. So far the biggest dyke relocation project in Germany.

Project area

1031

Project area specifications

Area of reconnected floodplain.

Size

420.00

Size unit

ha

Basis of design

Through the NWRM, 36% of a 20-25 years flood flow (3250 m3/sec) would take place in the newly created floodplain.

Principles

Consequent integration of nature conservation and flood protection objectives - as well as the sustainable use of the area through extensive agriculture.
Increasing public acceptance by providing a lot of information about the project.

Factor constraints

- In general, giving more space to water in floodplain areas (including through the relocation of dykes) is seen very positively in public discussions. Also the basic principle of taking both nature conservation and flood protection objectives into account influenced the choice of the measure.
- The dyke relocation became the central measure of the project, as it was only by this measure that the desired restoration of the floodplain to its original state and function could be achieved.
- Intensive research has taken place beforehand on the morphology and dynamics of the river Elbe (research project from 1996 to 2000). - Several alternatives had been examined, models have been elaborated.
- Alluvial forests had disappeared largely beyond the project area, and contributing to their recovery formed part of the project's objectives from the beginning.
- One alternative which would have led to a bigger retention area has not been retained, as depriving more areas from use wouldn’t have found public acceptance. Furthermore, problems with upward seed had been expected for this alternative.

Constraints

No information on physical / biophysical constraints

Favourable preconditions

Preconditions which led to the implementation of the measure were not natural, but mainly due to the fact that the old dyke had been constructed very close to the river bed. Alsot the topography : wide low-lying terrain with low slope

Financing

Total cost

13000000.00 €

Total cost information

11.5 million euros for the construction of the new dyke (include 0.71 million euros for planning). 1.5 million euros for opening the old dyke (include 240 000 euros for planning).

Costs investment

13000000.00 €

Costs investment information

11.5 million euros for the construction of the new dyke (include 0.71 million euros for planning). 1.5 million euros for opening the old dyke (include 240 000 euros for planning).

Costs operation maintenance information

n/a

Costs maintenance information

Maintenance costs exist for maintaining the dyke.

Economic costs, actual income loss

Actual income loss: In the newly created floodplain, agriculture has been abandoned on 444.5 ha. It has been replaced by a landscape conservation pasturing (half open pasture landscape).

Information on Economic costs other annual

Hunting rights have been limited in the area.

Administrative annual cost information

no information

Information on Economic costs - income loss

Agricultural activities have been abandoned, but which were (after the German reunification) anyway not very adapted to the new market situation.

Financing authorities

Authority name	Type of funding	Comments	Financing share

BfN (Federal Agency for Nature Conservation)	National funds	Restoration funding	~75%
MELUV Brandenburg	Sub-national funds	Co-financing	~18%
BUND	Private funds	NGO - Coordination, co-funding	~7%

Compensations

Yes

Compensations number of beneficiaries information

Land in the newly created floodplain only belonged to two farmers.

Compensations scheme information

Compensation payments have been made for the abandonment of agricultural areas, for the herewith induced operating adaptations of the farming activity, the dissolution of current land tenures and the land use difficulties of furthermore cultivated areas.

Policy and Governance

Policy description

The Elbe is regularly subject to (extreme) flood events, and first reflections on dyke relocation in the North of Lenzen were made some decades ago. But only after the German reunification did the discussion become more dynamic. Flood protection (in Germany) is based today on three pillars: Natural water retention, technical flood protection and flood prevention. In specific evaluations and in the public discussion, retention of water in the landscape, and here in particular in the floodplains and retention areas, receives high importance.
With the Elbe being also an important water way, acceptable measures required an intensive cooperation between different institutions: integration of ecological, flood protection and navigation objectives.

Land ownership

Mixed: private agricultural land and public land. Acquisitions and long-term agreements were negotiated.

Policy targets

Peak-flow reduction

Runoff control

Improved Biodiversity

Pollutants Removal

Target remarks

- Re-creation of a near nature floodplain landscape, formed by the dynamic processes of streaming water
- Establishment of alluvial forests on former grassland through scattered, small-area initial plantings as well as development and maintenance of a floodplain typical mosaic of habitats with the associated species (e.g. hard- and softwood forests)
- Preservation of the groundwater dynamic which is characteristic for a floodplain and the corresponding soil types
- Development of half-open pasture and meadow landscapes
(periodically inundated grassland))
- Removal of a hydraulic bottleneck and the associated narrowing of the flood water flow bed

Pressure remarks

River channelisation.
Disconnected floodplain.
Agricultural use.

Impact remarks

High flood risk before the project
Loss of biodiversity and ecosystem functions

Requirement directive remarks

Compensation for land use change
Long-term maintenance agreements

Policy challenges requirements

The project was integrated in the restoration of the flood protection dykes in the German Federal State of Brandenburg. It has been initiated by the biosphere reserve "Flusslandschaft Elbe-Brandenburg", with the aim to recreate in particular alluvial forests. Furthermore, the manager of a large farm was at the origin of the discussions and further promoted the whole project with the idea to diversify his activities and embed them in a sustainable regional development strategy.

Part of a wider plan

Yes

Wider plan

Wider plan type	Wider plan focus	Name	Comments
National	Environment & Biodiversity	Blaues Band Deutschland	Nature-based river restoration

Public consultation

Yes

Consultation activities

Activity stage	Activity type	Comments
Implementation phase	Guided tours	Guided tours take place in the project area.
Implementation phase	Visitor centre	A visitor centre informs about the project.

Has contractual arrangements

Yes

Contractual arrangements

Arrangement type	Name	Comments
Contractual agreement	Land use & maintenance agreement	Agreement with farmers

Impacts and Monitoring

Monitoring System

Monitoring requirements

Hydrological stations, biodiversity surveys

Monitoring parameters

The following aspects are monitored (Damm et al. 2011):
- Hydrology: 12 groundwater gauges are supervised by the association carrying the project
- Hydraulics: Construction of 4 dyke gauges through the large-scale nature conservation project, steady reading of the meter by the state office, analysis through the Federal Waterways Engineering and Research Institute
- Soils: Two permanent observation plots of the Land Brandenburg, complemented by an evaluation at the end of the project
- Forestry: Examination of the planted alluvial forests in 2009 (evaluation)
- Fishes: Examination of the flood channels in 2009 and 2010, in time intervals further observations in cooperation with research institutes
- Birds: Examination in the framework of the evaluation of the project continuously 2007-2010, continued by the state of Brandenburg
- Vegetation: surveys through cooperation between the project management association, the state of Brandenburg and different research institutes

Maintenance

Maintenance requirements

Periodic dyke inspections & vegetation management led by local water board & Biosphärenreservat.

Impact Assessment Methodology

Performance impact assessment method

Catchment outlet

Performance impact estimation information

Substantial modeling exercises and numerical calculations had been undertaken to predict the effect on flood peaks. A two-dimensional, hydro-dynamic numerical model has been used (it compares the previous situation without dyke relocation with the one with dyke relocation).
The impact of the measures with regards to flood protection could be directly observed during the extreme flood event in January 2011.

Socio-economic Impacts

Direct benefits

Benefits of the project have not been specifically analysed. However, the following ones can be identified: - Flood protection (water retention)
- Benefits for the regional development: The project area got quickly established as a regional attraction on the international Elbe bike trail. In connection with a centre for environmental education and a visitor centre for the area a sustainable increase of the number of visitors occurred.
- During the construction period there had been some socio-economic effects in terms of employment and local consumption.

Ancillary benefits information

Benefits for the regional development: The project area got quickly established as a regional attraction on the international Elbe bike trail. In connection with a centre for environmental education and a visitor centre for the area a sustainable increase of the number of visitors occurred.
Furthermore, during the construction period, there had been some socio-economic effects in terms of employment and local consumption.

Biophysical impacts: Hydrology

Retained water

16.00

Retained water unit

mio m3/month

Information on retained water

16 million m3 of water can be retained by the new floodplain area in case of flood events.

Increased water storage

38095.00

Increased water storage unit

m3/ha

Information on increased water storage

In terms of flood events, up to 16 million m3 can be retained in the 420 ha of the newly created floodplain area.

Peak flow reduction

36.00

Peak flow reduction unit

% Percent

Information on peak flow reduction

In times of extreme flood events (ocurring every 20-25 years), 36% of the flood flow is taking place in the floodplain.

Information on increased groundwater level

Problems with upward seed are mentioned in the area next to the relocated dyke.

Information on increased landscape storage capacity

Water level reduction of 40–50 cm locally, up to 10 cm reduction upstream at Wittenberge.

Information on ecosystem flood control volume

The created floodplain is limited by a (relocated) dyke - no separation of the effects is possible.

Information on ecosystem flood control return periods

Effects with regards to the following flood events have been calculated:
a) Flood events recurring every 1-2 years = 1500 m3/s → 8.6 % of the flow in the new floodplain, water level reduction of 9.2 cm
b) Flood events recurring every 3-5 years = 2300 m3/s → 27.5 % of the flow in the new floodplain, water level reduction of 28 cm
c) Flood events recurring every 20-25 years = 3250 m3/s → 36 % of the flow in the new floodplain, water level reduction of 38.9 cm

Reducing flood risks quantity change

The reduction of (extreme) flood peaks is locally between 25 to 35 cm, depending on the flood flow rate.

Biophysical impacts: Biodiversity

Improved biodiversity

Yes

Information on improved biodiversity

Alluvial forests have been initiated by planting respective tree species. Furthermore, an half-open pasture landscape is maintained. An impact has been stated amongst others with regards to the development of a diverse avifauna.

Biophysical impacts: Water & Soil Quality

Water quality overall improvements

Positive impact-WQ improvement

Information on water quality overall

An effect on water quality is assumed through the retention of nitrogen and phophorous in the floodplain. Natural filtration processes were restored.

Information on water quality improvements (P)

Retention of P is assumed, no measurements took place.

Information on water quality Improvements (N)

Retention of N is assumed, no measurements took place.

Soil quality overall improvements

Not relevant for this application

Information on soil quality overall improvements

With regards to the impact of the measure, it is not about the quality of the soil, but its change back to its alluvial character.

Biophysical impacts: Others

Ecosystem impact climate regulation

No information available

Lessons Learned

Key lessons

The project shows a successful combination of nature conservation, flood protection and other objectives (agricultural, regional development, and others).
It is said that public communication activities should have been made in a more intensive way, in particular at the beginning of the project.
From an ecological perspective, an earlier / deeper connection to the Elbe would have been better to improve the lateral connectivity and morphological dynamic of the river. The latter would have also helped to minimize sedimentation processes in the new floodplain area, which can be expected in the middle and long term.
The highest effect of the measure can be stated next to the first opening of the dyke (on the "evil place") and it decreases towards the downstream part of the dyke relocation. Further downstream from the dyke relocation, the measure does not have any effect anymore on the water level. Upstream, the positive effect diminishes with an increasing distance. This shows that the measure has a very clear, but mainly regionally working impact. In order to solve the important flood problems of the Elbe river, it is indispensible to carry out other dyke relocation measures.
The measures are suitable to be applied also elsewhere. However, areas free of settlement are needed.
The continuous persuasion works from a few - and over several years - is highlighted as one key factor for the successful implementation of the project. The prior implementation of research projects ensured the effectiveness of the measure design, but was also very useful for providing support for public discussion.

Barriers

Barrier type	Barrier role	Comments
Lacking financing sources	Secondary barrier	No major barriers to implementation are reported, apart from the need for substantial funding, but which could be resolved.

Drivers

Driver type	Driver role	Comments
Organisation committed to it	Main driver	It was only due to the continued commitment of local stakeholders that the project could be implemented.
Past flooding events	Main driver	Reducing the local flood risk was a main driver for the implementation of the measures. The 2002 event reveales need for better retention.
Legal obligations	Main driver	There had been legal obligations to adjust the old dyke to current requirements - which temporarily coincided with the development of the project idea.

Success factors

Success factor type	Success factor role	Comments
Attitude of relevant stakeholders	Main factor	Early involvement of farmers was crucial and positive.
Financing possibilities	Secondary factor	Access to various funding sources secured the feasability of the project.

Cost effectiveness

High: multiple ecosystem services for relatively low cost; cost lower than flood defence-only options.

Transferability

The preconditions in terms of stakeholder engagement were quite particular - going back to changes in the framework of the political turnover in Germany. However, from a technical point of view, dyke relocations can be implemented in any other area were sufficient settlement free areas exist. High transfer potential in lowland floodplains; replicable if space and stakeholder support exist.

Basin characteristics influence

Relocating the dyke near the Elbe’s sharp bend at “Böser Ort” created a key water retention area, reducing the river corridor from 1200 m to under 500 m and improving flood management.

Sources

Sources

Auenschutz - Hochwasserschutz - Wasserkraftnutzung. Beispiele für eine ökologisch vorbildliche Praxis

Die Deichrückverlegung bei Lenzen an der Elbe

Naturschutzgroßprojekt Lenzener Elbtalaue

Hochwasser: Rückverlegung des Deichs bewährt sich

Die Deichrückverlegung bei Lenzen an der Elbe

Landwirtschaftliche und touristische Nutzungsänderungen im Naturschutzgroßprojekt "Lenzener Elbtalaue" (2005 - 2009) Sozio-ökonomische Evaluierung (I)

Sozio-ökonomische Betroffenheit der Landwirtschaft durch Deichrückverlegung im Bereich der brandenburgischen Mittelelbe unter Berücksichtigung betrieblicher Anpassungsmöglichkeiten

Floodplains in Germany "Synergies with nature conservation, WFD and flood protection"

Ecological restoration and dike relocation on the river Elbe, Germany