

Nature-based Solutions to Address Flood Risks in Coastal Communities



CEC

Introduction to Nature-based Solutions



“ NBS mitigates flood risks through the informed use of natural systems and natural processes, while simultaneously providing environmental, social, and economic co-benefits. ”

Context

Many coastal areas are exposed to significant coastal flood hazards, such as inundation and erosion. Coastal flood-risk management systems in North America have historically relied upon ‘gray’ engineering techniques, which typically involve building hardened structures, such as seawalls or dikes. Relying only on ‘gray’ methods frequently overlooks or undervalues environmental, social, and economic needs and values. In contrast, nature-based solutions (NBS) offer flood-risk management (FRM), while also providing numerous co-benefits.

Project & Guidance Documents

In 2021, the Commission for Environmental Cooperation (CEC) initiated a [project](#) to support the broader uptake of NBS to manage flood risks in coastal communities across Canada, Mexico, and the United States. As part of the project, a comprehensive set of four [guidance documents](#) were developed on NBS, covering the topics of co-benefits, retrofitting existing infrastructure, and monitoring efficacy and methodology.



The Value of Using NBS

- ✓ Improves flood or erosion risk management
- ✓ Reinforces or repairs existing aging infrastructure
- ✓ Improves resilience
- ✓ Enhances climate change adaptation
- ✓ Provides opportunity for Indigenous and community partnerships
- ✓ Improves public buy-in
- ✓ Provides social, environmental, and economic co-benefits
- ✓ Advances and applies new knowledge
- ✓ Location-specific solutions

Cape May, New Jersey, United States



Dune breached during storm in 1991

Source: Naturally Resilient Communities, 2022

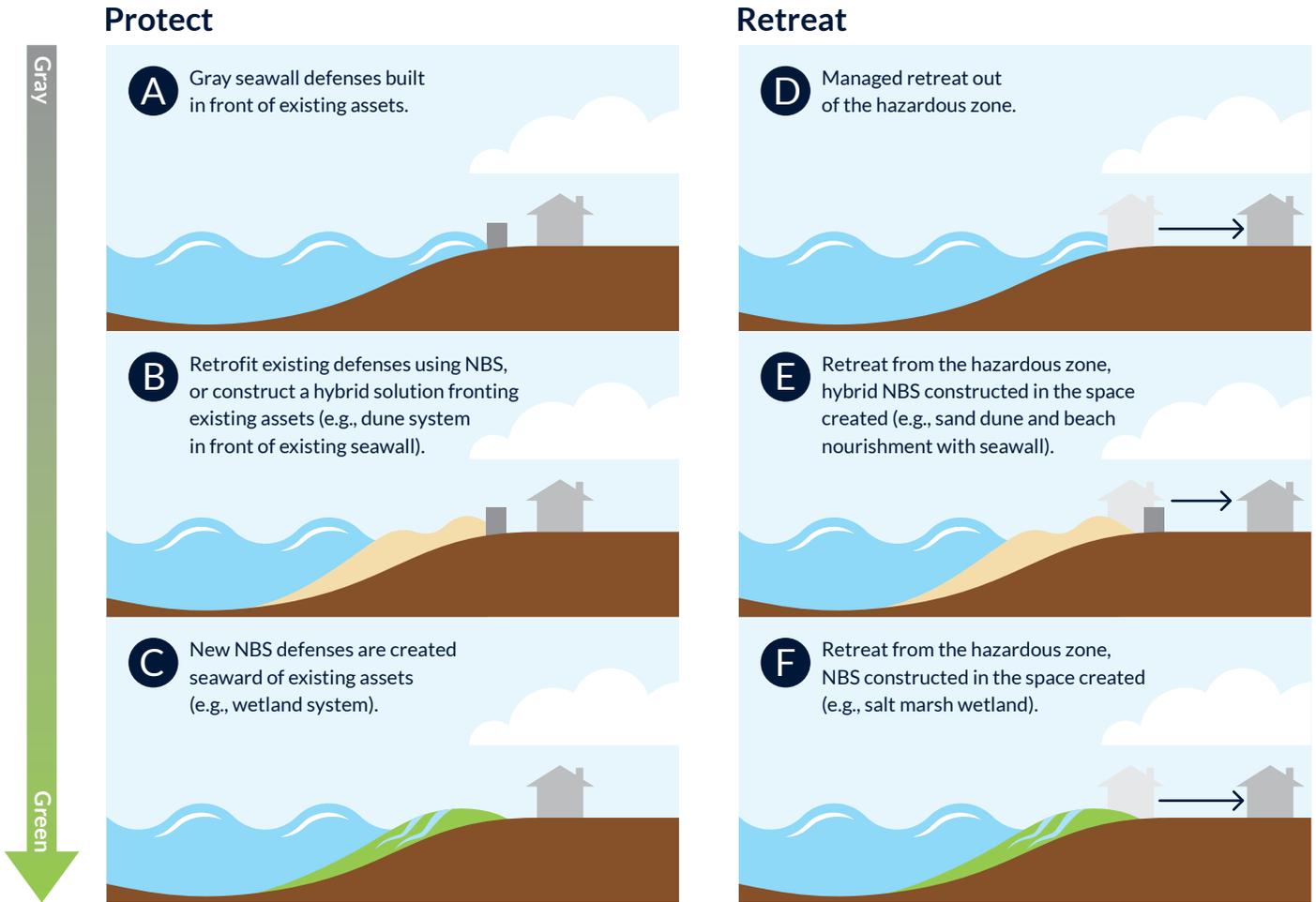


Healthy system, post-NBS

Source: Naturally Resilient Communities, 2022

The Nature-based Solution Spectrum

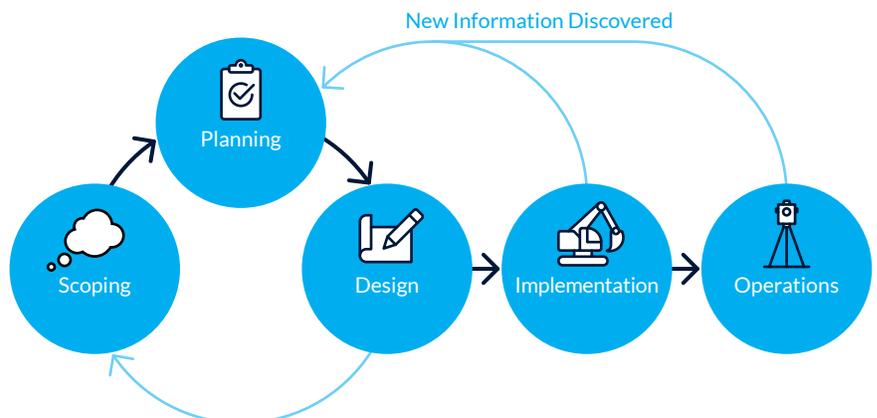
Flood-risk management infrastructure exists on a 'Gray to Green' spectrum. 'Gray' coastal flood-risk management options include concrete seawalls, tide gates, and breakwaters, among others. 'Green' solutions may include NBS such as beaches, wetlands, and oyster reefs.



Nature-based Solution Development Framework

This framework for a NBS project encompasses five cyclical phases.

This process promotes continuous reassessment and updates to plans at any point along the project development. Engagement and monitoring plans should be established early in the project cycle, during scoping and planning stages.



Types of Nature-based Solutions



Beaches & Dunes
Beach nourishment
Dune restoration



Wetlands
Mangroves
Salt marshes



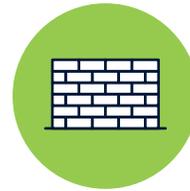
Islands
Habitat islands
Barrier islands



Forests & Woody Areas
Woody vegetation
Other terrestrial
vegetation

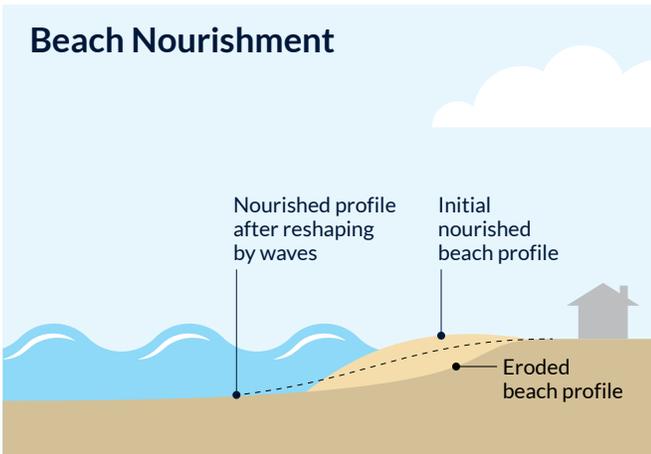


Submerged Features
Coral & oyster reefs
Eelgrass & kelp beds

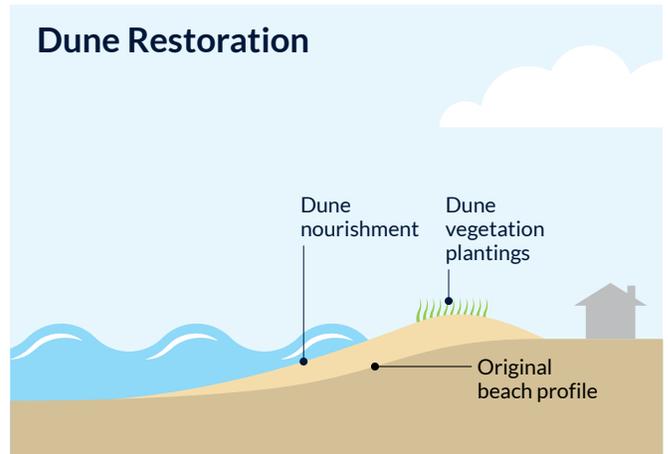


Hybrid Features
Living dikes
Beach & headland
systems

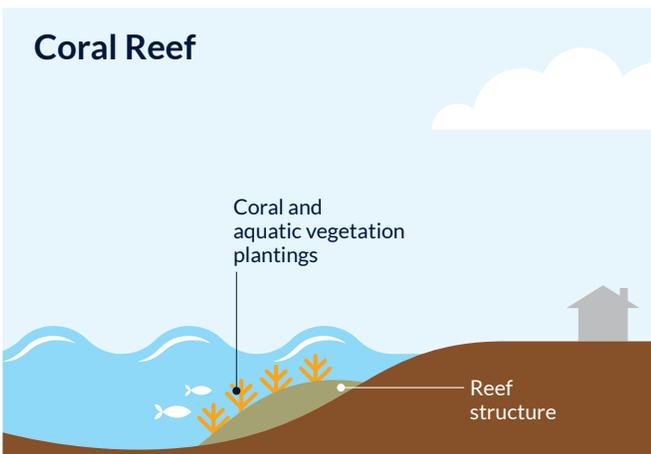
Beach Nourishment



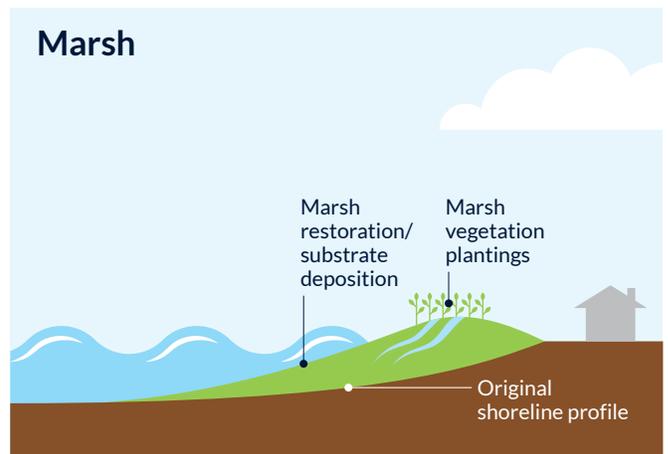
Dune Restoration



Coral Reef



Marsh



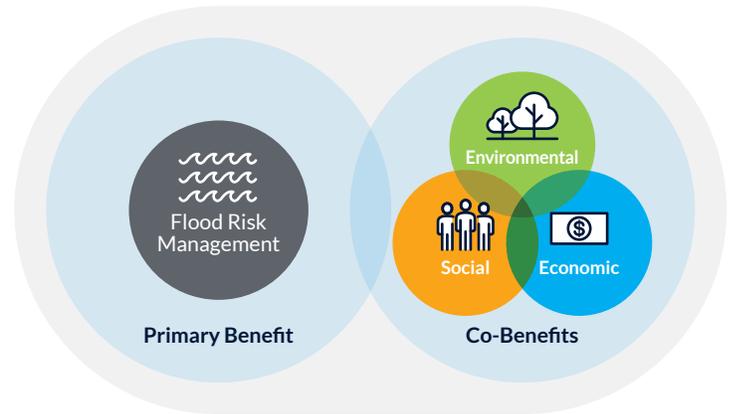
Co-benefits

Historically, co-benefits have often been identified in the later stages of flood-risk management projects, but they are an essential component of NBS and should be considered during all phases of the project.

The benefits provided by NBS include both primary flood-risk management benefits and secondary co-benefits—environmental, social, and economic. These four categories of benefits are dynamic and interconnected, with significant overlap between each.

Analyzing co-benefits helps to:

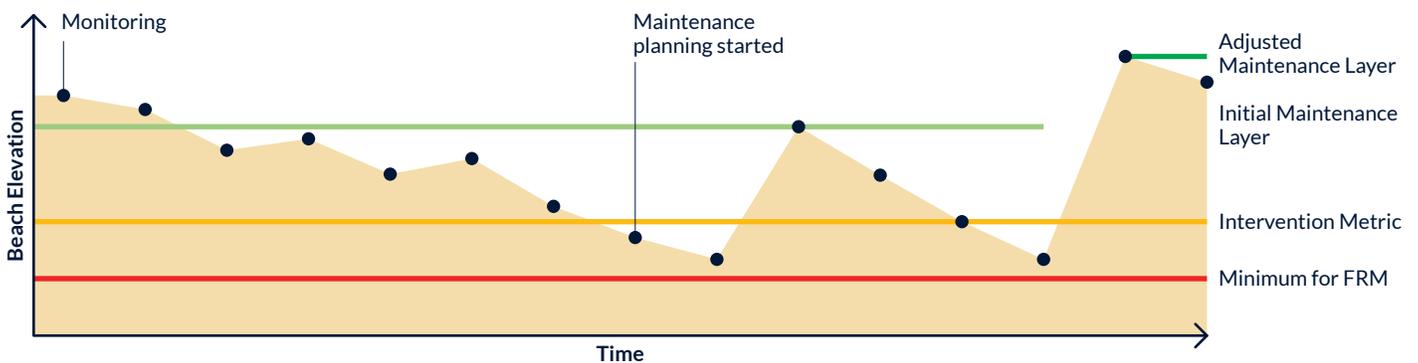
- ✓ Holistically compare options
- ✓ Improve engagement and public buy-in
- ✓ Assess unintended impacts and improve accountability
- ✓ Anticipate trade-offs and set priorities
- ✓ Increase funding opportunities
- ✓ Inform adaptive management
- ✓ Share knowledge



Adaptive Management and Monitoring

Adaptive management is central to the long-term success of NBS, particularly in response to climate change, and allows for continuous improvement of the NBS project and of the monitoring program. Monitoring provides foundational data for adaptive management.

Beach Elevation Monitoring to Inform Adaptive Management



Monitoring helps to:

- ✓ Reduce uncertainties
- ✓ Evaluate NBS effectiveness
- ✓ Modify the NBS design or monitoring program
- ✓ Promote knowledge growth on NBS

“Adaptive management is built on the principle of addressing and reducing uncertainties in NBS projects in a phased implementation. It acknowledges the dynamic nature of the environment and focuses on the project aspects that can be controlled or adapted, increasing flexibility in planning stages and allowing the design to evolve over time.”

Systems Thinking

Systems Thinking involves approaching projects holistically, from a natural, social, and cultural perspective, and taking into consideration how their interactions are driving change. This includes the consideration of system boundaries, spatial and temporal scales, feedback loops within a system and those in adjacent systems.

Understanding the feedback loops within and between these systems will influence design, implementation, and monitoring and adaptive management programs.

Systems thinking provides the opportunity for a site to evolve naturally, resulting in optimal environmental, social, and cultural conditions.

