



Exercise: Assessing Vulnerability to Sea Level Rise

Version 1

Instructions

- Please assign a note-taker and someone to present group conclusions to the rest of the stakeholder working group.
- Rank the exposure, sensitivity, and adaptive capacity for the three following assets on a scale from 1 to 5 (1 = low, 5 = high).
- Then combine the rankings of the three variables to determine the overall vulnerability of the specific asset (how you combine the three variables to determine vulnerability is up to your individual group).
 - Remember high exposure and sensitivity is bad but high adaptive capacity is good.
- Throughout exercise think about what information isn't provided that you would like to have known.

	Exposure	Sensitivity	Adaptive Capacity		Vulnerability
Asset 1					
Asset 2					
Asset 3					

Asset 1 (Yellow): Storm Water Outfall

- Designed to withstand mild flooding but during historical flooding events the system has backed-up flooding city streets
- Room for vertical migration (i.e. raising the pipe to a higher elevation) but doing so is extremely expensive
- Room for horizontal migration (i.e. moving the outfall further inland) as there is not a lot of development directly around the outfall but surrounding land provides habitat to endangered bird species
- Sediment and trash frequently clogs the outfall

Asset 2 (Red): Road

- Very low elevation, currently experiences shallow flooding during large storm events
- No room for horizontal migration, backed-up against development
- Not well maintained due to community budget constraints
- Primary road in and out of town for citizens (i.e. central evacuation route)
- Used by all farms in the area to transport their goods

Asset 3 (Orange): Community Park

- Extremely low elevation with highly erodible surfaces
- No room for horizontal migration, surrounded by protected wetland habitat
- Only park within 30 miles of community
- Place of several afterschool activities for at-risk-youth and highly valued among community members
- Built through a charitable donation, low funds for improvements





Climate Understanding & Resilience in the River Valley

Exercise: Assessing Vulnerability to Sea Level Rise

Version 2

Instructions

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- Rank the exposure, sensitivity, and adaptive capacity for the three following assets on a scale from 1 to 5 (1 = low, 5 = high).
- Then combine the rankings of the three variables to determine the overall vulnerability of the specific asset (how you combine the three variables to determine vulnerability is up to your individual group).
 - Remember high exposure and sensitivity is bad but high adaptive capacity is good.
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	Exposure	Sensitivity	Adaptive Capacity		Vulnerability
Asset 1					
Asset 2					
Asset 3					

Asset 1 (Yellow): Salt Marsh Habitat

- Dominant vegetation can accommodate variable salinity concentrations and water levels
- Only place in region where this type of habitat exists
- Provides habitat for several endangered migratory bird species
- Has room to migrate inland given enough time
- Low accretion rates mean rises in marsh elevation are particularly slow
- System is already stressed by pollution from surrounding urban areas

Asset 2 (Red): Riparian Habitat

- Dominant vegetation can only accommodate low salinity concentrations and water levels
- General habitat type is common throughout region
- Provides habitat for an endangered population of the blue-winged sparrow (non-migratory), species does not exist anywhere else in region
- Habitat does not have room to migrate inland, backed-up against development

Asset 3 (Orange): Hiking Trails

- Range from high to low elevations, providing rare access to endangered habitat
- No room for horizontal migration considering it is surrounded by extremely sensitive habitat
- Popular tourist attraction among bird watchers and outdoor enthusiasts
- General area is culturally significant to local tribes, housing many traditionally important plant species





What to think about when assessing Sensitivity & Adaptive Capacity

Sensitivity is the degree to which an asset is impaired by a climate impact.¹ Metrics used to guide the analysis of sensitivity includes:

Built Environment¹

- What type of land use or service is provided (e.g. residential land uses, facilities that are critical for emergency response, or provide key community services to at-risk or vulnerable, less mobile populations)?
- What is the susceptibility of structures to flooding damage due to design or function (e.g. foundation type, flood-proofing, below-ground entrances or uses)?
- What are the historic effects of flooding (e.g. loss of function, disruption or delay of service)?
- What is the asset's elevation relative to current water level (e.g. low, mid, or high marsh habitat)?
- What is the asset's capacity to keep up with sea level rise (e.g. vertical accretion and subsidence rates)?
- What is the asset's capacity for horizontal (inland) migration (i.e. lateral accommodation space available)?
- Is contaminated soil or groundwater present?
- What is the current depth of groundwater?
- What is the seismic susceptibility due to increased liquefaction potential?

Natural Environment (Habitats)²

- Physiological sensitivity: How sensitive is the physiology of the dominant vegetation type to changes in moisture, temperature, CO₂ concentrations, pH, salinity...?
- Place/ ecosystem size: Is the administrative unit dominated by a single ecosystem/ habitat type, or does it encompass a range of climate and ecosystems?
- Disturbance regimes: How sensitive is the administrative unit likely to be to a change in disturbance regimes (e.g. flooding)?
- Individual species sensitivities: How sensitive are key species in the administrative unit to climate change (e.g. flagship species, ecosystem engineers, keystone species)?
- Sensitive habitats: Does the administrative unit contain (or is it characterized by) many habitats that will be particularly sensitive to climate change (e.g. vernal pools, shallow wetlands, coastal marshes, coral reefs)?
- Non-climatic stressors: To what degree are the habitats in the administrative unit negatively impacted by other, non-climatic stressors (e.g. invasive species, habitat loss, pollution)?





Adaptive Capacity is the ability of an asset to accommodate or adjust to an impact and thus to maintain its primary functions.¹ Metrics used to guide the analysis of adaptive capacity includes:

Built Environment¹

- What is the potential for partially compromised asset to maintain key functions and continue to provide necessary community services?
- Are there alternative comparable assets available (i.e. asset redundancy)?
- What is the capacity of the whole system to function without an asset or if an asset is compromised?
- What is the ability to restore asset function quickly, easily, or in a low-cost manner if compromised?
- Are there disaster or emergency response resources (e.g. onsite staff, backup power, equipment for cleanup, temporary flood protection, pumps, "friends of" organizations or volunteers)?
- Operation and maintenance costs
- Capital improvement costs
- Potential for reengineering or redesign
- What is the status of existing plans (e.g. emergency or disaster response plan, master plans, etc)?
- How complex are the regulations governing operations, maintenance, or capital improvements?
- How complex is decision-making regarding operations, maintenance, or capital improvement planning and implementation?

Natural Environment (Habitats)²

- What are the defining characteristics of the habitat community, and how vulnerable are they to climate change (e.g. presence of particular minerals in the soil may not be affected by climate change, whereas presence of vernal pools may be heavily affected)?
- Is there a diversity of species in each functional group within the community/ habitat?
- Is the geography, land use, etc. such that it would be possible for the community/ habitat to shift location over time?
- Are there microclimates within the area that could support refugial communities?
- What is the nature of people's relationship to this habitat/community? Does it occur in areas where there is strong development pressure? Do people value this habitat because of services it provides (e.g. clean water, hunting or fishing opportunities, bird watching etc.)?
- How rigid/ specific are the rules governing management of the unit (e.g. for National Wildlife Refuges, what is in the enabling legislation)?

¹ Adapting to Rising Tides (ART) Vulnerability and Risk Assessment Report (Sept. 2012). *Chapter 1: Introduction to the ART Vulnerability and Risk Assessment*. San Francisco Bay Conservation and Development Commission.

² Climate Change Vulnerability Assessment Training (November 2012). U.S. Fish & Wildlife Service: National Conservation Training Center. [Glick, P.;B.A. Stein; and N.A. Edelson, editors (2011). *Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment*. National Wildlife Federation, Washington, D.C.]

