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NbS Fresco



A collaborative tool for exploring, understanding,and promoting Nature-based Solutions for climate adaptation and resilience.

Catalogue

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NBRACER
Nature Based Solutions
for Atlantic Regional Climate Resilience

Network Nature

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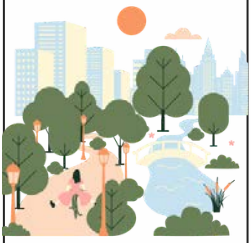
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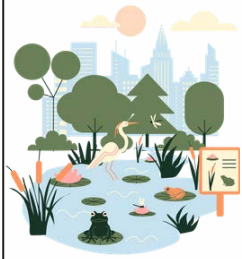
Network Nature

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Urban Landscape



Green corridors



Constructed inland Wetland



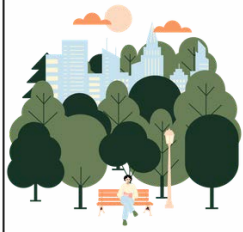
Urban farming



Bioretention areas



River & stream renaturation



Urban & pocket forests



Green roofs & walls

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Rural Landscape



Agroforestry



Riparian Buffer Zones



Re-meandering of Rivers



Wetland Construction and Restoration



Pollinator Habitats and Corridors



Soil Conservation Practices



Variable Retention Forestry



Pasture and range land management

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Marine & Coastal Landscape



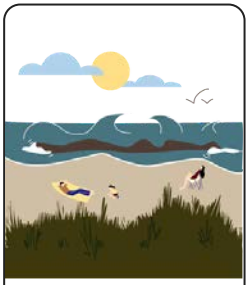
Dune and Cliff Restoration



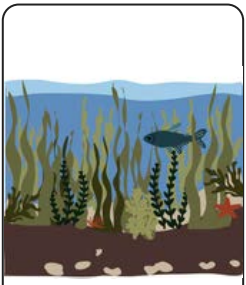
Seagrass Meadow Restoration



Salt Marsh Restoration



Living Breakwaters and Reefs



Kelp Forest Restoration



Estuary Naturalization



Floating Wetlands

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Green corridors

Green corridors are elements of urban green infrastructure that connect patches of natural or semi-natural vegetation, facilitating ecological connectivity and allowing species to move, adapt, and shift their ranges in response to environmental changes such as climate change. These corridors form part of ecological networks that enhance resilience by maintaining biodiversity and ecosystem functions within urban and peri-urban landscapes. They are often integrated alongside other infrastructure such as grass ditches, water storage gardens, and recessed green spaces to reduce climate risks like urban heat and flooding.

Biodiversity Pressures

- Land-use Change
- Climate Change
- Pollutions

Climate Hazards

- Temperature Change or Variability
- Precipitation Change or Variability
- Drought



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Flooding


Heat stress


Soil degradation


Loss of ecosystem services

Impacts: Humans


Safety, health, and well-being


Energy insecurity

Benefits: Humans


Aesthetic Value


Recreation/ Tourism


Health & Wellbeing

Benefits: Natural ecosystems


Ecosystem Connectivity


Biodiversity Conservation or Restoration


Climate Regulation


Air quality Regulation


Erosion Control


Water Runoff Reduction


Wind Buffering


Pollination


Habitat restoration and/ or creation


Cooling


Shading

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Constructed (inland) wetlands

Constructed inland wetlands are engineered systems that mimic natural wetlands to treat wastewater and stormwater by filtering pollutants through plants, soil, and microbes. They sequester carbon via plant growth and sediment accumulation, aiding climate mitigation. These wetlands also reduce flood risks by storing excess water, support biodiversity, and cool urban areas. Integrated into city landscapes as green infrastructure, they provide recreational spaces while enhancing climate adaptation and ecosystem resilience. Their adaptability makes them a sustainable solution for urban water management and ecological restoration.

Biodiversity Pressures

- Land-use Change
- Climate Change
- Pollutions

Climate Hazards

- Storm
- Precipitation Change or Variability
- Drought



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Flooding


Heat stress


Soil degradation


Loss of ecosystem services


Water stress

Benefits: Natural ecosystems


Biodiversity Conservation or Restoration


Climate Regulation


Water Runoff Reduction


Habitat restoration and/ or creation


Cooling

Impacts: Humans


Safety, health, and well-being


Infrastructure damage

Benefits: Humans


Recreation/ Tourism


Health & Wellbeing

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Urban farming

Urban farming encompasses local food-growing networks in cities that integrate production, processing, and distribution to enhance sustainability, food security, and community resilience. These systems-ranging from rooftop gardens and vertical farms to community plots - reduce food miles, improve access to fresh produce, and foster social cohesion. By utilizing green spaces efficiently, urban farming also contributes to climate adaptation, biodiversity, and urban greening, while empowering residents through education and economic opportunities.

Biodiversity Pressures

- Land-use Change
- Climate Change

Climate Hazards

- Temperature Change or Variability
- Precipitation Change or Variability
- Drought



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Impacts: Natural ecosystems


Biodiversity degradation


Soil degradation


Loss of ecosystem services

Impacts: Humans


Safety, health, and well-being


Food insecurity

Benefits: Natural ecosystems


Soil Formation and Fertility


Biodiversity Conservation or Restoration


Climate Regulation


Air quality Regulation


Erosion Control


Water Runoff Reduction


Pollination


Habitat restoration and/ or creation


Shading

Benefits: Humans


Educational Value


Recreation/ Tourism


Cultural Heritage


Health & Wellbeing


Community Engagement and empowerment


Social Equity and Environmental Justice


Economic Value


Food provision

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Bioretention areas

Bioretention areas are vegetated depressions—such as bioswales, rain gardens, or retention ponds—that capture, store, and slowly release stormwater to mitigate runoff. Acting as natural filters, they trap pollutants via soil and plant systems, recharge groundwater, and reduce urban flooding while enhancing biodiversity.

These green infrastructure solutions also cool urban heat islands, improve air and water quality, and support climate resilience in cities. Their adaptability enables seamless integration into streetscapes, parks, and parking lots,.

Biodiversity Pressures

- Land-use Change
- Climate Change

Climate Hazards

- Precipitation Change or Variability
- Drought



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Impacts: Natural ecosystems


Water quality loss


Flooding


Water stress


Soil degradation


Loss of ecosystem services

Benefits: Natural ecosystems


Climate Regulation


Erosion Control


Water Quality Regulation


Resistance to Pest and Diseases


Water Runoff Reduction


Cooling

Impacts: Humans


Infrastructure damage


Drinking water scarcity

Benefits: Humans


Aesthetic Value


Infrastructure protection


Water provision

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River and stream renaturation

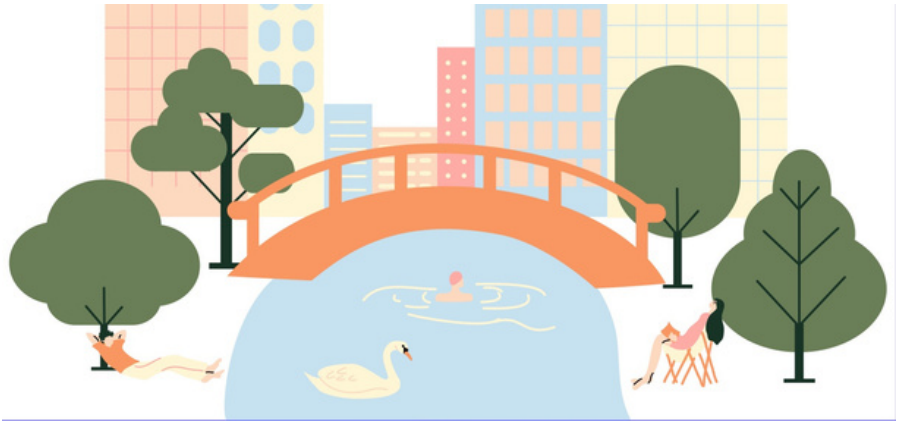
River and stream renaturation in urban areas restores natural hydrological processes by re-establishing riparian corridors, removing artificial embankments, and revegetating riverbeds and banks.
These actions revive biodiversity, improve water quality through natural filtration, and reduce flood risks by enabling healthier water flow. The process also cools urban microclimates, creates green corridors for recreation, and fosters community connection to nature, enhancing urban resilience and livability.

Biodiversity Pressures

- Land-use Change
- Climate Change

Climate Hazards

- Precipitation Change or Variability



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Fresh water scarcity


Water quality loss


Flooding


Water stress


Loss of ecosystem services

Benefits: Natural ecosystems


Ecosystem Connectivity


Biodiversity Conservation or Restoration


Climate Regulation


Water flow regulation


Water Runoff Reduction


Habitat restoration and/ or creation


Cooling

Impacts: Humans


Safety, health, and well-being


Infrastructure damage

Benefits: Humans


Recreation/ Tourism


Health & Wellbeing


Infrastructure protection


Economic Value


Water provision

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Urban & Pocket Forests

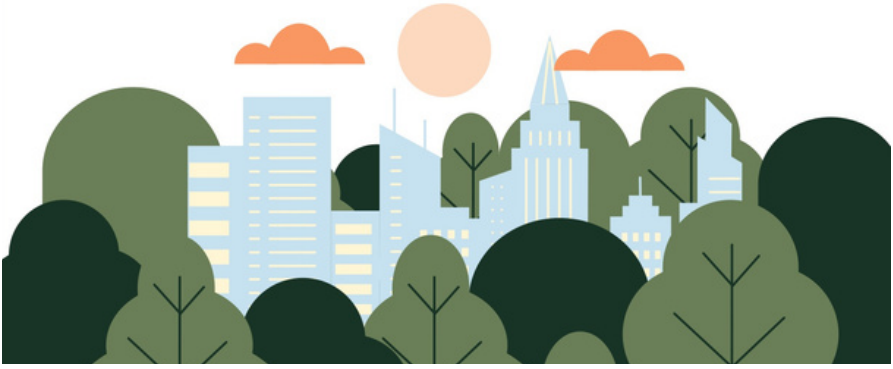
Urban and pocket forests are dense, native tree networks - from small groves to compact woodland- planted and preserved in cities. They cool urban heat islands, purify air by filtering pollutants, and create habitats for pollinators and birds, while providing shade and reducing noise. They create tranquil pockets for communities, improving mental and physical well-being while enhancing urban resilience and sustainability.

Biodiversity Pressures

- Land-use Change
- Climate Change
- Pollutions

Climate Hazards

- Temperature Change or Variability
- Precipitation Change or Variability
- Drought



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Flooding


Heat stress


Soil degradation


Loss of ecosystem services

Impacts: Humans


Safety, health, and well-being

Benefits: Humans


Aesthetic Value


Recreation/ Tourism


Cultural Heritage


Health & Wellbeing

Benefits: Natural ecosystems


Ecosystem Connectivity


Biodiversity Conservation or Restoration


Climate Regulation


Air quality Regulation


Water flow regulation


Water Runoff Reduction


Wind Buffering


Soil Formation and Fertility


Pollination


Habitat restoration and/ or creation


Cooling


Shading

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Green roofs & walls

River and stream renaturation in urban areas involves concrete actions like re-establishing riparian corridors, removing concrete embankments, and revegetating riverbeds and banks.
These measures restore natural water flow, reduce flooding, and filter pollutants while reviving biodiversity. They result in healthier ecosystems, cooler urban microclimates, and spaces for recreation and community connection.

Biodiversity Pressures

- Land-use Change
- Climate Change
- Pollutions

Climate Hazards

- Temperature Change or Variability



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Dune and Cliff Restoration

Restoring coastal dunes and stabilizing cliffs employs natural vegetation, sand fencing, and structural reinforcements to combat erosion. Dunes serve as dynamic, self-renewing barriers that absorb and dissipate wave energy during storms, protecting inland infrastructure and communities. Cliff stabilization prevents landslides and rockfalls while preserving unique geological formations. These natural defenses adapt to changing sea levels and storm patterns, offering sustainable protection against coastal retreat. Beyond erosion control, restored dunes and cliffs support specialized flora and fauna, maintain scenic landscapes, and provide recreational spaces, making them multifaceted solutions for climate adaptation and ecosystem conservation.

Biodiversity Pressures

- Land-use Change
- Climate Change

Climate Hazards

- Storm
- Sea Level Rise



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Flooding


Storm Surge


Coastal erosion


Saline intrusion


Loss of ecosystem services

Impacts: Humans


Safety, health, and well-being


Infrastructure damage


Displacement and migration


Economic losses

Benefits: Natural ecosystems


Ecosystem Connectivity


Biodiversity Conservation or Restoration


Water flow regulation


Habitat restoration and/ or creation


Erosion Control


Natural Hazard Regulation

Benefits: Humans


Recreation/ Tourism


Health & Wellbeing


Infrastructure protection


Economic Value


Educational Value


Aesthetic Value


Cultural Heritage


Community Engagement and empowerment

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Seagrass Meadow Restoration

Seagrass meadows are flowering plants that form extensive underwater grasslands in shallow coastal waters. Restoring these meadows delivers exceptional climate benefits, as they sequester carbon at rates up to thirty-five times greater than tropical rainforests. They stabilize sediments, improve water quality, and provide critical nursery habitats for commercially important fish species and endangered marine organisms. Seagrass beds also dampen wave energy, reducing coastal erosion and protecting shorelines from storm surges. Their recovery supports local fisheries, enhances biodiversity, and creates resilient coastal ecosystems capable of adapting to rising sea temperatures and ocean acidification.

Biodiversity Pressures

- Land-use Change
- Climate Change
- Invasive Alien Species

Climate Hazards

- Storm
- Sea Level Rise
- Temperature Change or Variability



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Storm Surge


Loss of ecosystem services


Ocean acidification


Water quality loss

Benefits: Natural ecosystems


Ecosystem Connectivity


Biodiversity Conservation or Restoration


Water flow regulation


Habitat restoration and/ or creation


Erosion Control


Water Quality Regulation

Impacts: Humans


Safety, health, and well-being


Displacement and migration


Economic losses


Food insecurity

Benefits: Humans


Recreation/ Tourism


Infrastructure protection


Economic Value


Educational Value


Food provision

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Salt Marsh Restoration

Salt marshes are intertidal wetlands regularly flooded by tides, creating highly productive ecosystems. Restoration involves re-establishing natural hydrology, replanting native vegetation, and removing invasive species. These marshes excel at carbon sequestration, storing vast amounts of carbon in their waterlogged soils for millennia. They buffer coastlines against storm surges, absorbing floodwaters and reducing wave energy. Salt marshes also filter agricultural runoff and urban pollutants, improving downstream water quality. As nurseries for fish and shellfish, they support commercial and recreational fisheries while providing essential habitat for migratory birds and diverse wildlife species.

Biodiversity Pressures

- Land-use Change
- Climate Change
- Pollutions
- Invasive Alien Species

Climate Hazards

- Storm
- Sea Level Rise
- Precipitation Change or Variability



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Flooding


Storm Surge


Coastal erosion


Saline intrusion


Loss of ecosystem services


Water quality loss


Heat stress

Impacts: Humans


Infrastructure damage


Displacement and migration


Economic losses


Drinking water scarcity

Benefits: Natural ecosystems


Ecosystem Connectivity


Biodiversity Conservation or Restoration


Water flow regulation


Habitat restoration and/ or creation


Natural Hazard Regulation


Climate Regulation


Water Quality Regulation

Benefits: Humans


Recreation/ Tourism


Health & Wellbeing


Infrastructure protection


Educational Value


Aesthetic Value


Cultural Heritage

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Living Breakwaters and Reefs

Living breakwaters and reefs are engineered structures designed to replicate natural reef systems, typically using sustainable materials like oyster shells, coral fragments, or concrete modules. These submerged formations dissipate wave energy before it reaches shorelines, significantly reducing erosion and flooding risks. Unlike conventional seawalls, living structures promote marine biodiversity by providing attachment surfaces for corals, sponges, and invertebrates. They create complex three-dimensional habitats supporting fish populations and enhancing local fisheries. Additionally, these solutions offer recreational opportunities, support ecotourism, and adapt dynamically to changing environmental conditions, offering long-term coastal protection.

Biodiversity Pressures

- Climate Change
- Resource Overexploitation

Climate Hazards

- Sea Level Rise
- Changing Wind Patterns
- Storm



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Storm Surge


Loss of ecosystem services


Flooding


Coastal erosion

Impacts: Humans


Safety, health, and well-being


Displacement and migration


Economic losses


Food insecurity


Infrastructure damage

Benefits: Natural ecosystems


Ecosystem Connectivity


Biodiversity Conservation or Restoration


Water flow regulation


Habitat restoration and/ or creation


Erosion Control


Water Quality Regulation


Wind Buffering


Natural Hazard Regulation

Benefits: Humans


Recreation/ Tourism


Infrastructure protection


Economic Value


Educational Value


Food provision

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Kelp forest restoration

Kelp forests are large brown algae that form dense underwater canopies in cold, nutrient-rich waters. Restoring these forests involves seeding kelp spores, protecting juvenile plants from herbivores, and monitoring ecosystem health. Kelp grows remarkably fast, up to half a meter daily, making it one of Earth's most efficient carbon absorbers. These forests provide complex three-dimensional habitats supporting extraordinary biodiversity, from invertebrates and fish to marine mammals and seabirds. Kelp forests also buffer coastlines against wave action, improve water quality through nutrient uptake, and support sustainable aquaculture and fisheries, contributing to both climate mitigation and local economies.

Biodiversity Pressures

- Land-use Change
- Climate Change
- Invasive Alien Species

Climate Hazards

- Temperature Change or Variability
- Sea Level Rise



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Loss of ecosystem services


Ocean acidification


Heat stress

Benefits: Natural ecosystems


Biodiversity Conservation or Restoration


Habitat restoration and/ or creation


Climate Regulation

Impacts: Humans


Economic losses


Food insecurity


Infrastructure damage

Benefits: Humans


Recreation/ Tourism


Economic Value


Food provision


Health & Wellbeing

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Estuary Naturalization

Estuary naturalization restores degraded river mouths and tidal zones to their natural, meandering configurations. This process involves removing channelization structures, reconnecting floodplains, and re-establishing natural sediment transport. Naturalized estuaries slow water velocities during high flows, reducing downstream flooding and erosion while recharging aquifers. These restored ecosystems filter pollutants, trap sediments, and transform nutrient loads through biological processes, dramatically improving water quality. Estuaries serve as critical transition zones supporting diverse species, including migratory fish, waterfowl, and invertebrates. They also provide carbon storage, recreational opportunities, and enhanced resilience to sea level rise and extreme weather events.

Biodiversity Pressures

- Land-use Change
- Climate Change

Climate Hazards

- Precipitation Change or Variability
- Sea Level Rise



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Loss of ecosystem services


Water quality loss


Coastal erosion


Saline intrusion


Flooding


Heat stress

Impacts: Humans


Safety, health, and well-being


Displacement and migration


Food insecurity


Infrastructure damage

Benefits: Natural ecosystems


Ecosystem Connectivity


Biodiversity Conservation or Restoration


Water flow regulation


Habitat restoration and/ or creation


Erosion Control


Water Quality Regulation


Climate Regulation

Benefits: Humans


Recreation/ Tourism


Infrastructure protection


Economic Value


Educational Value


Food provision


Health & Wellbeing


Community Engagement and empowerment

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Floating Wetlands

Floating wetlands are engineered platforms covered with native aquatic plants that rest on water surfaces, creating artificial marshes. These systems naturally absorb excess nutrients like nitrogen and phosphorus through plant uptake, significantly reducing eutrophication and improving water clarity. Root systems provide habitat for fish, amphibians, insects, and microorganisms, enhancing aquatic biodiversity. Floating wetlands stabilize shorelines, dampen wave energy, and reduce bank erosion. In urban environments, they mitigate heat island effects, sequester carbon, and create green spaces for education and recreation. Their modular design allows flexible deployment in diverse aquatic settings, from polluted harbors to ornamental ponds, offering scalable water quality improvement.

Biodiversity Pressures

- Land-use Change
- Climate Change
- Pollutions
- Invasive Alien Species

Climate Hazards

- Temperature Change or Variability
- Precipitation Change or Variability



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Storm Surge


Loss of ecosystem services


Ocean acidification


Water quality loss


Heat stress


Saline intrusion

Impacts: Humans


Safety, health, and well-being


Economic losses

Benefits: Natural ecosystems


Ecosystem Connectivity


Biodiversity Conservation or Restoration


Habitat restoration and/ or creation


Water Quality Regulation


Climate Regulation


Cooling

Benefits: Humans


Recreation/ Tourism


Economic Value


Educational Value


Aesthetic Value


Community Engagement and empowerment

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Agroforestry

Agroforestry is a land management practice that combines trees, crops, and sometimes livestock on the same plot. This integration creates diverse, productive, and sustainable rural landscapes. Trees provide shade, improve soil fertility through nutrient cycling, and enhance water retention. They also capture and store carbon, helping reduce greenhouse gases. By mixing species, agroforestry increases biodiversity and resilience to climate extremes. It supports farmers by diversifying income sources and improving food security. This approach balances agricultural production with ecosystem health, making it an effective nature-based solution for climate mitigation and adaptation in rural areas.

Pressures on biodiversity

- Land use change
- Climate change
- Pollution

Climate risks

- Temperature change or variability
- Precipitation change or variability
- Drought



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Soil degradation


Water quality loss


Water stress


Loss of ecosystem services

Impacts: Human


Safety, health and well-being


Food insecurity


Economic losses


Loss of traditional knowledge


Drinking water scarity

Benefits: Humans


Economic value


Food supply


Health and well-being

Benefits: Natural ecosystems


Soil Formation and Fertility


Biodiversity Conservation or Restoration


Climate regulation


Water quality regulation


Erosion control


Water Runoff Reduction


Pollination


Resistance to pests and diseases


Cooling


Community Engagement and empowerment


Educational value


Cultural Heritage


Social equity and environmental justice

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Riparian Buffer Zones

Riparian buffer zones are vegetated strips of trees, shrubs, and grasses planted along rivers and streams in rural landscapes. They protect water bodies by filtering pollutants, reducing soil erosion, and stabilizing banks. These buffers enhance biodiversity by providing habitat corridors and improve water quality, supporting ecosystem health. Riparian zones also sequester carbon, contributing to climate mitigation. By moderating microclimates and regulating water flow, they increase resilience to floods and droughts. This NbS integrates ecological benefits with agricultural productivity, making it vital for sustainable rural land management and climate adaptation.

Pressures on biodiversity

- Climate change
- Pollution

Climate risks

- Temperature change or variability
- Change or variability in precipitation



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Impacts: Natural ecosystems


Fresh water scarcity


Habitat fragmentation and loss


Flooding


Water quality loss


Water stress


Loss of ecosystem services

Impacts: Human


Safety, health and well-being


Infrastructure damage


Drinking water scarcity

Benefits: Natural ecosystems


Water flow regulation


Biodiversity Conservation or Restoration


Climate Regulation


Water Quality Regulation


Erosion Control


Water Runoff Reduction


Pollination


Natural Hazard Regulation


Cooling


Shading

Benefits: Humans


Infrastructure protection


Food provision


Health & Wellbeing


Community Engagement and empowerment


Educational Value


Aesthetic Value


Recreation/ Tourism

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Re-meandering of Rivers

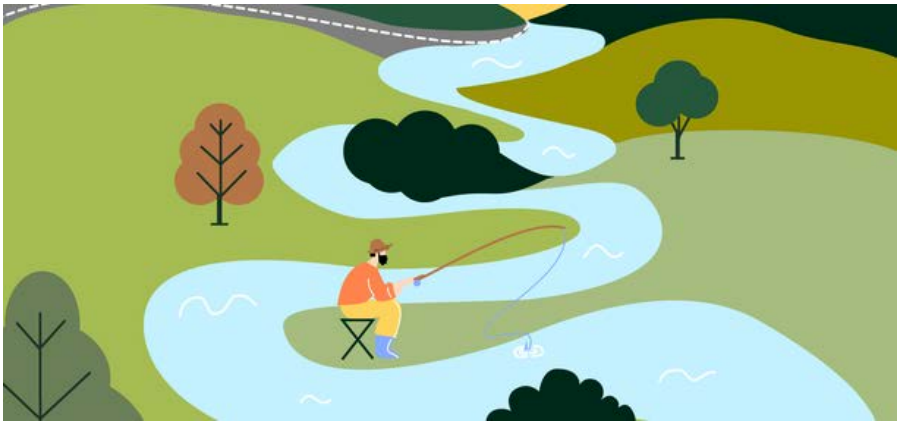
Re-meandering of rivers restores natural winding patterns to previously straightened or channelized river sections in rural areas. This process slows water flow, reduces erosion, and improves flood management by increasing water retention and groundwater recharge. Restored meanders enhance aquatic and riparian habitats, boosting biodiversity and ecosystem resilience. By reconnecting rivers with their floodplains, re-meandering supports nutrient cycling and sediment deposition, improving soil fertility. This nature-based solution helps mitigate climate impacts by reducing flood risks and enhancing landscape adaptability, while promoting healthier rural ecosystems and sustainable water management.

Pressures on biodiversity

- Land use change
- Climate change
- Pollution

Climate risks

- Change or variability in precipitation
- Drought
- Storm



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Impacts: Natural ecosystems


Fresh water scarcity


Habitat fragmentation and loss


Flooding


Water quality loss


Biodiversity degradation


Loss of ecosystem services

Benefits: Natural ecosystems


Water flow regulation


Biodiversity Conservation or Restoration


Climate Regulation


Water Quality Regulation


Erosion Control


Natural Hazard Regulation


Cooling

Impacts: Human


Safety, health and well-being


Infrastructure damage


Displacement and migration

Benefits: Humans


Infrastructure protection


Cultural Heritage


Health & Wellbeing


Community Engagement and empowerment


Aesthetic Value


Recreation/ Tourism

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Wetland Construction and Restoration

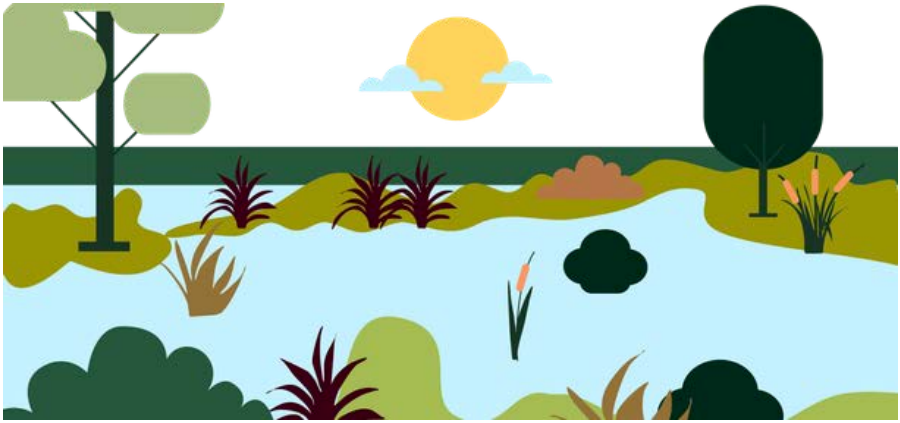
Wetland construction and restoration involve creating or rehabilitating wetlands in rural landscapes to revive natural water filtration, storage, and biodiversity functions. These wetlands act as carbon sinks, capturing greenhouse gases and helping mitigate climate change. They improve water quality by filtering pollutants and sediments, reduce flood risks by absorbing excess water, and recharge groundwater. Restored wetlands provide critical habitats for diverse species, enhancing ecosystem resilience. This NbS supports climate adaptation by regulating local microclimates and hydrology, while promoting sustainable land use and biodiversity conservation in rural areas.

Pressures on biodiversity

- Land use change
- Climate change
- Pollution

Climate risks

- Change or variability in precipitation
- Storm



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Impacts: Natural ecosystems


Fresh water scarcity


Habitat fragmentation and loss


Flooding


Water quality loss


Biodiversity degradation


Loss of ecosystem services

Benefits: Natural ecosystems


Water flow regulation


Biodiversity Conservation or Restoration


Climate Regulation


Water Quality Regulation


Soil Formation and Fertility


Cooling

Impacts: Human


Drinking water scarcity


Infrastructure damage


Displacement and migration

Benefits: Humans


Infrastructure protection


Cultural Heritage


Health & Wellbeing


Educational Value


Water provision


Recreation/ Tourism

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Pollinator Habitats and Corridors

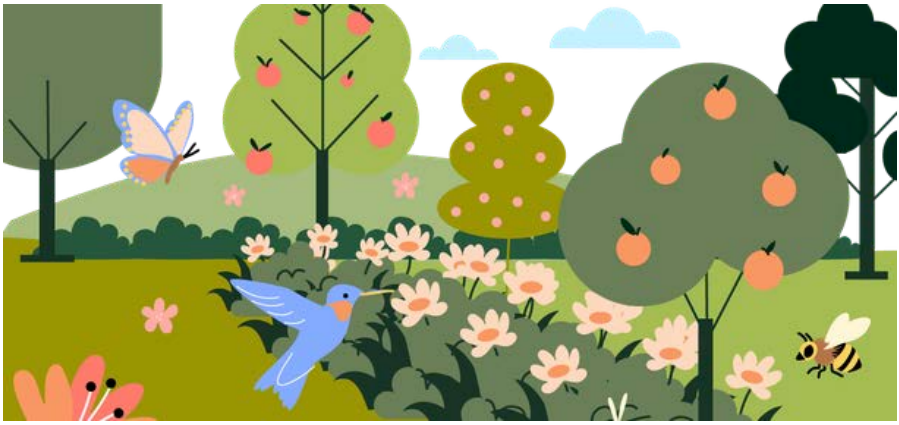
Pollinator habitats and corridors are designated areas in rural landscapes that provide food, shelter, and safe movement pathways for pollinators like bees, butterflies, and birds. These habitats support pollinator populations essential for crop pollination and biodiversity. Corridors connect fragmented habitats, allowing species to migrate and adapt to climate changes. By enhancing ecosystem health and resilience, they improve agricultural productivity and maintain genetic diversity. This NbS strengthens rural ecosystems, supports food security, and contributes to climate adaptation by sustaining vital ecological processes.

Pressures on biodiversity

- Land use change
- Climate change

Climate risks

- Temperature change or variability
- Change or variability in precipitation
- Drought



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Soil degradation


Loss of ecosystem services


Pests and diseases

Impacts: Human


Food insecurity


Economic losses


Loss of traditional knowledge


Drinking water scarcity

Benefits: Natural ecosystems


Biodiversity Conservation or Restoration


Erosion Control


Reduction of water runoff


Pollination


Resistance to pests and diseases


Restoration and/or creation of habitats


Wind buffering


Natural hazard regulation


Ecosystem connectivity

Benefits: Humans


Economic value


Food supply


Community engagement and empowerment


Educational value


Cultural Heritage

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Soil Conservation Practices

Soil conservation practices in rural landscapes include techniques such as contour farming, cover cropping, reduced tillage, and terracing to prevent soil erosion, enhance soil organic carbon, and improve water retention. These practices maintain soil fertility and structure, supporting sustainable agricultural productivity and ecosystem health. Soil conservation contributes to climate change mitigation by increasing carbon sequestration and reducing greenhouse gas emissions from degraded soils. Additionally, these practices enhance resilience to climate impacts by improving water availability and reducing vulnerability to drought and flooding, making them essential NbS for sustainable land management and climate adaptation.

Pressures on biodiversity

- Land use change
- Climate change
- Pollution
- Invasive alien species

Climate risks

- Temperature change or variability
- Change or variability in precipitation
- Drought



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Impacts: Natural ecosystems


Soil degradation


Water quality loss


Water stress


Loss of ecosystem services


Pests and diseases


Desertification

Impacts: Human


Safety, health, and well-being


Food insecurity


Economic losses


Loss of traditional knowledge


Drinking water scarcity


Displacement and migration

Benefits: Humans


Economic Value


Food provision


Health & Wellbeing

Benefits: Natural ecosystems


Soil Formation and Fertility


Biodiversity Conservation or Restoration


Climate Regulation


Water Quality Regulation


Erosion Control


Water Runoff Reduction


Pollination


Resistance to Pest and Diseases


Cooling


Educational Value


Cultural Heritage


Social Equity and Environmental Justice


Community Engagement and empowerment

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Variable Retention Forestry

Variable retention forestry is a sustainable forest management approach that retains selected trees and structural elements during harvesting to preserve forest complexity and biodiversity. This practice maintains habitat continuity, supports ecosystem functions, and enhances carbon storage in rural landscapes. VRF contributes to climate mitigation by sustaining carbon stocks and promoting forest resilience to climate change. It also supports adaptation by preserving microclimates and ecological processes, reducing vulnerability to disturbances. This NbS balances timber production with conservation goals, fostering multifunctional forests that enhance ecosystem services and long-term sustainability.

Pressures on biodiversity

- Overexploitation of resources
- Climate change

Climate risks

- Temperature change or variability
- Forest fire
- Storm



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Soil degradation


Loss of ecosystem services


Pests and diseases


Landslide/ Mudslide

Benefits: Natural ecosystems


Biodiversity Conservation or Restoration


Water Runoff Reduction


Pollination


Resistance to Pest and Diseases


Cooling


Wind Buffering


Climate Regulation


Air quality Regulation


Soil Formation and Fertility


Water Quality Regulation

Impacts: Human


Damage to infrastructure


Economic losses


Loss of traditional knowledge

Benefits: Humans


Economic Value


Food provision


Educational Value


Cultural Heritage

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Pasture and Rangeland Management

Pasture and rangeland management involves sustainable grazing practices that optimize vegetation cover, soil health, and carbon sequestration in rural landscapes. Techniques include rotational grazing, controlled stocking rates, and restoration of degraded lands to enhance biomass productivity and soil organic carbon. These practices are effective solutions to mitigate climate change by reducing greenhouse gas emissions and increasing carbon storage. Improved management also enhances ecosystem resilience, water retention, and biodiversity, supporting adaptation to climate variability. This approach promotes sustainable livestock production while maintaining ecosystem services and landscape multifunctionality.

Pressures on biodiversity

- Land use change
- Climate change
- Overexploitation of resources

Climate risks

- Temperature change or variability
- Change or variability in precipitation
- Drought



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Impacts: Natural ecosystems


Biodiversity degradation


Habitat fragmentation and loss


Soil degradation


Desertification


Water stress


Loss of ecosystem services

Benefits: Natural ecosystems


Soil Formation and Fertility


Biodiversity Conservation or Restoration


Climate Regulation


Water flow regulation


Erosion Control


Water Runoff Reduction


Pollination

Impacts: Human


Safety, health, and well-being


Food insecurity


Economic losses


Loss of traditional knowledge


Conflicts over resource use


Displacement and migration

Benefits: Humans


Economic Value


Food provision


Health & Wellbeing


Social Equity and Environmental Justice


Educational Value


Cultural Heritage


Community Engagement and empowerment

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Other Cards

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Risks - Biodiversity Pressures


Land-use Change


Resource Overexploitation


Climate Change


Pollutions


Invasive Alien Species

Risks - Climate Hazards


Temperature Change or Variability


Wildfire


Changing Wind Patterns


Storm


Precipitation Change or Variability


Sea Level Rise


Drought

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Impacts: Natural Ecosystems


Ocean acidification


Biodiversity degradation


Habitat fragmentation and loss


Pests and diseases


Fresh water scarcity


Water quality loss


Flooding


Heat stress


Water stress


Soil degradation


Storm Surge


Coastal erosion


Landslide/ Mudslide


Saline intrusion


Desertification


Loss of ecosystem services

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Impacts: Humans


Food insecurity


Infrastructure damage


Displacement and migration


Safety, health, and well-being


Economic losses


Energy insecurity


Loss of traditional knowledge


Conflicts over resource use


Drinking water scarcity

Funded by
the European Union

Benefits: Natural Ecosystems


Ecosystem Connectivity


Biodiversity Conservation or Restoration


Climate Regulation


Air quality Regulation


Water flow regulation


Erosion Control


Water Quality Regulation


Resistance to Pest and Diseases


Water Runoff Reduction


Wind Buffering


Natural Hazard Regulation


Soil Formation and Fertility


Pollination


Habitat restoration and/ or creation


Cooling


Shading

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Benefits: Humans


Educational Value


Aesthetic Value


Recreation/ Tourism


Cultural Heritage


Health & Wellbeing


Community Engagement and empowerment


Social Equity and Environmental Justice


Infrastructure protection


Economic Value


Food provision


Energy provision


Water provision


Raw material provision

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Barriers & Solutions Case studies

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Green Roofs & Walls

Urban case study: Milan, Italy

Barrier: Limited funding & resources

The Bosco Verticale are two residential towers that prioritize urban vegetation by integrating trees, shrubs, and flowering plants on every balcony. This architectural project, located in Milan (Italy), aims to improve air quality, provide shade, and reduce noise pollution from the city. Plants are often overlooked in urban design, but here, they take center stage.
The use of cherry, olive, and oak trees, already 3 to 6 meters tall, allowed residents to enjoy the harvest quickly, but it also posed a weight challenge.
The project underscores the importance of multidisciplinary collaboration. It was funded by public subsidies for ecological innovation and Hines Italia (a real estate developer).
Stakeholders: Horticulturists, botanists, architects, and engineers
Budget: 27-30M€



Image: https://www.arup.com/projects/bosco-verticale/

Barrier: Traditional buildings are not designed to support the weight of plants, nor the structures needed to hold them, let alone the weight of the soil and water they require. These adaptations increase the overall costs, which were already high.

Solution: To reduce this, the team optimized the soil composition by creating a lighter mixture of agricultural soil, organic matter, and volcanic material instead of plain soil. This permitted the use of less concrete and to lower the total cost of the buildings.

More info:

- https://www.re-thinkingthefuture.com/city-and-architecture/a14896-is-the-bosco-verticale-a-real-solution-or-just-expensive-foliage/
- https://worldgbc.org/article/its-not-that-easy-being-green/

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Constructed (inland) Wetlands

Urban case study: West Flanders, Belgium

Barrier: Social Acceptance and Cultural

This constructed wetlands project, implemented on a private individual's land for decentralized water treatment, took place in West-Flanders. The goal was to enable water purification in a natural setting and achieve independence from the centralized system. This was made possible through the use of plants and the biodiversity they foster, while also helping isolated individuals gain access to such systems.

Project stakeholders: Province of West-Vlaanderen, knowledge partner VITO, the property owner, several municipalities, local citizens, and the NBRACER project team.

Budget: 1.5-2M€



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Barrier: The system owner lacked technical knowledge for the NbS, which led to inadequate monitoring.

Solution: Project partner VITO organized workshops, discussions, and interviews, presenting scientific explanations and evidence of the system's efficiency. This approach helped stakeholders—both citizens and the owner—understand the benefits of this type of installation

More info:

- NBRACER project: https://nbracer.eu
- https://nbracer.eu/wp-content/uploads/2025/10/NBRACER-D3.1_Co-design-of-transformative-systemic-solutions-in-urban-landscape-systems.pdf
- https://miro.com/app/board/uXjVJGo_S94=/?share_link_id=671161909717

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Green Roofs & Walls

Urban case study: Rotterdam, Netherlands

Barrier: Governance and Institutional

The Hof van Heden project in Rotterdam emerged from the city's pressing housing shortage and the high waterproofing of its surfaces, a direct result of rapid urbanization. Addressing these intertwined challenges—while also combating temperature extremes, heat waves, heavy rainfall, and drought—required a holistic approach.

The project introduced communal gardens (small private gardens without fences or hedges), shared storage spaces, above-ground precipitation drains, and buffer zones to manage water flow. Urban forests and ecosystems were integrated as NbS to tackle air pollution, biodiversity loss, flooding, and heat stress, ultimately enhancing residents' quality of life.

Stakeholders: Public Works Department of Rotterdam Municipality (urbanism), atelier GROENBLAUW (architects), a group of future residents, the WiMBY! foundation (Welcome in My Backyard!), Vestia (a social housing cooperative), and an ecological landscape gardener.



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Barrier: Coordinating between diverse stakeholders with varying priorities slowed decision-making and implementation, and so did bureaucratic processes.

Solution: By fostering inclusive governance, the project ensured that all voices were heard, aligning objectives and streamlining collaboration. Regular co-design workshops and participatory planning sessions allowed stakeholders to collectively shape the project's direction. This approach not only improved efficiency but also strengthened institutional support for long-term success.

More info:

- https://urbangreenbluegrids.com/projects/hof-van-heden-rotterdam/
- https://www.ateliergroenblauw.nl/ontwerp/hof-van-heden/



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Green Corridors

Urban case study: Barcelona, Spain

Barrier: Spatial and Temporal

The "Supermanzanas" project is a greening project focused on neighborhoods and mobility axes in Barcelona, a city known for its heavy car traffic and the seasonal pressure from tourism, particularly during the summer months.

The goal is to create healthy public spaces by establishing green corridors that help purify the air, manage heavy rainfall, droughts, heat, and drafts. Beyond environmental benefits, the project also aims to foster social interactions, boost the local economy, and enhance safety.

Project participation was made open to anyone who wanted to contribute.

Stakeholders: The main actors include the Municipality of Barcelona, as well as neighbors, local entities, and collectives.

Budget: 5-10M€

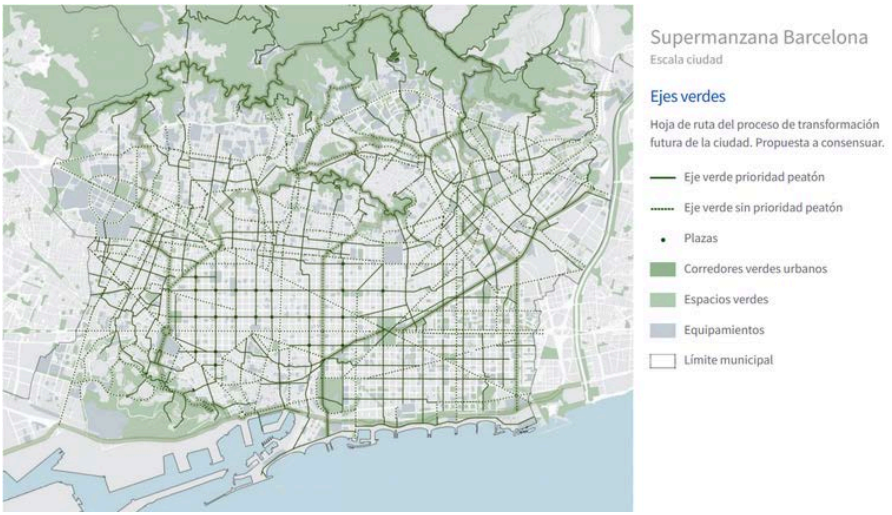


Barrier: The project faced spatial and temporal challenges, as Barcelona attracts a large number of tourists every year. Altering traffic routes can significantly impact mobility and tourism within the city.

Solution: The city council decided to spread the work outside the summer season and divide the project by collectives. Given the city's size and density, this approach makes it easier to manage the project in smaller, more manageable sections.

More info:

- https://planbleu.org/wp-content/uploads/2024/07/Plan-Bleu-NbS-in-Mediterranean-cities-report_Final.pdf
- https://ajuntament.barcelona.cat/superilles/es/content/documentacion_ejes



Link: https://ajuntament.barcelona.cat/superilles/es

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Wetland Restoration

Rural case study: Ciobarciu, Romania

Barrier: Limited funding and resources

The restoration of wetlands near the village of Costuleni in Romania aimed to create 250 hectares of wetland by raising the water level in an embanked area. By excavating and reopening old river meanders that had been filled in, the team created a variety of new habitats, including deep and shallow water zones as well as dry land.

This project also restored the meanders of the Old Jijia River, improving connectivity and ecosystem diversity.

Stakeholders: Collaboration between the Prut–Barlad River Basin Authority, RIZA (Dutch government agency for water management), Hunze & Aa's (regional water authority in the northern Netherlands), and the NGO Het Drentsche Landschap.

Budget: 400k€

CIOBARCIU WETLAND FIVE YEARS AFTER PROJECT COMPLETION (MARK CORNELISSEN, JUNE 2011)



Barrier: Securing funding proved difficult, as purchasing the land required for the wetlands consumed a significant portion of the budget. Local funders were already committed to other river restoration projects and could not financially support it on their own.

Solution: The project obtained support from PIN-MATA, a fund from the Dutch government dedicated to protecting and rehabilitating natural areas in Eastern European countries. This contribution covered 66% of the total required funding. Diversifying their income at the EU level made it possible to carry out this project.

More info:

- https://water.europa.eu/freshwater/freshwater/resources/nwrm-imported/nwrm-case-studies/wetland-restoration-ciobarciu-romania
- https://www.ecrr.org/Portals/27/Ciobarciu%20case%20study.pdf
- https://edepot.wur.nl/288797



Restoring flow on the Old Jijia river (from left; before, during and after work)
All images ©Prut-Barlad River Basin Authority (ABAPB)

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River remeandering

Rural case study: Marais-Poitevin, France

Barrier: Social Acceptance and Cultural

This project aims to restore the meanders of the Vendié River in the Marais Poitevin, a region where ancient wetlands were drained for agriculture and the expansion of local villages. Recreating the alluvial valley helps manage droughts and flooding by providing more space for water to flow gradually.

Stakeholders: SMBVSN (local watershed organization), NBRACER project beneficiaries, the local drinking water public service (SEV), the Public Institution of Marais Poitevin (EPMP), the Environmental State Agency (DREAL Nouvelle-Aquitaine), landowners, farmers, and state services.



photo https://nbracer.eu/wp-content/uploads/2025/10/NBRACER-D4.1_

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Barrier: Social and cultural acceptance is a challenge, as landowners fear losing arable land. For generations, people have worked to drain these areas, making the idea of restoration difficult to embrace

Solution: Explaining the project's benefits to farmers and landowners has been key. This includes improving meadow productivity, reducing irrigation needs, and ensuring a steady water supply in the riverbed year-round, all of which are major advantages for agriculture. On a broader scale, reintroducing the river to these lower areas can optimize land use, even if it requires reorganizing production. The project includes infrastructure improvements to enhance farming conditions

More info:

- NBRACER project: https://nbracer.eu
- https://miro.com/app/board/uXjVJMlU-AE=/
- Co-design-of-transformative-systemic-solutions-in-rural-landscape-systems_compressed.pdf



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Forest regeneration

Rural case study: Bavaria, Germany

Barrier: Spatial & temporal constraints

Bavaria, in Germany, has faced severe storms, floods, and avalanches. To address these challenges, the Bavarian state government, local forest authorities, forest owners, the regional forest office, the regional watershed authority, the regional nature conservation authority, the regional hunting authority, and environmental NGOs collaborated on the Mountain Forest Initiative (BWO) project, established by the regional government.

This project focuses on identified high-risk areas vulnerable to degradation due to climate change. The goal is to manage these areas so they can withstand global warming and act as buffer zones.

This involves planting adapted tree species, tending to them with a focus on natural regeneration, using logging methods like cable cranes, and constructing new forest roads.

Budget: 500k-1M€ per year



photo https://www.intechopen.com/chapters/77794

Barrier: Struggle of farmers with the complexity of EU and national subsidy systems. Administrative rigidity slowed down approvals, and fragmented coordination between regional, departmental, and municipal authorities created confusion.

Solution: The project established a regional one-stop shop, combining services from the Île-de-France Region, the Chamber of Agriculture, and local municipalities to simplify paperwork and grant applications. It also organized practical workshops on pilot farms, developed digital tools (cost simulators, maps of eligible plots), and built partnerships with agricultural schools to train future farmers in agroecological techniques.

More info:

- https://www.stmelf.bayern.de/wald/wald_mensch/initiative-zukunftswald-bayern-bergwaldoffensive/index.html



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Agro-ecology

Rural case study: Versailles, France

Barrier: Insufficient Policy and Regulatory Support

This project supports 25 farms in their transition to agroecological practices. To achieve its goals, the project implements measures such as reducing synthetic pesticides and fertilizers, introducing diverse crop rotations to break pest and disease cycles, planting hedgerows to enhance biodiversity and natural pest control, and adopting sustainable water management practices like rainwater harvesting, drip irrigation, and soil moisture monitoring. The region provides technical support, training, and resources to farmers. These efforts aim to restore soil health, increase biodiversity, and improve long-term farm resilience.

Stakeholders: Plaine de Versailles Association (lead), local municipalities, consumer associations, the regional Chamber of Agriculture.

Budget: €1.8 million (50% funded by the Region, 30% by the State, and 20% by the farmers)



photo https://nbracer.eu/wp-content/uploads/2025/10/NBRACER-D41_

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Barrier: Struggle of farmers with the complexity of EU and national subsidy systems. Administrative rigidity slowed down approvals, and fragmented coordination between regional, departmental, and municipal authorities created confusion.

Solution: The project established a regional one-stop shop, combining services from the Île-de-France Region, the Chamber of Agriculture, and local municipalities to simplify paperwork and grant applications. It also organized practical workshops on pilot farms, developed digital tools (cost simulators, maps of eligible plots), and built partnerships with agricultural schools to train future farmers in agroecological techniques.

More info:

- https://www.plainedeversailles.fr/



photo https://www.mdpi.com/2071-1050/15/9/7219

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Floating Wetlands

Rural case study: Northern Portugal

Barrier: Social Acceptance and Cultural

Creating floating wetlands is an effective solution for tackling water pollution and poor water quality. This method was used in stormwater ponds in Portugal near the Paço de Calheiros, because it is both affordable and low-maintenance. This mat raft is an agglomerate cork-based platform with frustoconical holes of two different sizes and planted with locally native species that validated 5 criteria.

The study put forward its biodiversity hot spot aspect which was not among the primary objectives.

The project was funded by National Funds from FCT (Fundação para a Ciência e a Tecnologia) under the scope of several research projects.

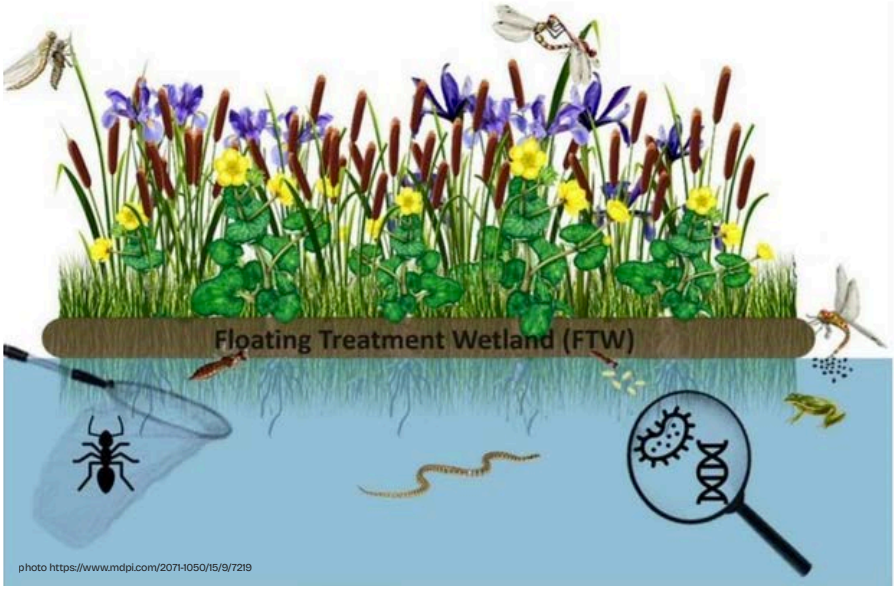


photo https://www.mdpi.com/2071-1050/15/9/7219

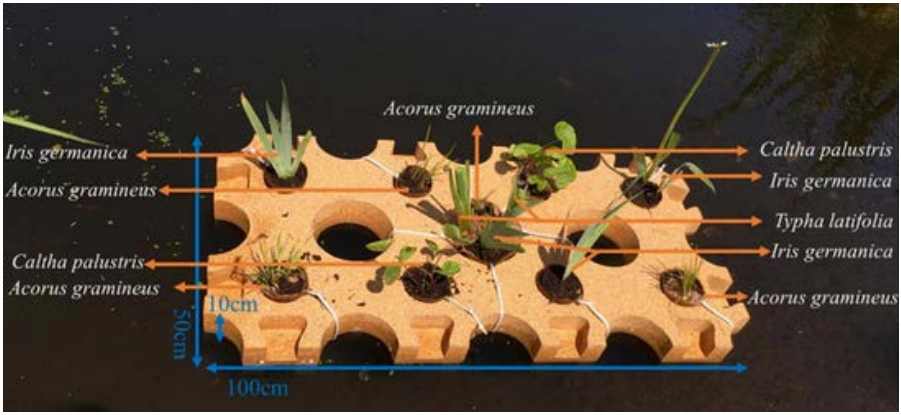
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Barrier: Securing approval from local communities and the city council proved challenging due to a lack of understanding and expertise about the benefits this solution could offer.

Solution: The team addressed this by organizing discussions and providing scientific explanations about NbS and the Nature Restoration Law, which cities are obliged to follow. This approach helped raise awareness and gain the necessary support for the project.

More info:

- https://environment.ec.europa.eu/news/floating-island-plant-rafts-create-wildlife-hotspots-nurture-beneficial-microbes-and-pond-ecosystems-2025-09-23_en
- https://www.interregeurope.eu/good-practices/floating-island-for- nutrient-removal
- https://www.sciencedirect.com/science/article/pii/S0925857425000862?via%3Dihub



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Dune & Cliff restoration

Rural case study: Manabas Coast, Sweden

Barrier: Governance and Institutional Challenges

The project consists of 14 pilot sites, including one in Bärby, Sweden. Its goal is to protect beach meadows from erosion. This can be achieved through NbS, such as using native plants whose roots stabilize the dunes or placing rocks to reduce the force of waves and wind. The MANABAS COAST project integrates coastal forest restoration with dune management.

Stakeholders: The initiative is led by the County Administrative Board of Västra Götaland, in collaboration with the National Geotechnical Institute (SGI) but also local communities such as the inhabitants of Barby.

Funding: EU Interreg North Sea Programme ; Swedish Agency for Marine and Water Management.



Strandäng inside stone reef. Parts of the ground have been broken and washed into the sea. Pilot area in Bärby.

Barrier: The project involves many stakeholders, with differing interests and goals, making coordination a significant challenge.

Solution: Regular meetings, participatory workshops, and training sessions were organized to align objectives and ensure collective support.

More info:

- https://www.interregnorthsea.eu/manabas-coast/pilots
- https://stranderosion.lansstyrelsen.se/
- https://una.city/nbs/goteborg-fua/coastal-erosion-measures-glose-kungalv

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Kelp forest restoration

Rural case study: Central Coast, Portugal

Barrier: Spatial and Temporal Constraints

This project aims to reforest Portugal's coast with kelp, a species essential to marine ecosystems, particularly in cold to temperate regions. These underwater forests absorb excess wave energy, significantly reducing the impact of coastal waves and thus protecting shorelines from the physical damage caused by storms. They also act as important carbon sinks and provide habitats for marine life. The "green gravel" method was used here, achieving a success rate of 12%, which is considered a significant milestone.

Funding: This research was funded by EEA Grants through the BLUEFORESTS project and supported by Fundação para a Ciência e a Tecnologia for MARE and the Associate Laboratory ARNET. One of the researchers involved was employed by the company Seaforester.



Figure 2. (**A**) Technique used to deploy the gravel from the surface; (**B**) Scientific divers deployed buoys marking the area for deployment (100 m^2) in Berlengas at the Galos site; (**C**) close-up of the deployed green gravel.

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Barrier: The project is situated along an exposed coastline, which explains the relatively low success rate. This challenge arises from the high risk of kelp death due to disease, predators, or environmental factors.

Solution: The team focused on selecting resistant kelp strains, deployed water movement (m s^{-2}) and temperature (°C) logger sensors, and closely monitored all relevant physico-chemical parameters to improve survival rates.

More info:

- https://www.mdpi.com/2071-1050/16/21/9176

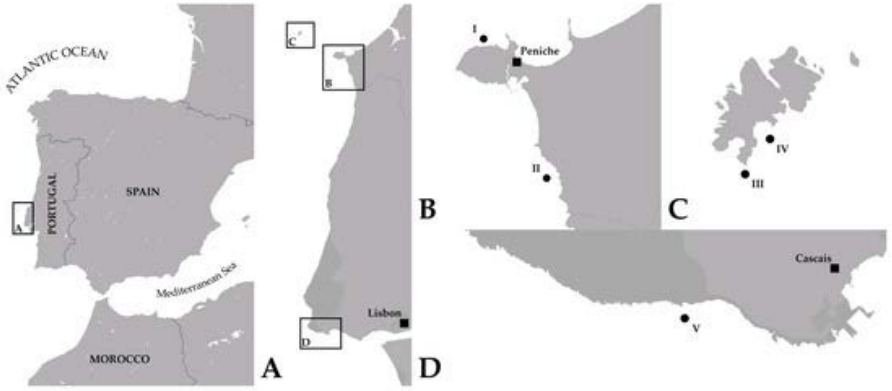


photo https://www.mdpi.com/2071-1050/16/21/9176



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