Harnessing Ecosystem Services for Water Management

Climate Resilience Webinar Series

U.S. Department of Housing and Urban Development
Disclaimer

• This presentation is intended to provide communities and states with the tools and information to help in climate resilience planning and activities.

• Information presented in this webinar is independent of the Notice of Funding Availability (NOFA) for the National Disaster Resilience Competition (NDRC). While we expect that this information will be useful to interested communities and eligible applicants, *it should not be construed as the definitive word on any singular approach to resilience.*

• All NOFA NDRC questions should be sent to: [resilientrecovery@hud.gov](mailto:resilientrecovery@hud.gov)
Presenters

- Chad Berginnis, Association of State Floodplain Managers (ASFPM)
- Kate White, U.S. Army Corps of Engineers
- Bob Newport, U.S. EPA
- Joanne Mathews Throwe, University of Maryland Environmental Finance Center
Agenda

1. Overview
2. Floodplain Management Overview
3. US Army Corps of Engineers Approach to Coastal Risk Reduction: Full Portfolio of Measures
4. Green Infrastructure
5. Green Infrastructure Financing
6. Questions
ASFPM

• National non-profit, professional organization with the mission to reduce flood losses and protecting the natural and beneficial functions of floodplains
• 16,000 members, 35 chapters
• What we do:
  • National CFM certification
  • Develop publications, technical guidance and resources for floodplain managers
  • No Adverse Impact (NAI initiative)
  • Conferences, events and continuing educational training

floods.org
**Definition of FPM:** Wisely using the nations’ floodplains to reduce losses and preserving the natural functions of floodplains

**Definition of a resilient community:** one that is able to resist and rapidly recover from disasters or other shocks with minimal outside assistance.

*Communities with effectively managed floodplains will be resilient from the hazard of flooding.*
Strategies and Tools for Floodplain Management

#1: Modify Susceptibility to Flood Damages and Disruption

- Local and state regulations for flood hazard areas (zoning, subdivision, FPM regulations; building, housing, sanitary codes)
- Acquisition/relocation
- Floodproofing (elevation, dry/wet floodproofing)
- Development and redevelopment policies
- Flood forecasting and warning systems
- Information and education
Acquisition and demolition of 4 floodprone homes. Instead of seeding and grading land, a community park and rain garden was created. Withstood heaving, flooding rains in 2014.
Elevation of a building is a common technique across the United States.
Strategies and Tools for Floodplain Management

#2: Modify Flooding

- Dams and reservoirs
- Dikes, levees, and floodwalls
- Channel alterations
- High flow diversions
- Land treatment measures
- On-site detention measures
Setting back 9,600 feet of levee reconnected 600 acres of floodplain with the river. New levee provides 200-year protection and reduced flood elevations in the area by 3 feet.
#3: Modify Impacts of Flooding on Individuals and the Community

- Information and education
- Flood insurance
- Loan Programs
- Disaster assistance
- Tax adjustments
- Flood emergency measures
- Pre- and Post-flood recovery planning
States and communities can develop programs to provide assistance, supplementing programs like the NFIP.
Strategies and Tools for Floodplain Management

#4: Protect and Restore the Resources and Functions of Floodplains

- Floodplain, wetland, and coastal barrier regulations
- Land use planning
- Conservation easements
- Open space management
- Multi-objective management
- Development and redevelopment policies
- Tax adjustments
- Information and education
Land contouring to lower the ground elevation by over 6 feet to create additional floodplain storage. Floodplain areas are open green space and soccer fields for recreational use.
US Army Corps of Engineers Approach to Coastal Risk Reduction: Full Portfolio of Measures

Kate White, PhD, PE
US Army Corps of Engineers
Outline

Considerations for Adaptation Measures

• Implications of approaches
• Adaptation continuum
• Long-range planning and implementation

It’s Not All About Extremes

• Continued development in vulnerable areas
• Potential changes in sea level and storm conditions
• Constrained economic conditions

Measures

• Natural and nature-Based
• Nonstructural
• Structural
• Combinations
“There are trade-offs between the goals of building resilience and reducing vulnerability. Adaptive management approaches that promote resilience seek to learn from failure and promote the ongoing structures and functions of overall systems. Vulnerability approaches, by contrast, focus on the most endangered individuals or ecosystems and seek adaptations that protect those, perhaps at the expense of robustness and resilience of the overall system...” – Adger et al 2009

Desired Adaptation Space
Adaptation Continuum (Notional Additions to IPCC AR5 WGII)

May be more feasible for communities with low technology and less-developed economies

May be more feasible for communities with high technology and well-developed economies

May be easier to implement for regions with low diversity, coherent governance, or smaller geographic scale

May be more difficult to implement for regions with high diversity, fragmented governance, or large geographic scale

Vulnerability & Exposure Reduction through development, planning, & practices including many low-regrets measures

Transformation including incremental & transformational adjustments

Spheres of Change  
Social  
Institutional  
Structural/Physical

Easier  
Harder

Ecosystem Management  
Livelihood Security  
Human Development

Spatial or Land-Use Planning  
Disaster Risk Management  
Poverty Alleviation
Increasing Severity of Climate Impacts

Infrastructure planned and built with past climate and weather in mind may not be adequate for future resilience and operation.

After United States Ports: Addressing the Adaptation Challenge, Mr. Mike Savonis
Preparing for the Long Term: When to Make Decisions?

<table>
<thead>
<tr>
<th>Indicator value</th>
<th>Threshold value of indicator when intervention is needed</th>
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<tr>
<td>(e.g. sea level rise)</td>
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**Initial Decision point** based on range of conditions*

Monitor and Record values of indicator

Date of review

Lead time for planning, design and construction

Projected future ranges of indicator

* Can be adjusted based on monitoring closer to decision point
“Sea level along much of the eastern U.S. was higher than normal for much of June and July 2009, enough to cause significant attention from coastal communities because of the lack of coastal storms that normally cause such anomalies....”

“... unique in that the NE winds were not at a multi-year high or the Florida Current transport at its low. But the coupled effect of the two forces created SL residuals that were at highest levels all along the East Coast.”

Figure 10. a) The June 2000–June 2009 average seasonal cycle of FC transport based on a 90-day low-pass filtered series and SL predictions above MSL and b) diagram showing cross-shore sea slope with low, average, and high FC transport (adaptation of Figure 2 in Noble and Gelfenbaum, 1992).
It’s Not All About Extremes → Nuisance Flooding
Integrated Approaches Aren’t New

Jadwin Report after Flood of 1927

• Require floodplains to carry flow, robust to floods of 2011

Mississippi Coastal Improvement Project after Katrina

• Increased coastal community resiliency
• Restoration of barrier and near-shore islands enhances protection of mainland areas.
• Moving private lands into the public sector reduces impacts of future storms and hurricanes and increases resiliency and sustainability

Natural and nature-based measures can improve the quality and resilience of economic, ecologic, and social systems

Multiple lines of defense with components addressing different threats support creative and comprehensive approaches
Full Portfolio = Multiple Lines of Defense

Quantification of performance of natural and nature-based coastal risk reduction measures is a critical knowledge gap.

Natural and Nature-Based Infrastructure at a Glance

**Dunes and Beaches**
- Benefits/Processes
- Breaking of offshore waves
- Attenuation of wave energy
- Slow inland water transfer
- Performance Factors
  - Berm height and width
  - Beach slope
  - Sediment grain size and supply
  - Dune height, crest, and width
  - Presence of vegetation

**Vegetated Features**
- Benefits/Processes
- Breaking of offshore waves
- Attenuation of wave energy
- Slow inland water transfer
- Increased infiltration
- Performance Factors
  - Marsh, wetland, or SAV elevation and continuity
  - Vegetation type and density

**Oyster and Coral Reefs**
- Benefits/Processes
- Breaking of offshore waves
- Attenuation of wave energy
- Slow inland water transfer
- Performance Factors
  - Reef width, elevation, and roughness

**Barrier Islands**
- Benefits/Processes
- Wave attenuation and/or dissipation
- Sediment stabilization
- Performance Factors
  - Island elevation, length, and width
  - Land cover
  - Breach susceptibility
  - Proximity to mainland shore

**Maritime Forests/Shrub Communities**
- Benefits/Processes
- Wave attenuation and/or dissipation
- Shoreline erosion stabilization
- Soil retention
- Performance Factors
  - Vegetation height and density
  - Forest dimension
  - Sediment composition
  - Platform elevation

[www.corpsclimate.us](http://www.corpsclimate.us)
Nonstructural and Floodproofing Measures at a Glance

GENERAL COASTAL RISK REDUCTION PERFORMANCE FACTORS:
COLLABORATION AND SHARED RESPONSIBILITY FRAMEWORK, WAVE HEIGHT, WATER LEVEL, STORM DURATION

**Floodplain Policy & Management**
Benefits/Processes
- Improved and controlled floodplain development
- Reduced opportunity for damages
- Improved natural coast environment

**Floodproofing and Impact Reduction**
Benefits/Processes
- Reduced opportunity for damages
- Increased community resiliency
- Does not increase flood potential elsewhere

**Floodproofing and Impact Reduction**
Benefits/Processes
- Reduced opportunity for damages
- Increased community resiliency
- Does not increase flood potential elsewhere

**Relocation**
Benefits/Processes
- Reduced opportunity for damages
- Does not increase flood potential elsewhere
- Improved natural coast environment

Performance Factors
- Wave height
- Water level
- Storm Duration
Nonstructural and floodproofing measures, including coastal zone management, can have a high return on investment and are a valuable part of a systems approach.

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<thead>
<tr>
<th>Adaptation Strategy</th>
<th>Resiliency/Effectiveness</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Elevate Equipment</td>
<td>Low/High</td>
<td>$$$$</td>
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<tr>
<td>Flood-Proof Equipment</td>
<td>Low/High</td>
<td>$$$</td>
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<tr>
<td>Install Static Barrier</td>
<td>Low/High</td>
<td>$$$</td>
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<tr>
<td>Seal Building</td>
<td>Low/High</td>
<td>$$</td>
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<tr>
<td>Sandbag Temporarily</td>
<td>Low/High</td>
<td>$</td>
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<tr>
<td>Install Backup Power</td>
<td>Low/High, Does not protect equipment but facilitates rapid service recovery</td>
<td>$$ $$</td>
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