



SALT MARSH RESTORATION

ADDRESSED
HAZARDSPROTECTED CRITICAL
INFRASTRUCTURE

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Salt marshes act as natural buffers, reducing the impact of coastal hazards such as storm surges and erosion while providing critical habitat for wildlife.

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Primary functions and key services

(Vuik et al., 2019; Marin-Diaz et al., 2023)

- **Flood Risk Reduction:** salt marshes act as vegetated foreshores that reduce wave loads on coastal structures such as dikes and dams, lowering the impact of storm surges on **flood barriers, roads, and urban drainage systems in the coastal zone.**
- **Wave Energy Attenuation:** the dense vegetation and sediment trap reduce wave height and energy, lessening stress on coastal defences like **seawalls and dikes.**
- **Sediment Accretion:** marshes trap sediment, gradually raising the coastal elevation and improving natural flood defence over time. This helps in preventing erosion-induced damage to **dikes, embankments, and coastal roads.**
- **Coastal Erosion Prevention:** root systems stabilise soil, reducing erosion and protecting coastal structures from degradation, helping to prevent foundation exposure of **roads and bridges.**

Site suitability, scale and coverage

Salt marshes are best suited for coastal areas with low-lying flood-prone zones, estuaries, and deltas where they can serve as a buffer against storm surges and coastal erosion. They are effective in protecting coastal infrastructure such as dikes, seawalls, ports, and transport networks.

Their role in sediment accretion makes them valuable for stabilising shorelines near industrial zones and settlements. The scale of implementation ranges from small riparian buffer zones to extensive regional coastal restoration projects, depending on hazard exposure and geographical context.

What is it?

Salt marsh restoration enhances coastal resilience by reducing flood risk and preventing erosion. By dissipating wave energy, salt marshes protect critical infrastructure such as dikes, seawalls, roads, and urban drainage systems from storm surges and long-term degradation. Their ability to trap and accumulate sediment raises coastal elevation over time, reinforcing shoreline stability and reducing maintenance costs for flood protection structures. Beyond infrastructure protection, salt marshes deliver essential ecosystem services. They support biodiversity by providing breeding and feeding grounds for fish, birds, and other wildlife. Additionally, their natural filtration capacity improves water quality by removing excess nutrients and pollutants from runoff, benefiting both marine and human communities. These multifunctional benefits make salt marsh restoration a cost-effective and sustainable strategy for coastal adaptation and long-term environmental health.

Challenges this NbS addresses

- **Floods** – prevention/reduction: absorb and dissipate wave energy, reducing coastal and inland flooding risks.
- **Coastal erosion** – prevention: stabilise sediments and protect shorelines from erosion and storm surges.
- **Climate change** – mitigation: sequester carbon in vegetation and sediments.
- **Storm surges** – reduction: lower wave energy and surge height.
- **Biodiversity loss** – recovery: provide habitats for diverse aquatic species and birds.
- **Water quality improvement** – prevention: Filter excess nutrients and pollutants, improving water quality.
- **Drought** – reduction: regulate local humidity and support groundwater recharge.

Ecosystem services

- ▶ **Carbon Sequestration:** salt-tolerant vegetation captures CO₂, with organic carbon stored long-term in biomass and the underlying sediments.
- ▶ **Biodiversity Support:** salt marshes provide habitat for diverse species, enhancing local biodiversity.
- ▶ **Water Purification:** trap pollutants, sediments, and nutrients, improving water quality.
- ▶ **Soil Formation:** salt marshes contribute to soil development by trapping sediment, improving coastal elevation over time.
- ▶ **Provisioning of Fisheries:** salt marshes provide critical breeding grounds for fish and other marine life, supporting local fisheries.
- ▶ **Cultural and Recreational Services:** these areas offer opportunities for ecotourism and cultural activities, supporting local economies.
- ▶ **Primary Production:** salt marshes contribute organic.



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Cost-benefit profile

Restoring salt marshes involves significant costs but offers long-term economic and environmental benefits. Restoration expenses vary, with estimates ranging from \$454,701 to \$1,418,770 per hectare (Wang et al., 2022).

Despite these costs, salt marshes provide valuable ecosystem services, including flood protection, carbon sequestration, and water filtration. They act as natural coastal defences, reducing wave energy and flood damage, which can lower disaster recovery costs. Many projects recover their financial investments through these benefits (Wang et al., 2022). In the USA alone, the risk reduction of 7,200 acres of salt marsh restoration is valued at \$21 million under current climate conditions, and to \$106 million with 0.5m sea-level rise and \$499 million with 1m sea-level rise (The Nature Conservancy, 2021).

Beyond direct economic returns from flood defence, salt marsh restoration enhances biodiversity, improves water quality, and contributes to long-term carbon storage.

Main components

Vegetation: salt-tolerant plants including grasses, shrubs, and herbs, which stabilise the soil and provide habitat.

Water: brackish or saline water that fluctuates with tidal changes, providing nutrients and supporting aquatic life.

Mudflats: shallow, flat areas between marsh vegetation trap sediment and slow down tidal flows, enhancing flood regulation.

Sediment: mud, sand, and organic matter accumulate in the marsh, forming the foundation of the ecosystem.

Environmental impacts (EU taxonomy)

- Climate change mitigation
- Climate change adaptation
- Sustainable use and protection of water and marine resources
- Transition to a circular economy
- Pollution prevention and control
- Protection and restoration of biodiversity and ecosystems.

Example of installation

- ▶ **Great Meadows Marsh Restoration – Strengthening Coastal Resilience in Connecticut** (NOAA Fisheries, 2022).
- ▶ **Location:** Stratford, Connecticut, USA
- ▶ **Implemented by:** NOAA, Audubon Connecticut, U.S. Fish and Wildlife Service, Connecticut Department of Energy and Environmental Protection
- ▶ **Projected Description and results:**
 - Restore nearly 40 acres of salt marsh and coastal habitats to enhance resilience against sea level rise.
 - Improve habitat for fish species.
 - Excavated and redistributed soil to increase marsh elevation and improve tidal flow.
 - Removed invasive plants and planted native vegetation to support long-term marsh health.

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