

# **Being Prepared for Climate Change** A Workbook for Developing Risk-Based Adaptation Plans

ASWM • Natural Floodplain Function Alliance

Michael Craghan, Ph.D. March 3, 2015



# **<u>Climate Ready Estuaries</u>**

Climate Ready Estuaries works with the National Estuary Programs and the coastal management community to:

- assess climate change vulnerabilities;
- develop and implement adaptation strategies;
- engage and educate stakeholders.

CRE shares NEP examples to help other coastal managers, and provides technical guidance and assistance about climate change adaptation.





# **Climate Change and Wetlands**

Air and water temperature Invasive species and habitat change Ice

Sea level rise Tides Salinity Habitat transgressions Loss of coastal marshes Living shorelines Deeper estuaries







## **Climate Change and Wetlands**

Hydrology Salinity Sediment sources Turbidity

Storms Natural and nature-based features Overwash and inlets

Carbon dioxide Photosynthesis Ocean acidification Blue carbon





Vulnerability Assessment + Implementing an Action Plan Climate Change Adaptation

A vulnerability assessment is an understanding of how climate change will affect an organization.

A VA is a ranked description of how climate changes would keep an organization from reaching its goals.

The VA tells you what your biggest risks are. An action plan tells what you will do about the risks.

Being Prepared for Climate Change A Workbook for Developing Risk-Based Adaptation Plans



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# Why risk-based plans?

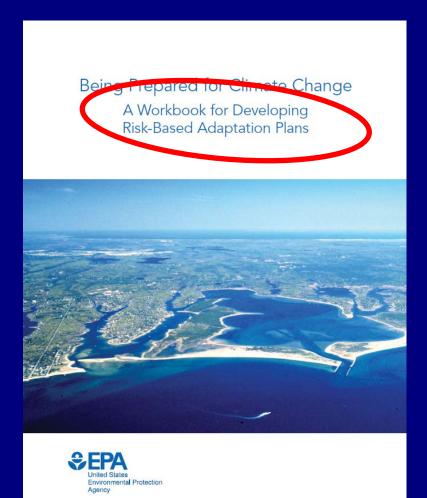
Risk management is about an organization.

### Your organization's:

- Goals.
- Context.
- Decisions.

It clarifies your situation.

You get a better plan.







### How do you decide what to do?

100+ discrete risks from climate change.

#### (unfortunately, $5 \times 6 \times 4 > 100$ )

How do you decide what to do if you don't have the resources to do everything you need to do?!





# Vulnerability Assessment

1—Communication and Consultation

2—Establishing the Context for the Vulnerability Assessment

3-Risk Identification

4-Risk Analysis

5—Risk Evaluation: Comparing Risks



## Risk evaluation

An example consequence probability

matrix.

Likelihood (probability) of occurrence	High	<ol> <li>Warmer water may stress immobile biota</li> <li>Warmer water may lead to changes in drinking water treatment processes</li> <li>n</li> </ol>	<ol> <li>Warmer water may hold less dissolved oxygen</li> <li>Sea level rise may cause bulkheads, sea walls and revetments to become more widely adopted</li> <li>n</li> </ol>	<ol> <li>Shoreline erosion from sea level rise may lead to loss of beaches, wetlands and salt marshes</li> <li>Combined sewer overflows may increase from more intense precipitation</li> <li>n</li> </ol>		
	Medium	<ol> <li>Increased wildfires from warmer summers may lead to soil erosion</li> <li>Warmer winters may lead species that once migrated through to stop and stay</li> <li></li> </ol>	<ol> <li>Parasites and bacteria may have greater abundance, survival or transmission due to warmer water</li> <li>Warmer summers may drive greater water demand</li> <li>n</li> </ol>	<ol> <li>More frequent drought may diminish freshwater flow in streams</li> <li>More intense precipitation may cause more flooding</li> <li>n</li> </ol>		
	worl	<ol> <li>Warmer water may lead open seasons and fish to be misaligned</li> <li>Warmer winters may lead to more freeze/thaw cycles that impact water infrastructure</li> <li>n</li> </ol>	<ol> <li>Warmer water may lead jellyfish to be more common</li> <li>Ocean acidification may cause the recreational shellfish harvest to be lost</li> <li>n</li> </ol>	<ol> <li>Contaminated sites may flood from sea level rise</li> <li>Warmer water may promote invasive species</li> <li>n</li> </ol>		
		Low	Medium	High		
	Consequence of impact					





### **Action Plan**



Step 6—Establishing the Context for the Action Plan

Step 7—Risk Evaluation: Deciding on a Course

Step 8a—Finding Adaptation Actions

Step 8b—Selecting Ad. Actions

Step 9—Preparing and Implementing an Action Plan

Step 10—Monitoring & Review



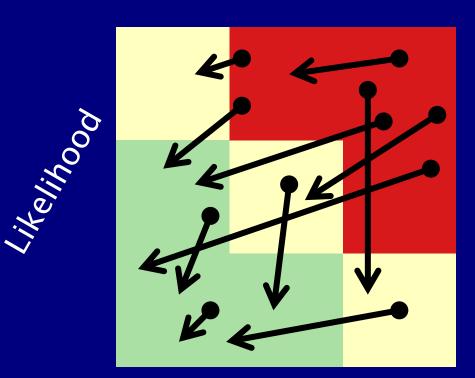
### Mitigating actions

Risks are mitigated by actions that lower their likelihood or consequence.

FPA

When a risk is mitigated it would be re-plotted closer to the lower left.

Your aim is to have no red risks.



Consequence





# A risk-based climate change adaptation plan

Q: How do you decide what to do if you don't have the resources to do everything you need to do?

The <u>vulnerability assessment</u> points toward the biggest risks! The ones that are highly likely to occur and will have high consequences when they do.

The <u>action plan</u> points to the actions that reduce the most risk and don't have bad side effects.

# Methods

#### **STEP ONE:** Communication and Consultation

Stakeholder	Issue/Area of Focus	When should/did they become involved?				
Angel Dieppa, Jobos Bay NERR		September workshop				
Benito Pinto, La Regata	Recreational/Navigation/Fishing	September workshop				
Craig Lilyestrom, DNER	Marine Resources/Fisheries	September workshop				
David Cuevas, EPA	Water resources	September workshop				
Ernesto Diaz, DNER- PRCZMP	Coastal hazards, development, nonpoint and point sources of pollution, public access	September workshop				
Ernesto Olivares, SJBEP	Enforcement	September workshop				
Evelyn Huertas, EPA		September workshop				
Gustavo Garcia, SJBEP and DNER Assistant to Secretary	Public Policy	September workshop				
Jorge Bauza, SJBEP	ALL	September workshop				
Jose Rivera, NOAA		September workshop				
Jose Seguinot Barbosa	Public health, water quality	September workshop				
Julio Morell, CariCOOS	Monitoring, modeling and data management	September workshop				
Katia Aviles, Proyecto ENLACE	Environmental justice communities, health, water quality, recreation, fisheries, marine resources	September workshop				
Luis Jorge Herrera, IDS		September workshop				
Luis Soler, USGS		September workshop				
Pablo Mendez, UPR/SJBEP		September workshop				
Pedro Diaz, USGS	Monitoring	September workshop				
Pedro Gelabert, SJBEP	ALL	September workshop				
Pedro Guevara, JCA	Water quality	September workshop				
Ray David Rodriguez, Fideicomiso		September workshop				
Raimundo Espinosa, TNC		September workshop				
Vance Vicente		September workshop				
Jorge Ortiz Zayas, UPR-ITES		September workshop				
Ernesto Otero, RUM_CIMA		September workshop				
Angel Melendez, JCA	Water quality	September workshop				
Jose Juan Terrasa, Turismo	Recreation, coastal hazards, marine resources	September workshop				

# Methods

### **STEP THREE:** Risk Identification

#### During risk identification process we also conducted community workshops.

#### Taller para la evaluación de riesgos en las comunidades

del Estuario de la Bahía de San Juan



Deseamos conocer cómo su comunidad se ha visto afectada por el **cambio climático**. Este fenómeno incluye aumento en las mareas, inundaciones, erosión en las costas, presencia de nuevas especies invasoras y otros.

Acompáñenos en una reunión comunitaria para discutir estos asuntos de gran importancia para su comunidad.

iESPACIOS LIMITADOS! Por favor reserve su lugar llamando al 787 725 8165 ó escriba al correo electrónico isabela117@gmail.com

**10 de julio de 2013** 5:00pm - 7:00pm

#### LUGAR

Choliseo Coliseo de Puerto Rico José Miguel Agrelot

#### www.estuario.org



CE 99206918

# Methods

#### **STEP FIVE:** Evaluation/Comparing Risks

*Using a consequence/probability matrix to reach consensus about each risk* 

1. Open seasons and his may become missligned (place or region; decades)         2. Increased occurrence (courting or soon to occur)         1. Increase in solid wate—more people using the beach and recreational activities (elections): decades)           0.         More frequent or more intense bad weather the activity of bathers (place or region; within the next 15-30 years)         1. Increase in solid wate—more around (extensive; decades)           0.         More frequent or more intense bad weather the activity of bathers (place or region; within the next 15-30 years)         1. Increase aquatic security may be threaded occurring)           0.         More frequent or more intense bad weather the activity of bathers (place or region; within the next 15-30 years)         1. Increase aquatic security may be threaded occurring)           0.         Increase aquatic security risks (place or region; within the next 15-30 years)         1. Increase aquatic security risks (place or region; within the next 15-30 years)           0.         Increase in natical activities (place or region; within the next 15- 30 years)         1. Eco-tourism resources or attractions may be degrade (e.g., burding, driving, fishing) or stand-up paddleboarding (SUP) (place or region; already occurring or soon to occur)         1. Invasive plants may clog creeks, canals and watherways reducing public access (extensive; decades)           1.         Recreational sheffish harvesting may be lost (place or region; decades)         2. Increased use (vesels (place or region; decades)           3.         Increased on the recreational fish (place or region; decades)         1. Invasive plants		RECREA	TIONAL ACTIVITIES IN AND ON				
Image: Spectrum		seasons and fish may become misaligned (place ore region;	of Ciguatera fish poisoning (extensive; already occurring or soon to occur) 3. Desired fish may not be around (extensive; decades) 4. More frequent or more intense bad weather may decrease recreational opportunities and reduce the activity of bathers (place or region; within the next 15-30 years) 5. Increased recreational fishing charter ships (place or region; decades) 6. Critical clearance under bridges may	<ul> <li>people using the beach and recreational activities (extensive; already occurring)</li> <li>2. Greater NPS pollution may impair recreation as a result of bacterial contamination (extensive; already occurring)</li> <li>3. Beaches or public access sites may be threatened by coastal erosion or inundation (place or region; already occurring)</li> <li>4. Impacts to hotel infrastructure as a product of erosion (site; already occurring)</li> <li>5. Increased aquatic security risks (place or region; within the next 15-30 years)</li> <li>6. Harmful algal blooms may be more likely (extensive; within the next 15-30 years)</li> <li>7. Increase in nautical activities (place or region; within the next 15-30 years)</li> </ul>			
Image: Selection of the	Likelihood (probability) of Occur Medium		<ul> <li>in winter impacting tourism industry (place or region; within the next 15- 30 years)</li> <li>2. Freshwater flows in streams may not support recreational uses like boating, kayaking, fishing or stand-up paddleboarding (SUP) (place or region; decades)</li> <li>3. Less tourism due to northern areas being warmer, less recreational use of water bodies (place or region; already occurring or soon to occur)</li> <li>4. Too hot for enjoyment of outdoor recreational activities (place or region; already occurring</li> </ul>	attractions may be degraded (e.g., birding, diving, fishing) (extensive;			
	low	shellfish harvesting may be lost (place or	may drive away targeted recreational fish (place or region; decades)	<ul> <li>creeks, canals and waterways reducing public access (extensive; decades)</li> <li>2. Jellyfish may be more common (place or region; within the next 15-30 years)</li> <li>3. Increased use of vessels (place</li> </ul>			
Consequence of Impact	(ö. 3)	Low					
			Consequence of In	npact			

RECREATIONAL ACTIVITIES IN AND ON THE WATER

# **Modifications/Lessons**



- Additions to Risk Analysis Spreadsheet:
  - Where was risk identified?
  - Scientific source/confidence
  - Mentioned in Workshops?
  - Notes

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# **Final Report**

Report: Assessing the San Juan Bay Estuary Program's Vulnerabilities to Climate Change











### Is this workbook for you?

- Do you have environmental goals?
- Do you think climate change might affect what you are trying to accomplish?
- Do you have lots of risks in a variety of sectors?
- Do you have partners and stakeholders who should be involved?
- Do you have resource constraints?
- Could you use some decision support?

Then,



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