Coastal Resilience Through Built and Natural Solutions

Who we are

A multidisciplinary team of scientists and engineers helping communities prepare for, resist, recover and adapt to coastal threats using a combination of natural and nature-based features, structural and non-structural measures to reduce their risks while delivering a full array of economic, environmental, and social benefits.

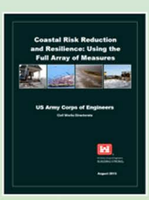
Natural & Nature-Based Features

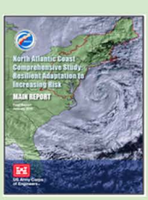
Additional Information

For support in applying NNBF in your region, refer to these recent reports:

The 2015 NNBF report produced jointly by the US Army Engineer Research and Development Center (ERDC) and the USACE Institute for Water Resources (IWR), offers an integrative engineering-based framework that focuses on classifying NNBF, characterizing vulnerability, developing performance metrics, incorporating regional sediment management, and both monitoring and adaptively managing projects from a systems perspective. The report can be downloaded from the Engineering With Nature website:
http://el.erdc.usace.army.mil/ewn/nnbf.html

The 2014 "Green Report" which offers USACE perspectives on the use of natural and nature-based features to reduce coastal risks and enhance resilience can be downloaded from:
http://www.corpsclimate.us/ccacrrr.cfml.





The North Atlantic Coast Comprehensive Study (NACCS) is a collaborative effort, bringing together governmental, academic, and non-governmental experts in coastal planning, engineering and science to collaboratively develop a risk management framework for the 31,000 miles of the North Atlantic coastline that were affected by Hurricane Sandy in 2011. The 2015 NACCS report describes opportunities to use NNBF in the post-Sandy recovery efforts, and can be obtained from the NACCS website:
http://www.nad.usace.army.mil/CompStudy.aspx

EWN Engineering With Nature
www.engineeringwithnature.org

Natural & Nature-Based Features

Reducing Coastal Risks and Increasing Community Resilience

North Atlantic Coast Comprehensive Study
http://www.nad.usace.army.mil/CompStudy.aspx

Contact Us:

Todd Bridges, Ph.D.
Senior Research Scientist
US Army Engineer Research and Development Center (ERDC)
Todd.S.Bridges@usace.army.mil

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Paul Wagner, Ph.D.
Senior Ecologist, Branch Chief
USACE Institute of Water Resources (IWR)
Paul.F.Wagner@usace.army.mil

•

Kelly Burks-Copes, Ph.D.
Research Ecologist
US Army Engineer Research and Development Center (ERDC)
Kelly.A.Burks-Copes@usace.army.mil

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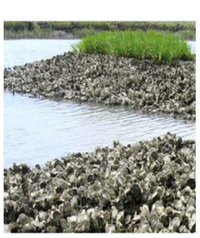
Joseph R. Vietri, Director
National Planning Center for Coastal Storm Risk Management

NNBF

Storm Risk Management • Erosion Control • Ecosystem Support

Natural & Nature-Based Features

US Army Corps of Engineers®
Engineer Research and Development Center



Risk Management from a Systems Perspective

NNBF
Natural & Nature-Based Features

Coastal Resilience
Through Natural
&
Natural-BasedSolutions

Natural & Nature-Based Features

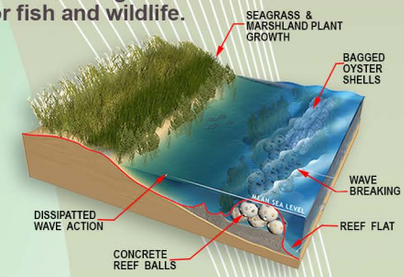
NNBF offer valuable options for developing "multiple lines of defense" for coastal systems, with the aim of producing social, economic, and ecological benefits that promote coastal and community resilience.

Prepare • Resist • Recover • Adapt

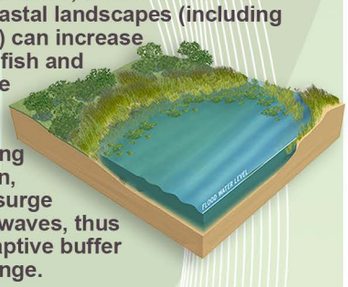
Why Use NNBF

By definition, NNBF refer to those features that define natural coastal landscapes, and are either naturally occurring or have been engineered to mimic natural conditions. Examples of NNBF include beaches and dunes; vegetated environments such as maritime forests, salt marshes, freshwater wetlands, and seagrass beds; coral and oyster reefs, and barrier islands.

An integrated approach to risk management that combines NNBF with nonstructural and structural measures will deliver the full array of ecosystem goods and services to the local communities. Adding artificial reefs along the shoreline can attenuate waves, offering improved flood protection during storms, and ultimately increasing property values. Blending these features with onshore vegetative plantings provides a degree of erosion control and generates functional habitat for fish and wildlife.



Along these same lines, the restoration of wetlands and coastal landscapes (including maritime forests) can increase opportunities to fish and watch birds while simultaneously serving the region by reducing shoreline erosion, reducing storm surge and attenuating waves, thus providing an adaptive buffer for sea level change.



SYSTEMS APPROACH

A systems approach to coastal planning and management will seek to combine natural and nature-based features, non-structural measures (e.g., floodplain management, etc)., and structural measures (e.g., seawalls, etc). across the coastal landscape. This approach to coastal resilience will: 1) acknowledge the processes and forces contributing to risks, 2) make use of the diverse nature of the measures available to address those risks, and 3) combine those measures to produce streams of desired benefits and services over time. A systems approach will also consider the interactions and dependencies within the network of measures. Active monitoring of the system focused on each measure's performance can then be used to inform future engineering actions.

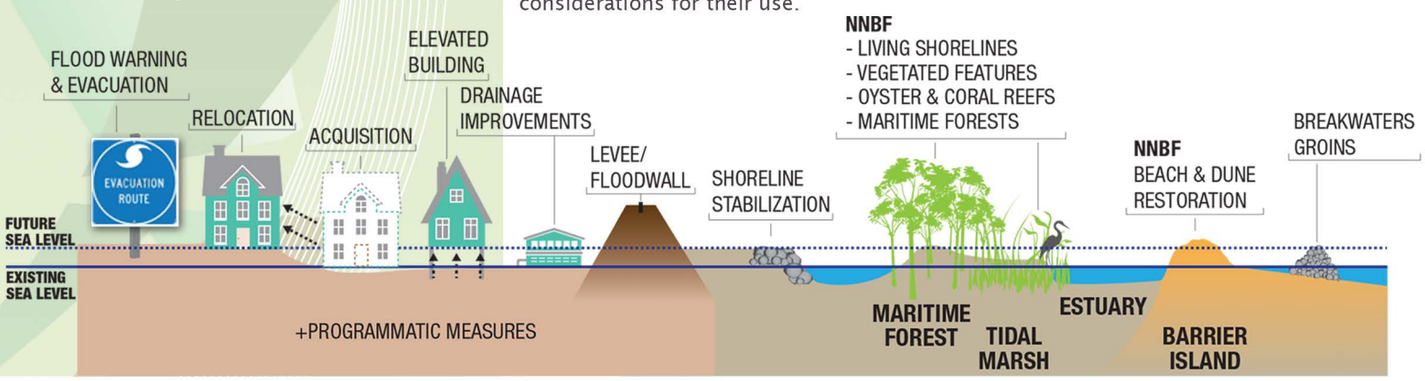
CAVEATS

A range of factors (e.g., the nature of the assets at risk, the regional geomorphology, etc.) will determine which measures are applicable to a given coastline. In some cases, the opportunities to use NNBF may be very limited due to the severity of the hazards (e.g., the magnitude of potential storm surge and waves). Levees, seawalls, storm surge barriers, and breakwaters, are effective and often necessary measures used to address coastal storm threats. Even in cases where structural measures will serve as the primary line of defense, NNBF can be blended into the network of actions to provide supporting functions and services to help prolong the useful life and function of the structural measures, while also providing a range of ecosystem services that are vital in enhancing the ecological integrity of coastal systems. An integrated approach to coastal management that makes use of the full array of measures will increase the resilience of coastal systems.

CONSIDERATIONS

The level of understanding about the performance of NNBF, nonstructural, and structural features varies, as do the methods to calculate and measure their performance. The dynamic behavior and response of NNBF to local processes such as coastal storms and urban development can affect their ability to provide the desired engineering performance and ecosystem benefits. For NNBF, including engineered beaches and dunes, this variation can be addressed through effective planning, engineering, and monitoring to maintain the desired level of service over time. Moreover, it is important to design nature-based features in such a way that natural processes are established that will support and sustain the features and services over time.

Investment in the use of NNBF for coastal risk management and resilience, in addition to other ecosystem services, should be based upon solid scientific and engineering evidence regarding the function and performance of these features. As with structural measures, nature-based features may require routine maintenance which should be factored into considerations for their use.



Multiple lines of defense in the face of coastal storms and sea level change