

# Reducing Coastal Hazard Impacts with Green Infrastructure – Part 1



Courtesy Brian Majka



**OFFICE FOR COASTAL MANAGEMENT**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

# Agenda

- Communicating climate and hazard impacts using the *Risk Communication Best Practices Guide*
- Visualizing climate and hazard impacts using the **Coastal County Snapshots** and **Lake Level Viewer**
- Communicating the benefits of green infrastructure for resilience using the **Green Infrastructure Protective Services Animation** and *Local Elected Official Green Infrastructure Hand Out*
- Incorporating climate and hazard impacts into conservation planning using the *How To Consider Climate Change in Coastal Conservation*



# Reducing Risks to Communities...





# ...by Preserving Ecosystem Services

Natural ecosystems provide multiple benefits to people, including food and water production, improved air and water quality, recreation, and spiritual inspiration.



# Green Infrastructure Approaches



**Landscape**



**Community  
and Site**



**Shoreline**



# Is Green Infrastructure Effective in Enhancing Resilience?

- Recent study\* on flood reduction during Hurricane Sandy showed:
  - Coastal wetlands saved more than \$625 million in flood damages
  - Where they exist, coastal wetlands reduced damages by more the 10% on average



\*Coastal Wetlands and Flood Damage Reduction: Using Risk Industry-Based Models to Assess Natural Defenses in the NE USA, 2016.



# Green Infrastructure Effectiveness Literature Database

**The marine 'great wall' communities**  
 2016 Peer reviewed  
 Over 100 miles long, the Great Wall of the Pacific is the largest artificial rocky breakwater in the world.

**Shoreline Resources: Natural Shoreline Protection Reference Material**  
 2016 Gray literature  
 Michigan Natural Shoreline Partnership  
 The Michigan Natural Shoreline Partnership provides the most up-to-date information on shoreline protection, mostly in the form of technical reports and design manuals.

**Mangroves as Protect**  
 2016 Gray literature  
 Journal of Coastal Management  
 This paper discusses the role of mangroves in coastal protection and the impact of climate change on their effectiveness.

**Response of vegetate**  
 2016 Peer reviewed  
 56% of the area is vegetated.

**Shoreline Resources: Natural Shoreline Protection Reference Material**

**Link to Resource:** <http://www.mishorelinepartnership.org/shoreline-resources.html>

**Keywords:** Restoration; Meta-analysis; Marsh; Living shorelines; UD; Landscape design; Land conservation/protection; Hard/Gray Infrastructure; Flooding; Field measurements; Erosion; Design calculations; Constructed Wetland; Cold climate; Bioretention/rain garden

Basic Information	
AUTHORS	Michigan Natural Shoreline Partnership
YEAR PUBLISHED	2016
SOURCE	Michigan Natural Shoreline Partnership
SOURCE TYPE	Gray literature
CITATION	Michigan Natural Shoreline Partnership. "Shoreline Resources: Natural Shoreline Protection Reference Material." (Multiple resources)

Classifications	
GREEN INFRASTRUCTURE TYPES AND/OR TECHNIQUES	Hard/Gray Infrastructure; Natural/restored habitat; Planting vegetation; Land conservation/protection; Marsh; Living shoreline; Other/Multi; UD; Constructed wetlands; Bioretention/rain garden
HAZARDS	Flooding - precipitation (stormwater, thermal insulation); Erosion
METHODOLOGICAL APPROACHES	Meta-analysis; Field measurements; Design/calculations

Location	
STUDY SCALE	SRL; Local (municipality); Watershed (landscape)

# Risk Communication Basics

- How and why people perceive risk differently
- How to learn more about your audience
- Best practices for risk communication
- Ways to frame your conversation
- Sample conversations

SOCIAL SCIENCE TOOLS FOR COASTAL PROGRAMS

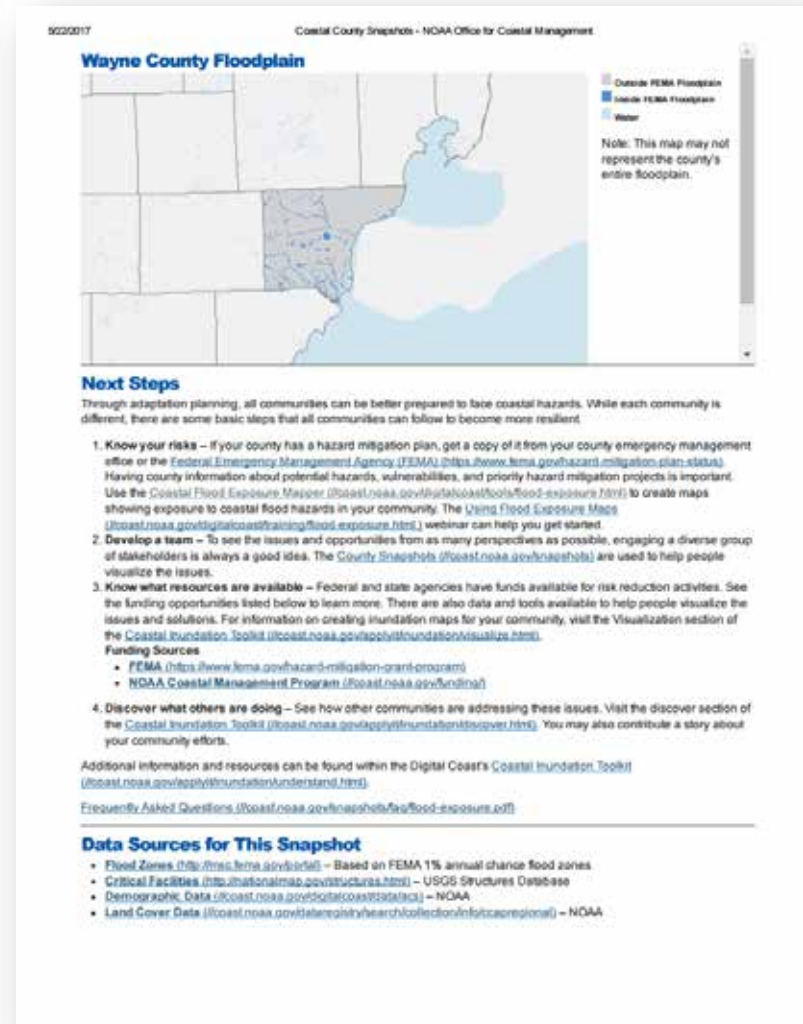
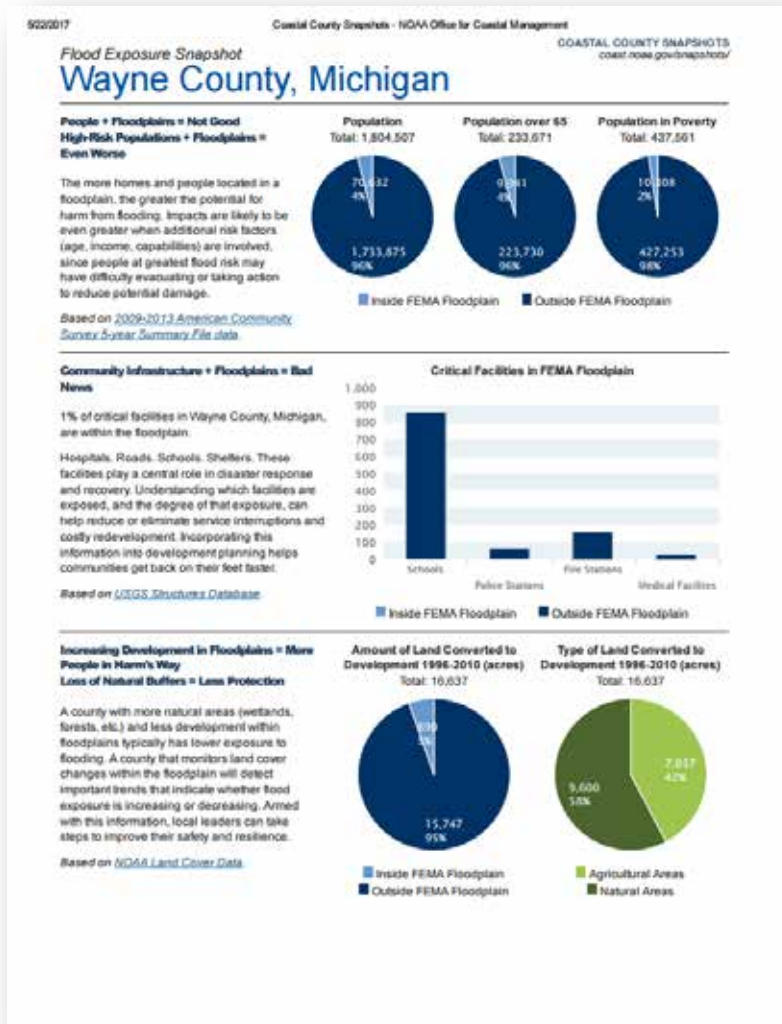
## Risk Communication Basics



*[coast.noaa.gov/digitalcoast/training/risk-communication-guidebook](https://coast.noaa.gov/digitalcoast/training/risk-communication-guidebook)*



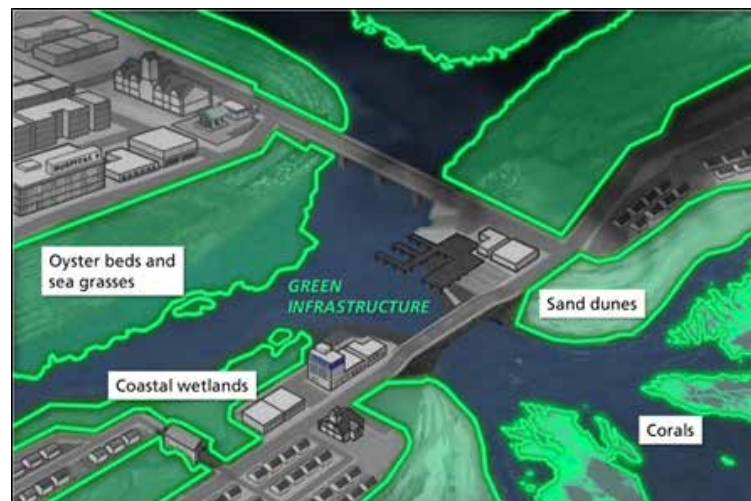
# Flood Exposure Coastal County Snapshot







# Green Infrastructure Protective Services Animation



[coast.noaa.gov/digitalcoast/training/gi-animation](https://coast.noaa.gov/digitalcoast/training/gi-animation)



# Tips for Communicating Green Infrastructure Benefits to Local Elected Officials



## Put Green Infrastructure between Your Community and the Next Coastal Storm.

There are many benefits.

### Tidal and Forested Wetlands

- Slow waves
- Filter and clean floodwaters
- Provide food and jobs

### Green Streets

- Capture and clean stormwater
- Beautify streets and encourage economic development
- Provide pedestrian-friendly walkways

### Oyster and Coral Reefs

- Slow storm surge
- Provide food
- Clean water

### Sand Dunes

- Buffer waves as a first line of defense
- Build economy through tourism

### Open Space and Parks

- Store floodwaters and recharge aquifers
- Increase property values

### Urban Trees

- Reduce runoff and absorb floodwaters
- Shade and cool homes and businesses
- Provide clean air and water

### Living Shorelines

- Slow waves and reduce erosion
- Protect property

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See the reverse of this page to learn more.

## Here's What You Can Do to Protect Your Community.

Green infrastructure can have multiple functions and cost less than using only gray infrastructure.



### Conserve Existing Natural Areas

Natural areas such as wetlands, dunes, and vegetated shorelines absorb storm surge waves, reducing damage to nearby homes and roads.

*How do we know it works?* A study after Hurricane Sandy showed that areas containing wetlands had less damage than those without. Wetlands prevented an estimated \$500 million in property losses.



### Increase Your Community's Ability to Absorb Stormwater

- Protect and plant trees.
- Implement other practices such as green streets to keep stormwater from running into sewers, lessening the strain on existing systems.
- Use capital improvement projects as an opportunity to fund stormwater projects.

*How do we know it works?* The City of Portland, Oregon, used a combination of green roofs, green streets, trees, and rain gardens to reduce the peak flow of stormwater runoff by 93 percent, cooling costs by 27 percent, and heating costs by 15 percent.



*Photo: Tracy Skelton, North Carolina Coastal Federation*

### Create Natural Shorelines

Create living shorelines using oysters, marsh grass, and other natural materials to absorb wave energy and reduce erosion.

*How do we know it works?* North Carolina properties that used natural shoreline protection measures withstood wind and storm surge during Hurricane Irene better than properties using seawalls or bulkheads.

To learn more, visit [coast.noaa.gov/digitalcoast/topics/green-infrastructure](http://coast.noaa.gov/digitalcoast/topics/green-infrastructure).

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# “How To” Consider Climate Change in Coastal Conservation



This online companion to the *Guide to Considering Climate Change in Coastal Conservation* provides access to select resources for each of the following steps. More detail and additional supporting resources are found in the guide. Many of those resources also contain examples or case studies. In addition to national resources listed, there may be regional, state, or local sources available that are more specific to your area.

*Digital Coast How To*

## How to Consider Climate Change in Coastal Conservation

Steps:

1. Articulate conservation goals and scope
2. Identify conservation targets
3. Identify non-climate stressors
4. Identify climate stressors
5. Review goals and identify strategies
6. Formulate a long-term management plan

## 1 Articulate Conservation Goals and Scope

To reach your destination, you need to know where you're going. Clear goals represent the foundation of the planning process and are necessary for determining conservation targets and management strategies. Whether you're developing a new conservation plan or revising an existing one, clear goals are needed in order to evaluate time and resource investments and evaluate success in getting there. In coastal areas, these goals may focus on a single objective or multiple benefits for the community and environment (e.g., to improve water quality, reduce flooding, and conserve biodiversity or open space).

▼ **Determine the geographic scope** of the conservation planning effort.

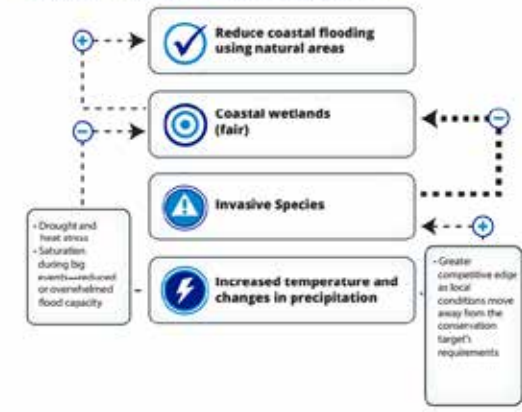
▼ **Understand relevant policy or management drivers** to inform conservation goals that will yield multiple benefits for the community and the environment.

▼ **Identify and engage relevant stakeholder interests**

▼ **Establish conservation goals** based on the scope, drivers, and stakeholder considerations identified (e.g., reduce coastal flooding using natural areas)

Detailed guidance, examples, and additional resources from the guide

Conceptual model with climate stressors and impacts added



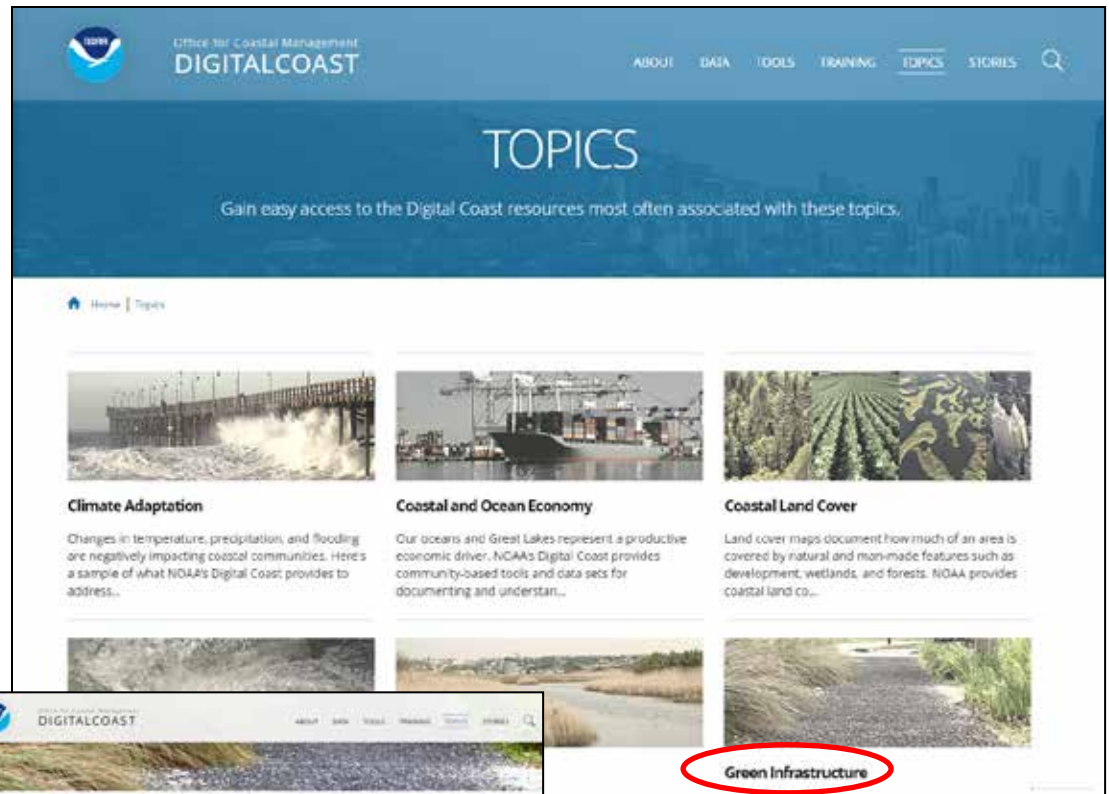
- ✓ = conservation goal
- 🎯 = conservation target (viability)
- ⚠️ = non-climate stressor
- ⚡ = climate stressor
- ⊕ = positive relationship
- ⊖ = negative relationship

**Figure 4. Conceptual model with example outcomes from Steps 1-4.** In this example, local climate stressors of increased temperature and precipitation changes are identified. These climate stressors directly impact the conservation target, and also indirectly affect the target by exacerbating the non-climate stressor's impact.

**Tip:** Use available data, information, and models to identify anticipated climate phenomena in your planning geography and during your planning time horizon.

# Thank You!

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Find resources here

*[coast.noaa.gov/digitalcoast/topics/green-infrastructure](https://coast.noaa.gov/digitalcoast/topics/green-infrastructure)*