

# Building Resilient Infrastructure and Communities (BRIC) and Nature-Based Solutions

July 29, 2020



Photo of Memphis, Tennessee



FEMA



Photo of Miami, Florida

# Agenda

- **Where Nature-Based Solutions and Future Conditions Fit into BRIC:**  
Camille Crain, FEMA
- **Future Conditions:**  
Art von Lehe, FEMA  
Adam Stein, NOAA
- **Nature-Based Mitigation:**  
Abby Hall, EPA  
Sarah Murdock, The Nature Conservancy  
Chad Berginnis, ASFPM

# Nature-Based Solutions

- Can support natural hazard risk mitigation
- Can provide economic, environmental, and social resilience benefits

## Examples:

- Restoration of grasslands, rivers, floodplains, wetlands, dunes, reefs
- Living shorelines
- Soil stabilization
- Bioretention systems

# Future Conditions

## Examples:

Population changes



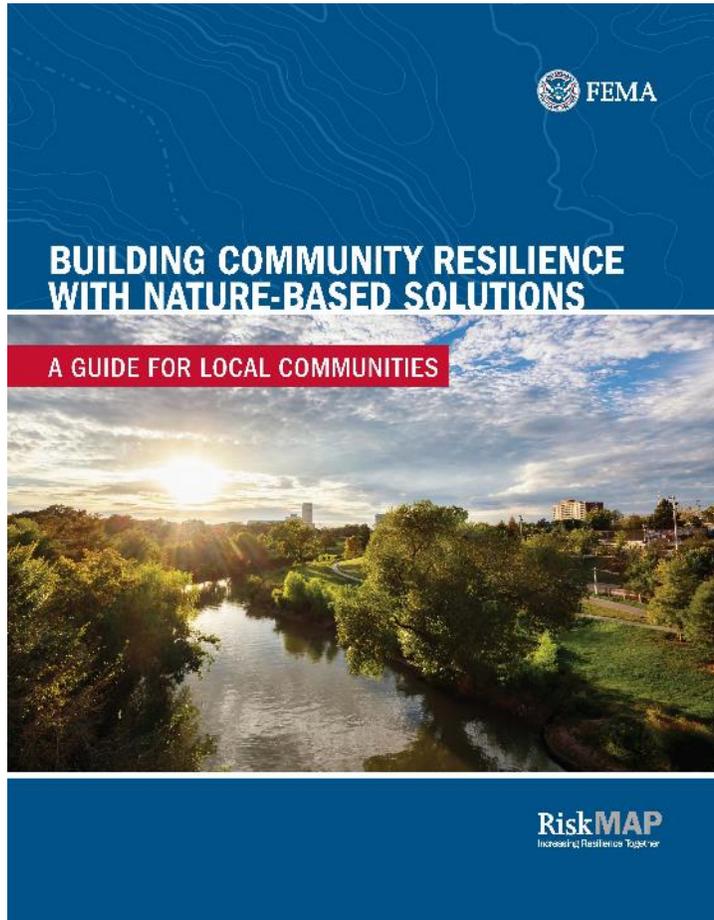
Demographic changes

Climate changes



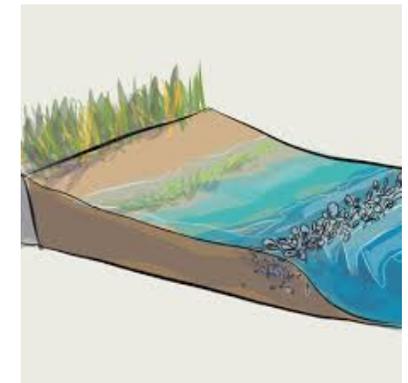
Land use changes

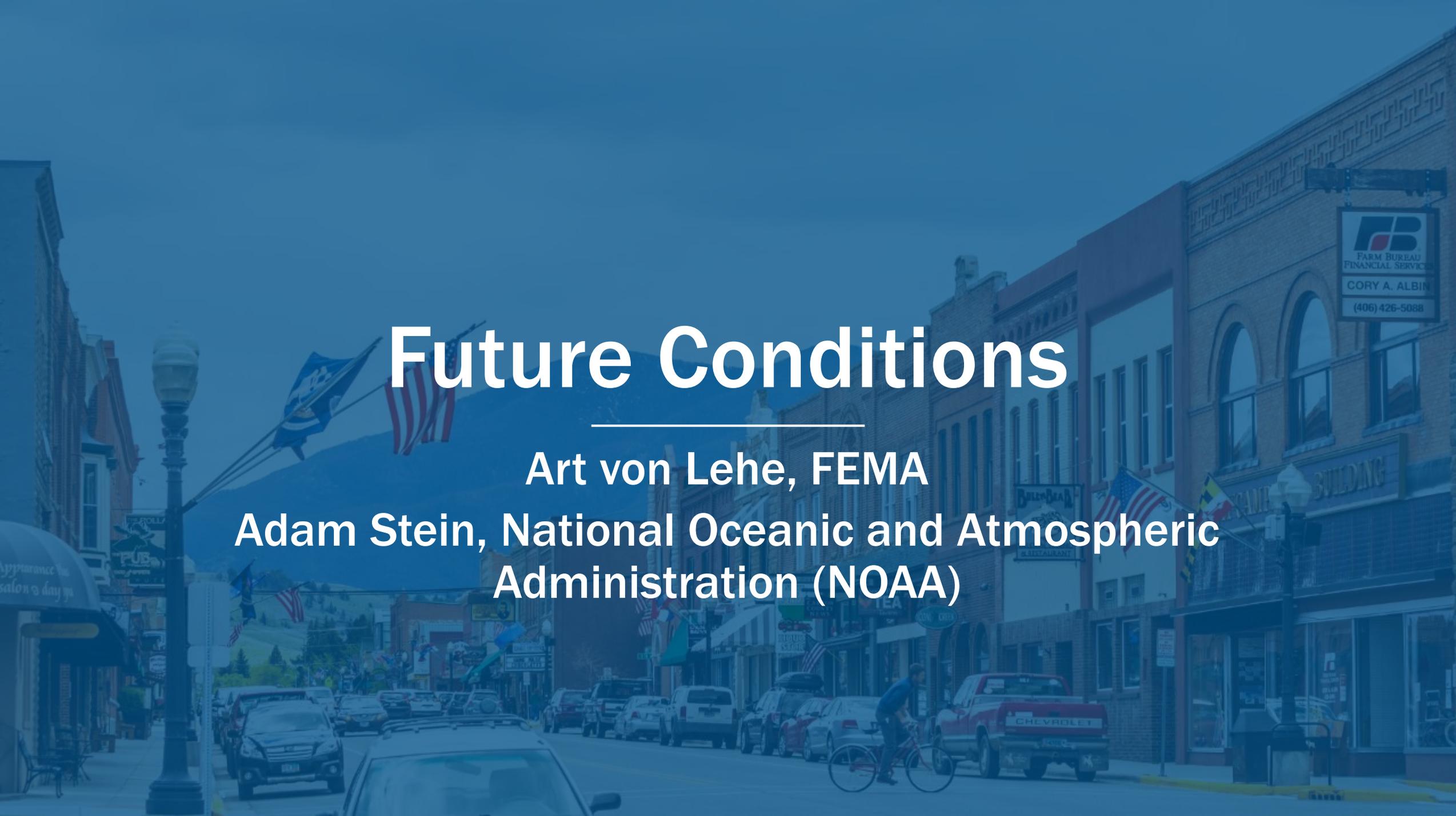
# FEMA Nature-Based Solutions Guide



## Building Community Resilience with Nature-Based Solutions: A Guide for Local Communities

<https://www.fema.gov/media-library/assets/documents/188958>





# Future Conditions

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Art von Lehe, FEMA

Adam Stein, National Oceanic and Atmospheric  
Administration (NOAA)

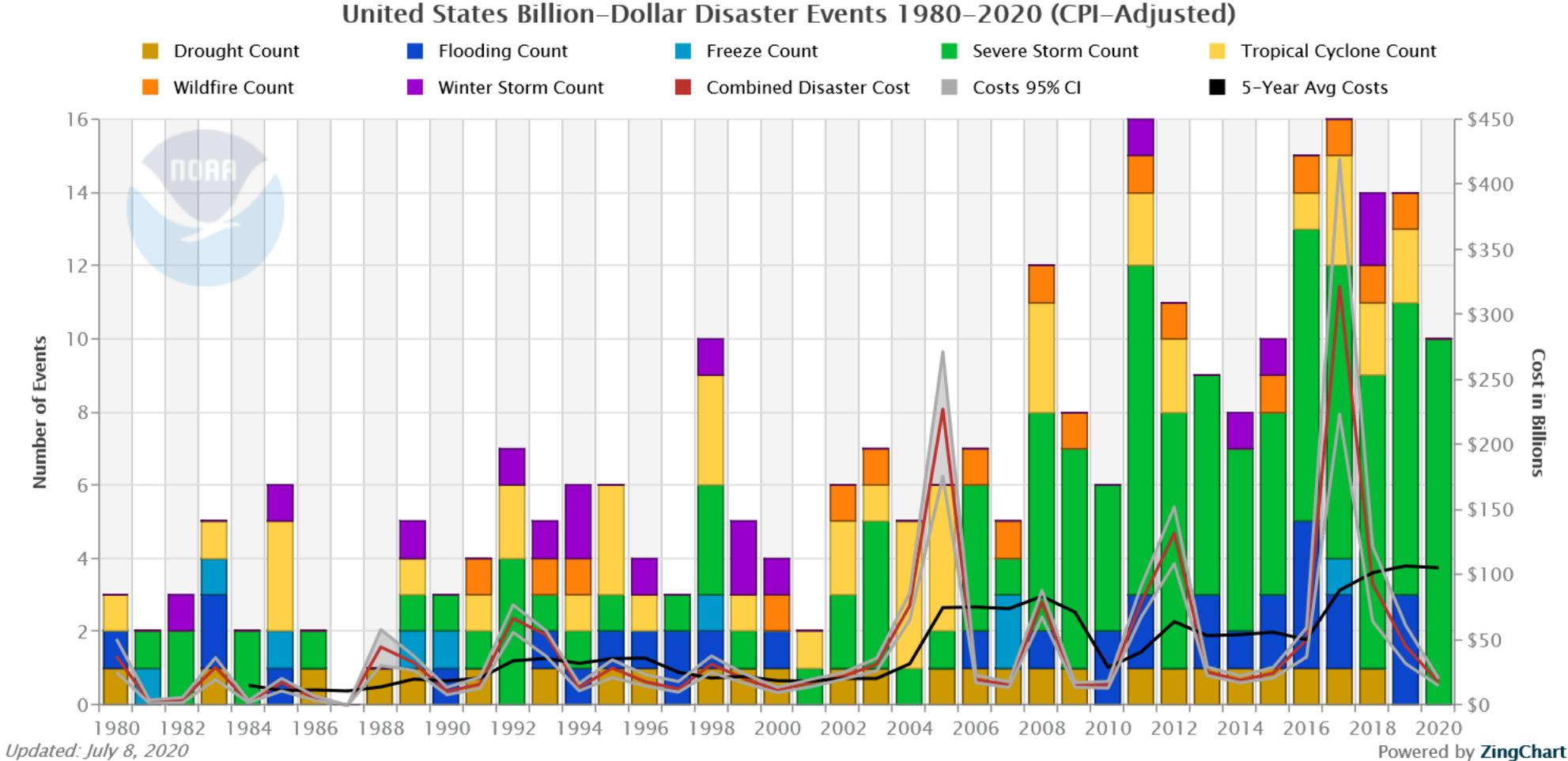


# Future Conditions and Nature-based Solutions

Art von Lehe, FEMA

Office of Environmental Planning and Historic  
Preservation

# “The number and cost of disasters are increasing” - NOAA



SOURCE: NOAA, available at: <https://www.ncdc.noaa.gov/billions/time-series/US>

# Changing Conditions and Emergency Management

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## Demographic and Development Trends

Land use  
Urban and suburban growth  
Deteriorating infrastructure  
Aging population



## Natural Hazard Trends

Extreme weather for flooding,  
heavy downpours, hurricanes,  
rising temperatures, wildfires,  
droughts, heat waves  
Sea Level Rise



## Emergency Management Implications

These trends are increasing the  
vulnerability of our  
communities and presenting  
new challenges for the field of  
Emergency Management

# Nature-based Design, Future Conditions Information, and FEMA

## The National Mitigation Investment Strategy

- The Strategy's scope includes: “Changing Conditions” and “Nature-Based Solutions and Natural Assets”

## Natural Hazards Risk Assessment

- Future conditions information can be incorporated into your Hazus analysis

## State Hazard Mitigation Plans

- FEMA-approved plan is required for hazard grant funding, including BRIC
- Requires applicants take changing conditions into account

## Benefit Cost Analysis

- For help applying sea level rise or other future conditions information to your project, please contact [bchelp@fema.dhs.gov](mailto:bchelp@fema.dhs.gov) or call 1- 855-540-6744

## Community Rating System

- CRS grants additional credits for nature-based design projects and the use of sea level rise information



# NOAA and Partner Resources: Future Conditions and Nature-Based Solutions



Photo: Jill Gambill, University of Georgia Marine Extension Service

**Adam Stein**  
NOAA Office for Coastal Management



## Resources

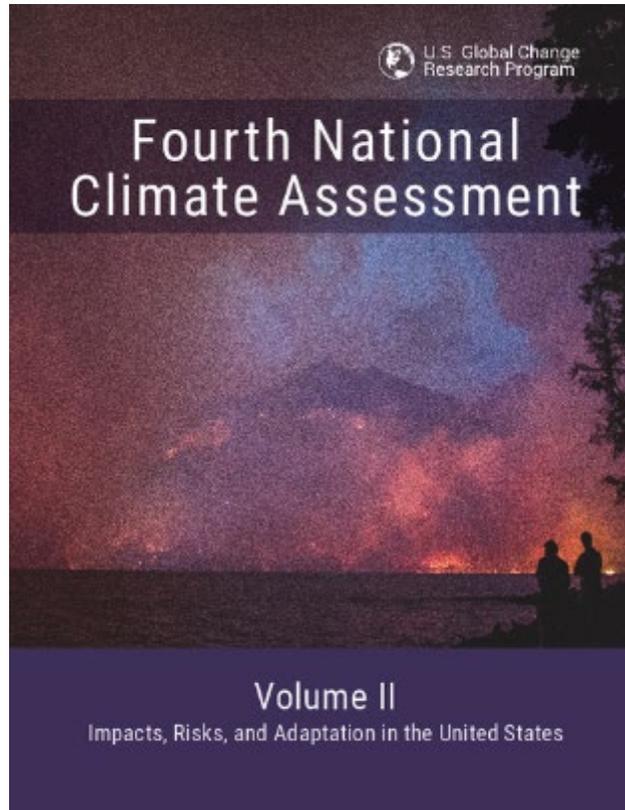
- Data and Information
- Partnerships
- Technical Assistance

## Future Conditions

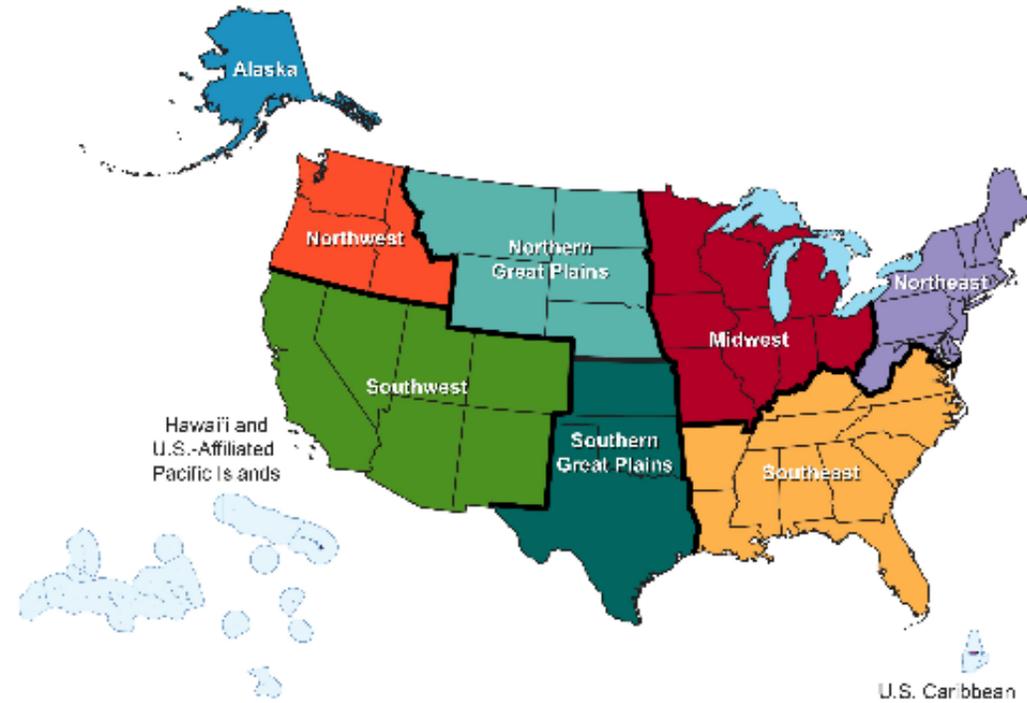
- Precipitation
- Temperature
- Drought
- Sea Level



# U.S. Global Change Research Program



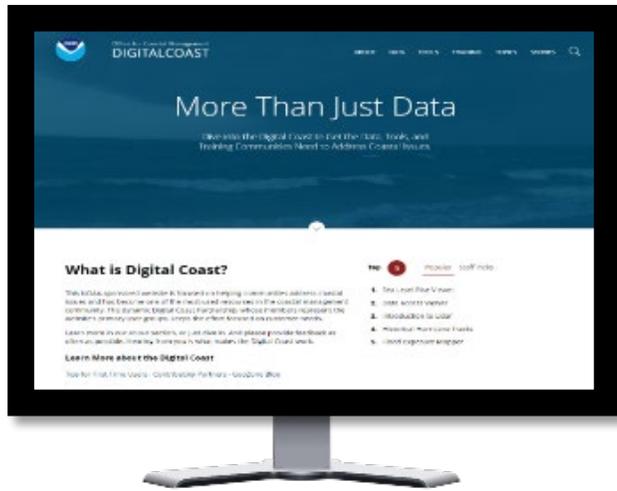
[nca2018.globalchange.gov](http://nca2018.globalchange.gov)



# NOAA Data and Information Resources

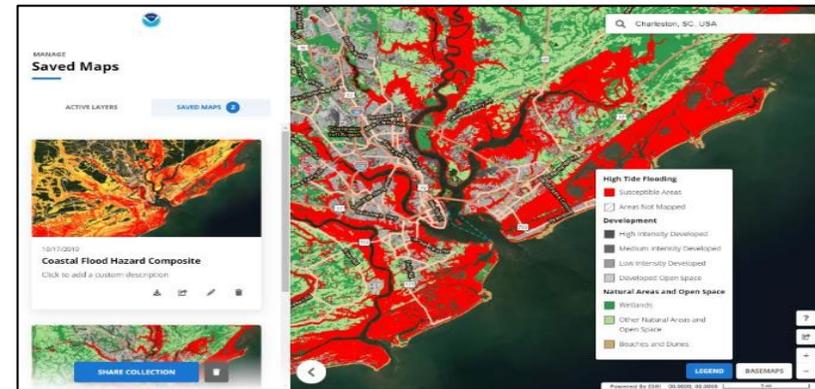
## Digital Coast

<https://coast.noaa.gov/digitalcoast/>



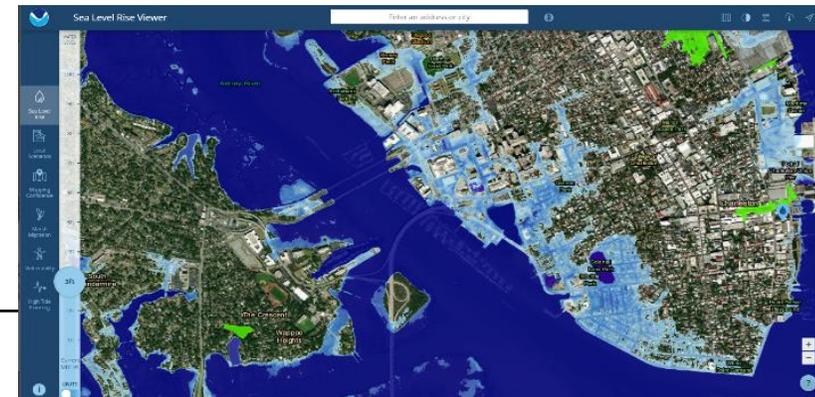
## Coastal Flood Exposure Mapper

<https://coast.noaa.gov/digitalcoast/tools/flood-exposure.html>



## Sea Level Rise Viewer

<https://coast.noaa.gov/digitalcoast/tools/slr.html>



# NOAA Data and Information Resources

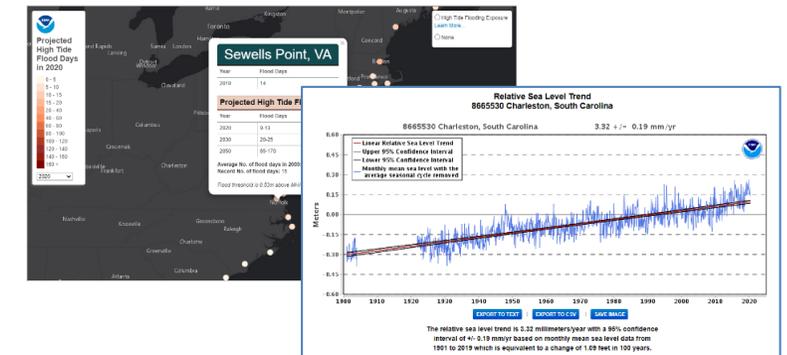
## Sea Level Trends

<https://tidesandcurrents.noaa.gov/sltrends/sltrends.html>



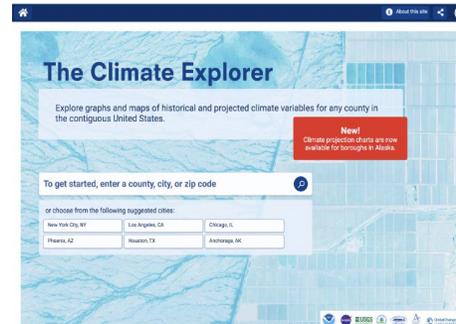
## State of High Tide Flooding and Annual Outlook

[https://tidesandcurrents.noaa.gov/HighTideFlooding\\_AnnualOutlook.html](https://tidesandcurrents.noaa.gov/HighTideFlooding_AnnualOutlook.html)



## Climate Resilience Toolkit

<https://toolkit.climate.gov/>



## The Climate Explorer

[toolkit.climate.gov/tool/climate-explorer-0](https://toolkit.climate.gov/tool/climate-explorer-0)



# NOAA Partnerships and Technical Assistance

## State Coastal Management Programs

<https://coast.noaa.gov/czm/>

## NOAA Regional Integrated Science and Assessment Programs

<https://cpo.noaa.gov/RISA>

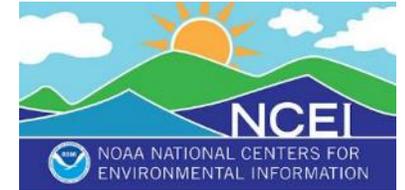
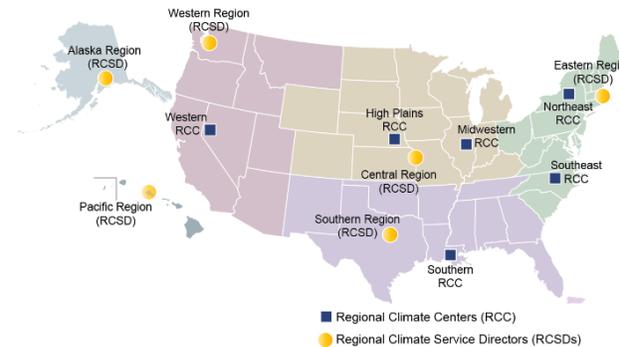
## Sea Grant College Programs

<https://seagrant.noaa.gov/>



## NOAA Regional Climate Services

<https://www.ncei.noaa.gov/>



## American Association of State Climatologist

<https://stateclimate.org/>



# Nature-Based Solutions Resources

The image displays two overlapping screenshots of the NOAA Digital Coast website. The top screenshot shows the 'TOPICS' page, which features a dark blue header with the NOAA logo and the text 'Office for Coastal Management DIGITALCOAST'. The navigation menu includes 'ABOUT', 'DATA', 'TOOLS', 'TRAINING', 'TOPICS', and 'STORIES'. The main heading is 'TOPICS' with the subtext 'Gain easy access to the Digital Coast resources most often associated with these topics.' Below this, there are three columns of topic cards: 'Adaptation Strategies', 'Coastal and Ocean Economy', and 'Coastal Land Use and Planning'. The bottom screenshot shows a detailed view of the 'Natural Infrastructure' topic. It features a large image of a coastal landscape with dunes and vegetation. The heading is 'Natural Infrastructure' with a subtext: 'Nature and man-made systems that mimic natural processes provides effective solutions for minimizing coastal flooding, erosion, and runoff. Provided below is a sampling of Digital Coast resources useful for communities considering a natural infrastructure approach.' Under the heading, there is a 'Getting Started' section with three items: 'Training: Introducing Green Infrastructure', 'Online Guide: Green Infrastructure Effectiveness Database', and 'Quick Reference: Practices and Benefits Matrix'. Each item has a 'View' button.

<https://coast.noaa.gov/digitalcoast/topics/green-infrastructure.html>

An aerial photograph of a coastal town, likely in New England, featuring a harbor with numerous sailboats, a prominent church steeple, and a dense residential area with green trees. The image is overlaid with a semi-transparent blue filter.

# Nature-Based Mitigation

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Abby Hall, U.S. Environmental Protection Agency (EPA)

Sarah Murdock, The Nature Conservancy

Chad Berginnis, Association of State Floodplain Managers (ASFPM)

# Memorandum of Agreement



# FEMA

- Sets up **coordination of activities** between EPA's sustainable communities, smart growth, environmental, and community technical assistance programs and FEMA's disaster recovery planning and hazard mitigation programs.
- Seeks to provide **lessons learned for EPA, FEMA, and other federal agencies** that can be used to build a stronger federal framework for mitigation planning as well as pre- and post-disaster recovery planning and operations.
- Seeks to provide a collaborative framework for **policy work related to both hazard mitigation planning and climate change adaptation** to create more resilient communities.

# Green Infrastructure for Climate Resiliency

Climate change is impacting urban areas in many ways, from exacerbating the urban heat island effect to elevating flood risk. Build green infrastructure to help improve community resilience.

## FLOODING



By the end of the century, annual damages from flooding in the U.S. are projected to **increase** by **30%**.<sup>1</sup>

## DROUGHT



**1 out of 3** U.S. counties in the lower 48 states face higher risks of water shortages by mid-century.<sup>2</sup>

## COASTAL DAMAGE



**50%** of Americans live in coastal counties, where water and energy infrastructure are increasingly vulnerable to higher sea levels.<sup>3</sup>

## URBAN HEAT

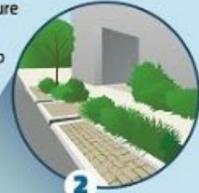


Climate change will likely lead to **more frequent and severe** heat waves during summer months.<sup>4</sup>

## Green Infrastructure Builds Resiliency

**1** Vegetation-based green infrastructure practices can mitigate carbon pollution.

**2** Build green infrastructure like rain gardens and permeable pavement to manage flooding.



**3** Reduce dependence on imported water and save money. Let water soak into the ground to recharge local groundwater supplies.

**4** Keep water local. Capture runoff in cisterns and rain barrels to reduce municipal water use.

**5** Plant trees and green roofs to mitigate the urban heat island effect.

**6** Use living shorelines, buffers, dunes and marsh restoration to reduce the impact of storm surges.

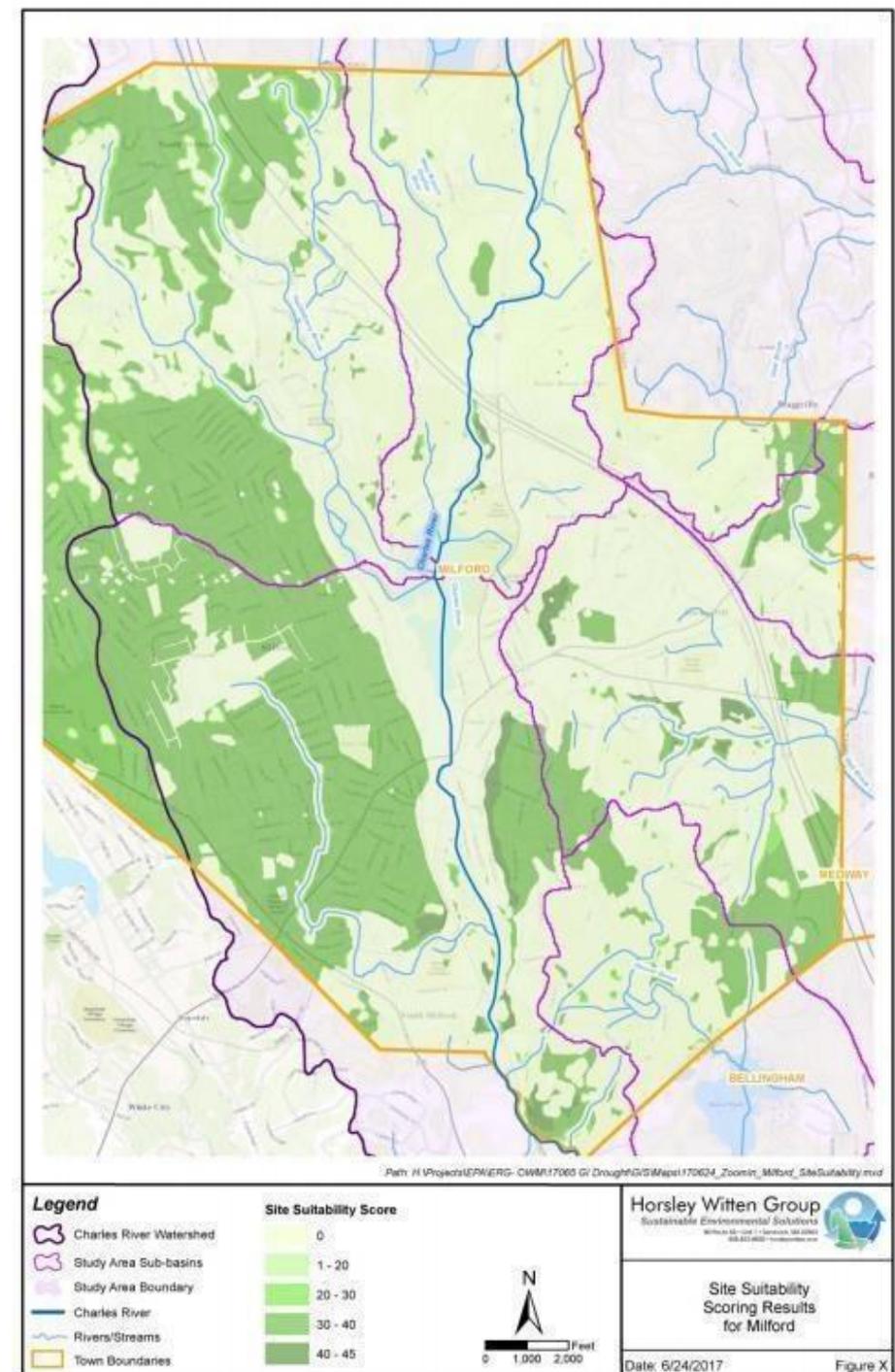
# Green Infrastructure at EPA

- 3 scales: Watershed, Neighborhood, Site
- Water quality + many other community benefits
- Climate resilience benefits
  - Manage flooding
  - Prepare for drought
  - Reduce urban heat island
  - Lower building energy demands
  - Spend less energy managing water
  - Protect coastal areas

# Green Infrastructure & Hazard Mitigation

- EPA has funded projects integrating FEMA Hazard Mitigation Plans and water quality plans to reduce natural hazards, such as floods, landslides, and drought, while emphasizing water quality benefits, including in:
  - Ashland, OR
  - Albany, NY
  - State of Massachusetts
  - Huntington, WV
  - Mystic River Watershed, MA
  - Maricopa County, AZ

Map showing infiltration site suitability in Millford, MA.



# Ashland, Oregon

- GIS mapping
- Ecosystem services evaluation
- Ordinance review
- Recommendations
  - Specific floodwater storage projects
  - Green streets program
  - Retrofit program for private landowners
  - Updated Jackson County HMP

GI and LID Example Best Management Practices	Natural Hazard Mitigation			Co-Benefits		
	Flood	Wildfire	Landslide	Water Quality	Community Benefits	Habitat
<b>Minimize Impervious Area:</b> Share parking spaces Minimize pavement widths Minimize front yard setbacks Share driveway Minimize building footprint(s) Minimize roadway cross section(s)	●		●	●	●	◐
<b>Limit Disturbance of Undeveloped Land:</b> Sequence construction schedule Conserve fast(er) draining soils Cluster development Preserve/protect trees Minimize foundation(s) Minimize grading	◐		●	◐	●	◐
<b>Prevent Runoff from Landscape and Hardscape Areas:</b> Rain garden(s) Bioswale(s) Bio-retention (infiltration) basin (Dry) Detention basin Tree and landscape planting(s) Remove existing pavement Contained planters Vegetated roofs (green roofs) Porous Pavement	●	◐	●	●	●	◐
<b>Protect Land and Ecosystems:</b> Conserve open space Protect/preserve wetlands Construct wetlands Protect/preserve riparian areas Maintain/enhance urban forest (forest parks)	●	●	◐	●	●	●

Source: *Low Impact Development in Western Oregon: A Practical Guide for Watershed Health*, with additions from the University of Oregon Service Center.

# RECOVERY AND RESILIENCY PARTNERSHIP MEXICO BEACH

STORMWATER MANAGEMENT AND GREENSPACE PROJECT

MEXICO BEACH, FLORIDA

DECEMBER 2019



# FEMA BRIC Summer Engagement Series

## Session 5: BRIC and Nature – Based Solutions

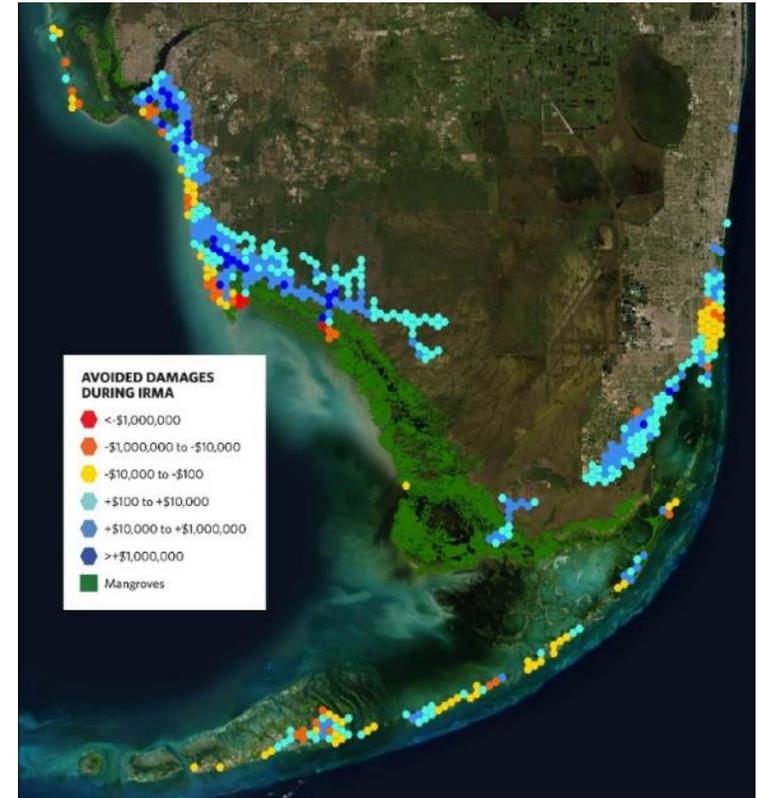


Sarah Murdock, Dir. Climate Resilience Policy

# Studying and Documenting Natural Infrastructure as an Effective and Cost-Effective Investment



Coastal Wetlands Prevented \$625M in Property Damage During Hurricane Sandy



\$1.5 Billion in avoided property damages due to mangroves in Hurricane Irma

# Floodplain Projects Demonstrate Success: Puyallup River, WA



PUBLIC INFORMATION STATEMENT, NATIONAL WEATHER SERVICE SEATTLE WA

1035 AM PST MON FEB 2, 2015

...CHANGES IN THE NATIONAL WEATHER SERVICE FLOOD LEVELS FOR THE PUYALLUP RIVER BASIN...

THE NATIONAL WEATHER SERVICE (NWS) IN SEATTLE WILL BE MAKING ADJUSTMENTS TO THEIR FLOOD WARNING LEVEL FOR THE PUYALLUP RIVER NEAR ORTING FLOOD WARNING POINT. THIS IS **DUE TO FLOOD MITIGATION EFFORTS BY PIERCE COUNTY THAT HAS REDUCED THE FLOOD THREAT AT UNUSUALLY VULNERABLE LOCATIONS NEAR ORTING.**

HIGH RIVER FLOWS THIS YEAR HAVE CONFIRMED THE SUCCESS OF THESE EFFORTS. THEREFORE **THE THREAT OF FLOODING NO LONGER OCCURS AT THE LOW THRESHOLD OF 4500 CFS BUT AT THE MUCH HIGHER LEVEL OF 10000 CFS** AS IN PREVIOUS YEARS.

Before



Lighting Point; Bayou La Batre, Alabama  
Coastal Restoration – Multiple Benefit Project

Photo by: Moffat & Nichol

Near Complete (6/2020)



Lighting Point Project

# FEMA BRIC Summer Engagement Series Session 5: BRIC and Nature – Based Solutions

## Project Types and Resources

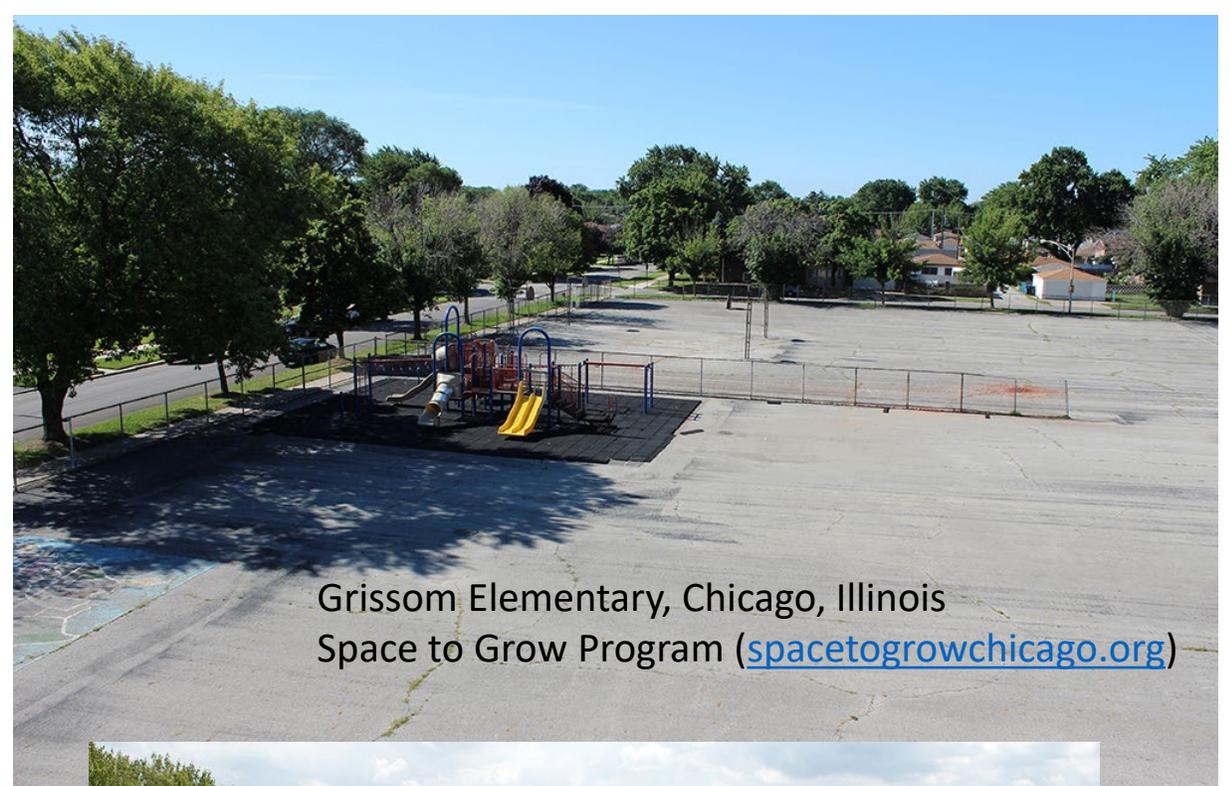
Chad Berginnis, CFM  
Executive Director ASFPM



Rain Garden Reserve, Cuyahoga Falls, Ohio

# Dare to Dream!

- Floodplain & stream restoration
- Floodwater diversion & storage
- Low Impact Development (LID)/ Green Infrastructure (GI)
- Flood friendly infrastructure
- Flood prone building acquisition
- Managed retreat



Grissom Elementary, Chicago, Illinois  
Space to Grow Program ([spacetogrowchicago.org](http://spacetogrowchicago.org))



# Considerations

- Smarter buyout projects
- Multiple funding sources
- One project? Several projects?
- Plans and community goals?
- Timeframe



Rush Creek Linear Park,  
Arlington, Texas

# Resources

## USING NATURE TO ADDRESS FLOODING

We've created this guide of nature-based solutions and included case studies of successful projects from across the country to help communities learn more and identify which nature-based solutions might work for them.



Credit: Darryl Boudreau

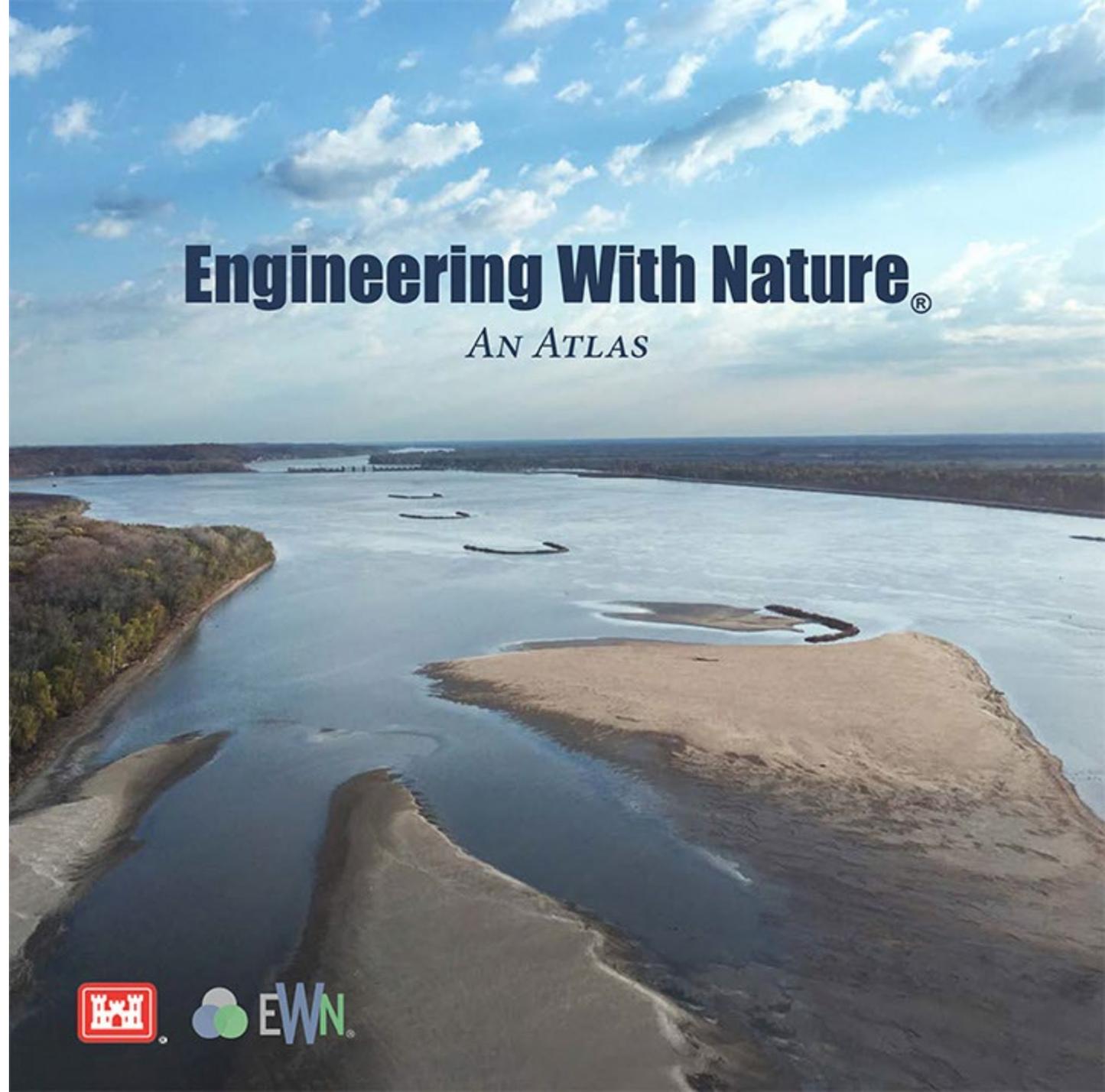
### WHAT ARE NATURE-BASED SOLUTIONS?

Nature offers a powerful set of tools for addressing hazards like flooding and erosion. Nature-based solutions use natural systems, mimic natural processes, or work in tandem with traditional approaches to address these specific hazards. Communities across the country— along rivers or coasts, large or small, rural or urban— can incorporate nature-based solutions in local planning, zoning, regulations, and built projects to help reduce their exposure to flood and erosion impacts.

[nrcsolutions.org](https://nrcsolutions.org)

# Resources

- Innovative Drought and Flood Mitigation Projects, FEMA (2017)
- Engineering with Nature *An Atlas*, USACE (2019)
- EPA's green infrastructure website [epa.gov/green-infrastructure](https://epa.gov/green-infrastructure)
- Green Infrastructure Toolkit, Georgetown Climate Center
- Floodplain Buyouts: An Action Guide for Local Governments on How to Maximize Community Benefits, Habitat Connectivity, and Resilience, UNC and ELI (2017)



An aerial photograph of a coastal town, likely in New England, featuring a harbor filled with numerous sailboats. The town is surrounded by dense green forest. The image is overlaid with a semi-transparent blue gradient. The word "Discussion" is centered in white, bold, sans-serif font, with a thin white horizontal line underneath it.

# Discussion



# BRIC Stakeholder Engagement Sessions

- BRIC Engagement Sessions – all about the BRIC program (July 2020)

Recordings available at:

[https://www.youtube.com/playlist?list=PL720Kw\\_OoJlKKwDJQpkCLJ-6v4I\\_ndNEJ](https://www.youtube.com/playlist?list=PL720Kw_OoJlKKwDJQpkCLJ-6v4I_ndNEJ)

- July 1: Introduction to BRIC
  - July 8: Meaning of the BRIC Name
  - July 15: BRIC and Building Codes
  - July 22: BRIC and Community Lifelines
  - July 29: BRIC and Nature-based Solutions
- BRIC NOFO Webinars – will occur after NOFO is released (August - September 2020)

# Resources

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## Building Resilient Infrastructure and Communities



This page provides general information about a new pre-disaster hazard mitigation program.

<https://www.fema.gov/bric>

**Sign up for BRIC and HMA Updates:**  
<https://www.fema.gov/hazard-mitigation-assistance>

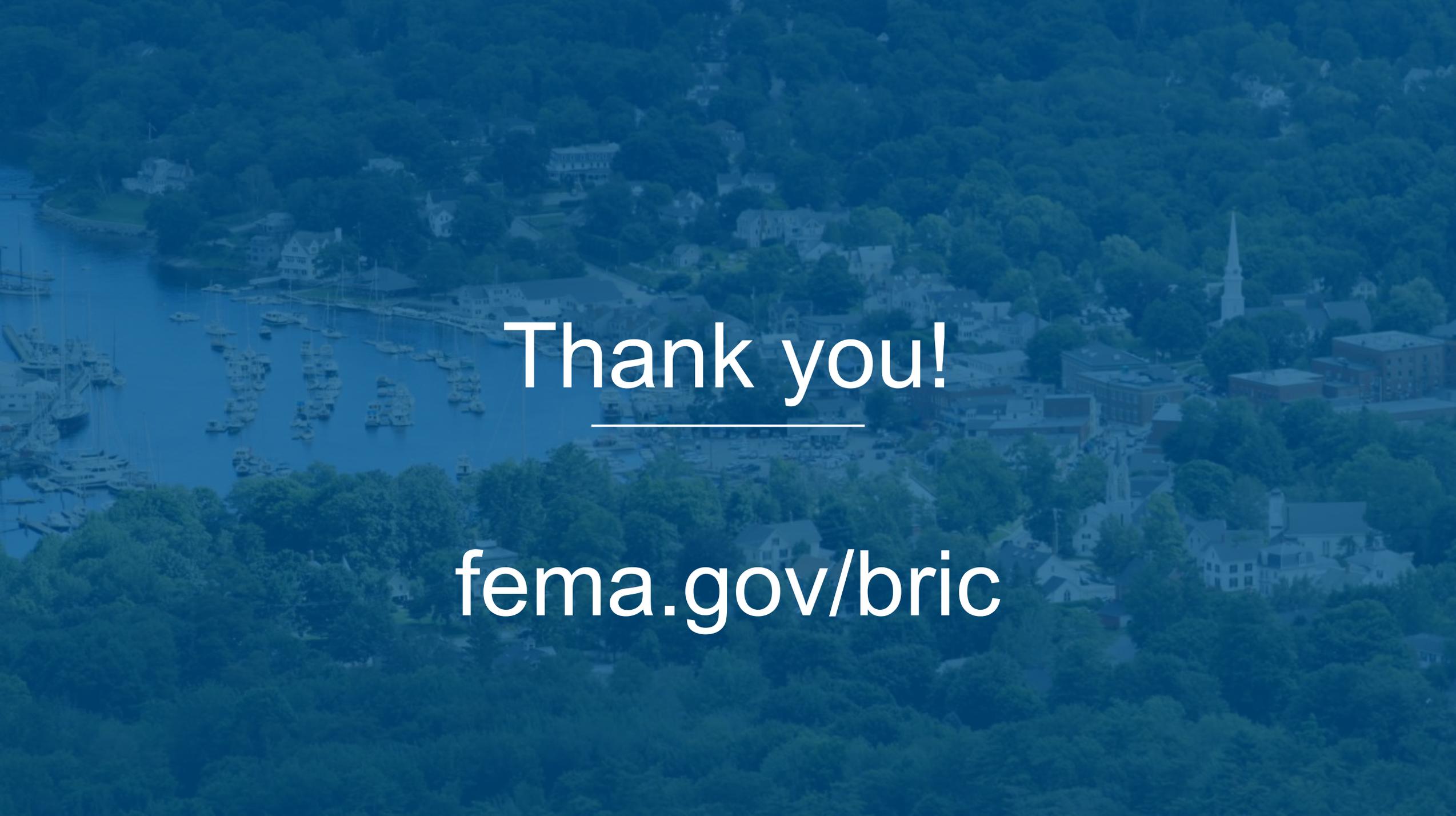
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Thank you!

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[fema.gov/bric](https://fema.gov/bric)