



REST-COAST

LARGE SCALE RESTORATION OF COASTAL ECOSYSTEMS  
THROUGH RIVERS TO SEA CONNECTIVITY

Fact Sheet

# Wadden Sea Ems Dollard



The Danish-Dutch-German World Heritage property “The Wadden Sea” inscribed in 2009 and extended in 2014.” Common Wadden Sea Secretariat (2016) Report on the State of Conservation of the World Heritage property “The Wadden Sea (N1314)”. Wilhelmshaven, Germany.)

Organisations responsible for the pilot



provincie  
groningen



Supporting partners

Deltares



hereon



WAGENINGEN  
UNIVERSITY & RESEARCH



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# Introduction

The Ems-Dollard is a unique estuarine system in the world, forming part of the Wadden Sea. In 2009, the Wadden Sea was designated a UNESCO World Heritage Site. The Ems-Dollard estuary lies on the border between the Netherlands and Germany, where the Ems River meets the Wadden Sea, one of the world's largest tidal areas. Human interventions have shaped parts of the Ems-Dollard estuary. As early as the Middle Ages, salt marshes were reclaimed with dikes, and coastal peatlands were converted into polders. Consequently, the size of the estuary has decreased while the polders have subsided due to agricultural use.

The estuary faces numerous challenges. Human activities such as deepening, dredging, and industrial development have degraded water quality. Additionally, the estuarine reach upstream of the Dollart suffers from extreme fine sediment accumulation. Farming practices and gas extraction have exacerbated land subsidence and peat oxidation, adding more green-

house gases to the atmosphere and making the polders more susceptible to salinization. These inland and coastal practices have disrupted ecological connectivity between the sea and inland waters, removing gradients in the coastal landscape. The remaining gradients in the form of salt marshes are threatened by sea-level rise on the seaward side and the need for dike expansion on the landward side.

To better understand the complex estuarine and coastal zone system, the Netherlands initiated the Ems-Dollard2050 program, a knowledge initiative. In 2016, the Dutch began several pilot projects under this program, adopting a "learning by doing" approach. On the German side, efforts focus on resolving the turbidity problem in the upstream reach of the estuary within the Masterplan Ems 2050 framework, with additional pilots in the Ems-Dollart area being prepared. Both countries are collaborating on developing a future-proof ecological sediment management strategy.



Tidal marshes and vegetation in Ems Dollard, photo credit: Programma Eems-Dollard 2050



## Ecosystem

Marine and coastal ecosystems involving mudflats, tidal and salt marsh, estuaries. The Wadden Sea is continuously shaped by wind, waves and tides moving the sand and silt. These natural processes, running uninterruptedly across the Wadden Sea create islands, sandbanks, channels, mudflats, gullies, salt marshes and dunes.

### Ecosystem type

Marine involving mudflats, tidal and salt marsh, estuaries

### Key species

Due to its unique composition, the Wadden Sea is one of the main hotspots of biodiversity globally. Annually it attracts 10-12 million migratory birds that are on



Marsh cliff with dike in Ems Dollard, photo credit: Björn Wylezich, stockadobe.com

their way to their breeding or wintering grounds. There are over 10,000 plant and animal species, such as the harbour/grey seal, plaice, sole, dab, gull, oystercatcher, redshank, blue mussel, Pacific oyster and seagrass.



Eurasian oystercatcher *Haematopus ostralegus*, photo credit: Alexander Limbach, stockadobe.com



Harbour seal *Phoca vitulina*, photo credit: Björn Wylezich, stockadobe.com

## Cross-Border Climate Adaptation Efforts and Collaboration

The Dutch and German measures share the same core objectives:

- Improving water quality in the estuary and reducing turbidity
- Restoring wetlands within the estuary and behind existing flood defences to recover dynamics and create new habitats
- Adapting to climate change with a focus on enhancing the quality of life

### Netherlands: Eems-Dollard 2050

The Eems-Dollard2050 program started in 2016 and explores two main solution directions:

- 1 Creating a Dynamic Land-Water Interface:
  - Breaking the hard boundary between land and water, allowing more space for natural systems.
  - Ongoing projects:** Groote Polder, scaling up opportunities in program VLOED.
  - Implemented projects:** Breebaart, Dubbele Dijk, Marconi.
- 2 Beneficial Use of Dredged Sediments:
  - Storing dredged sludge from harbours on land and using it beneficially, such as for ripening dyke clay, raising land, and building clay blocks.
  - Pilot projects:** Clay ripening, Wide Green Dike, raising farming land, and scaling up opportunities.

## Germany: Masterplan Ems 2050

The Masterplan Ems 2050, initiated in 2014, aims to improve the Ems estuary by addressing:

The fluid mud problem in the Unterems upstream of Dollart

- Ecological status in the tidal reach to achieve favourable conservation conditions by reducing upstream sediment transport.
- Creation and improvement of estuarine habitats and species.
- Protection of birds and their habitats.
- Maintaining the Ems as an efficient transportation route for ports and the port-related economy.

Several pilot projects supporting these aims and aligned with the joint ecological sediment management strategy are planned to start in 2024. The main goals include:

- Ensuring the growth of mudflats and forelands.
- Improving the quality and growth of seagrass and salt marshes.
- Removal or fixation of fine sediment to reduce turbidity.

- Sustainable protection of existing protected areas.
- Utilising fine sediments to raise the coastal zone.

In general, activities focus on measures to reduce fine sediments in the inner estuary.

## Collaboration between National and Regional Governments

National and regional governments need to collaborate with various key players to address several important issues:

- Socio-Economic and Financial Aspects:** Focus on reducing peat oxidation and creating freshwater buffers by raising surface water levels.
- Strategic Steps for Support and Implementation:** Addressing current issues and managing the tension between the interests of the agricultural sector and nature restoration.
- Integrated Solutions:** Developing solutions that offer multiple benefits to tackle mixed problems.
- While new measures are being implemented, ports in the estuary remain crucial to the economy, necessitating the continuation of dredging in shipping channels.



Bird nesting island in Ems Dollard, photo credit: Rijkswaterstaat



## Threats and challenges

The Ems-Dollard estuary is facing both local and global threats. Rising temperatures and extreme weather events have caused shifts in the geographical distribution of species. Many species are moving to deeper, cooler areas, and there are changes in the timing of bird migration and reproduction. Additionally, alien species pose a potential threat, as they can become invasive, altering the trophic regimes and habitats of the Wadden Sea.

### Navigation

Regular maintenance dredging is necessary to keep ports and fairways deep enough for ship navigation. However, dredging and sediment disposal, along with channel deepening, have contributed to the turbidity of the environment. Additionally, historic land reclamation has removed natural sediment sinks that could have helped reduce turbidity.

While coastal restoration, protection activities, and economic activities (such as modifications to estuaries) directly impact the site, larger-scale factors like climate variability and sediment availability also play significant roles.

### Ecological issues

- Excessive sedimentation leading to estuary silting
- Decline in natural habitats, including salt marshes, mussel beds, and eelgrass

- Lack of fresh-salt transition zones, reducing ecological connectivity
- Reduction in food sources for fish and birds
- Decrease in suitable nursery areas for juvenile fish
- Relative sea level rise, threatening intertidal and supratidal habitats, potentially causing complete submersion of the system

### Climate-Related Challenges

- Rising sea levels causing flooding and coastal erosion
- Increased peaks in water runoff
- Longer periods of extreme heat and drought






### Inland Issues

- Soil subsidence due to gas extraction
- Relative land lowering compared to rising sea levels and expanding forelands, reducing natural drainage capability
- Increased risk of inundation during floods
- Peat oxidation
- Salinization, particularly threatening agricultural functions








Oyster and mussel reefs in Ems Dollard, photo credit: Programma Eems-Dollard 2050



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**Nature-Based Solutions (NbS) and Ecosystem Services (ESS):** Implementation of NbS building blocks at pilot sites to deliver crucial ecosystem services, including the restoration of seagrass and salt marshes to enhance carbon sequestration and provide protection against coastal erosion and flooding.
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**Support for Biodiversity:** Restoration efforts will support migratory and breeding wetland birds and fish species, contributing to overall biodiversity improvement.
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**Pioneer Saltmarsh Creation:** Establishing pioneer saltmarshes by elevating the seabed, incorporating sediments with specific characteristics, and constructing permeable structures to enhance habitat quality.
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**Controlled Flooding Areas:** Increasing the extent of saltmarsh and summer polder areas through the creation of tidal inlets and the submersion of landward polder areas, promoting habitat diversity and resilience.
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**Agricultural Improvements Inland:** Enhancing agricultural areas by raising land levels, reducing salinization, and improving dewatering properties, thereby supporting sustainable agricultural practices.

By implementing these measures, the projects aim to create a sustainable and resilient Ems-Dollard estuary, fostering biodiversity, enhancing ecosystem services, and improving agricultural practices.

### Challenges and risks

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 Ensuring a coherent approach to water safety, water system management, and economic considerations.
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 Resolving conflicting interests and adhering to laws and regulations.
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 Balancing short-term and long-term perspectives.
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 Managing resistance from local inhabitants.
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 Securing financing from different sectoral budgets and combining public and private funds.
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 By addressing these challenges, the projects aim to create a sustainable and resilient Ems-Dollard estuary, supporting biodiversity, enhancing ecosystem services, and improving agricultural practices.



Erosion holes in tidal marshes, photo credit: creativenature.nl, stockadobe.com



# Stakeholders

As the Wadden Sea is part of three countries, it is governed on different levels. National, federal (Germany) and regional level with its regulatory framework differing in each country. Since all three countries are part of the European Union, they have to conform to EU Directives, such as the Habitats and Birds Directives and related Natura 2000 sites, the Marine Strategy Framework Directive and Water Framework Directive. In order to preserve the “biological, scenic and scientific importance of the Wadden Sea” the three countries bordering the Wadden Sea agreed to

cooperate on protecting it and established the Trilateral Wadden Sea Cooperation (TWSC).

**Partners**  
Ministries, Provinces, Municipalities, Waterboards, NGOs, Users, Influencers, Knowledge institutes, Supporting organisations, etc.



Agricultural fields and wind turbines in Ems Dollard, photo credit: familie-eisenlohr.de, stockadobe.com



# Modelling

The modelling efforts by Deltares, Hereon, and NL-WKN aim to develop a shared understanding of the Ems-Dollard estuary system and provide insights into the effectiveness of Nature-Based Solutions (NBS) for the area. The primary focus areas of these modelling activities include:

- Sediment distribution, flows, and morphological changes.
- Projecting changes in ecotopes (habitats for species).

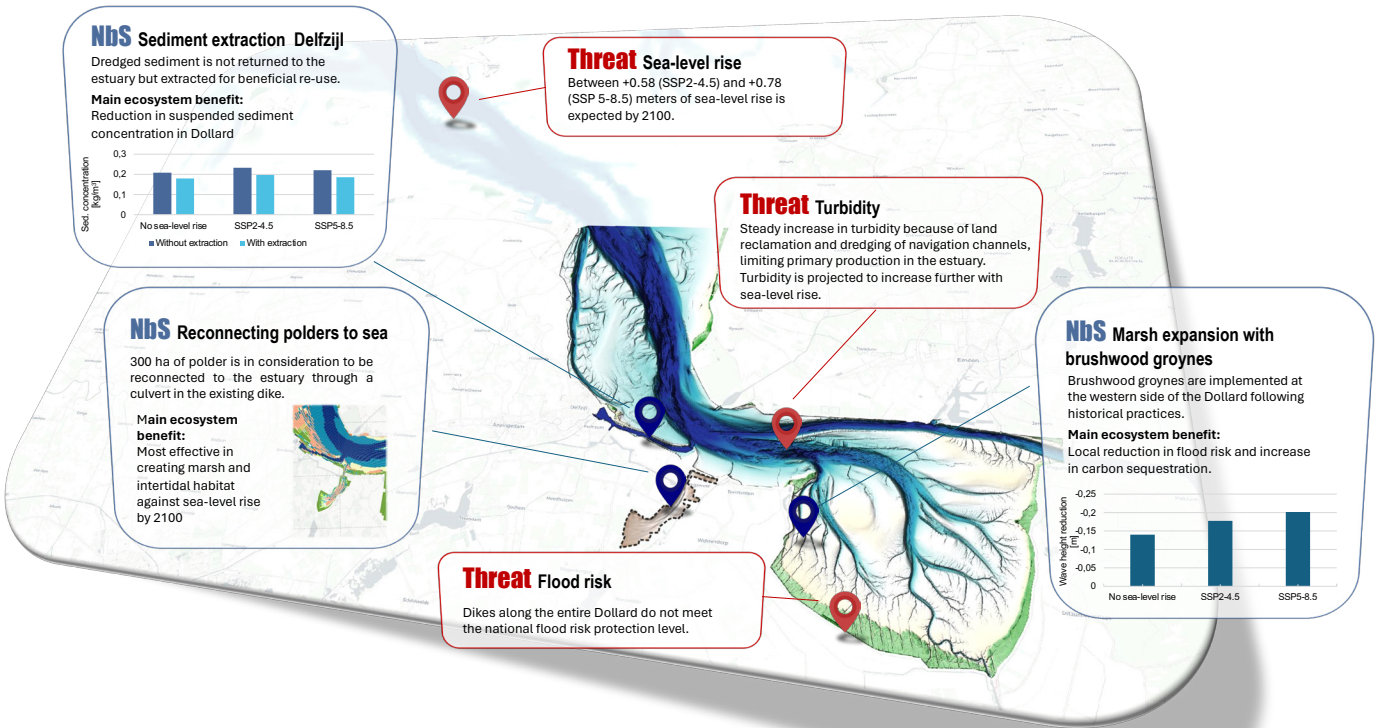
A key variable in environmental modelling, particularly regarding the impact of sea level rise on ecosystem services, is morphological adaptation. This project emphasizes the morphological adaptation of the Ems Estuary to climate change, combined with habitat restoration. Model outputs will be analysed concerning ecosystem services, especially coastal erosion, flood risk, and changes in ecotopes.

For the Ems-Dollard estuary, the primary question is: Which areas can benefit from sea-level rise in terms of sediment surplus, and what quality of natural habitat can be added to the estuary?

The role of NbS is also explored, particularly the hydrodynamic engineering capabilities of restored coastal seagrass vegetation and salt marshes along the German Wadden Sea. The focus is on the ecosystem services of reducing flood risk and coastal erosion under climate projections involving accelerating sea-level rise.

Relevant monitoring activities include observing biological, geophysical, and hydrological effects, such as:

- Habitat types and species abundance.
- Bathymetric changes and hydrodynamic parameters affecting morphological dynamics (sea level, waves, currents).



Map of the Ems Dollard estuary with threats and restoration measures explored by modelling, credit: Richard Marijnissen