

INTRODUCTION TO CLIMATE VULNERABILITY ASSESSMENT

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**What do you think of as
vulnerable to climate
change?**

**What do you feel is already
threatened/disrupted by
climate change?**



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Vulnerability

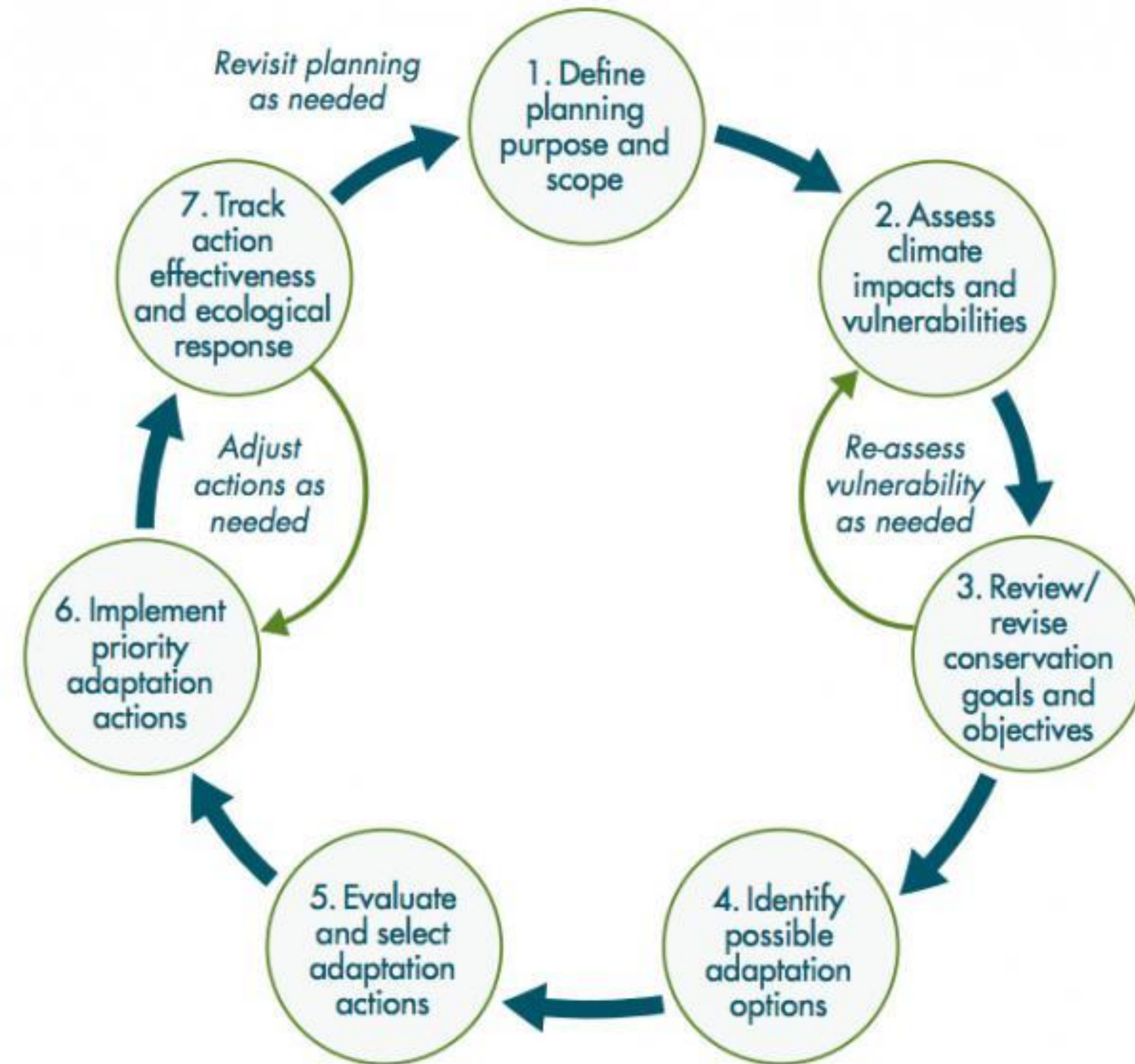
At this point we've covered climate science, and some impacts

Vulnerability takes us from the thinking about science to thinking about key items we're concerned about.

- What affects those items? (Hazards or Stressors)
- What are the impacts and consequences?
- What are the related actions and choices?



CLIMATE ADAPTATION PLANNING CYCLE



Vulnerability is about the *key items of concern*



Cultural



Ecosystems



Infrastructure



Species



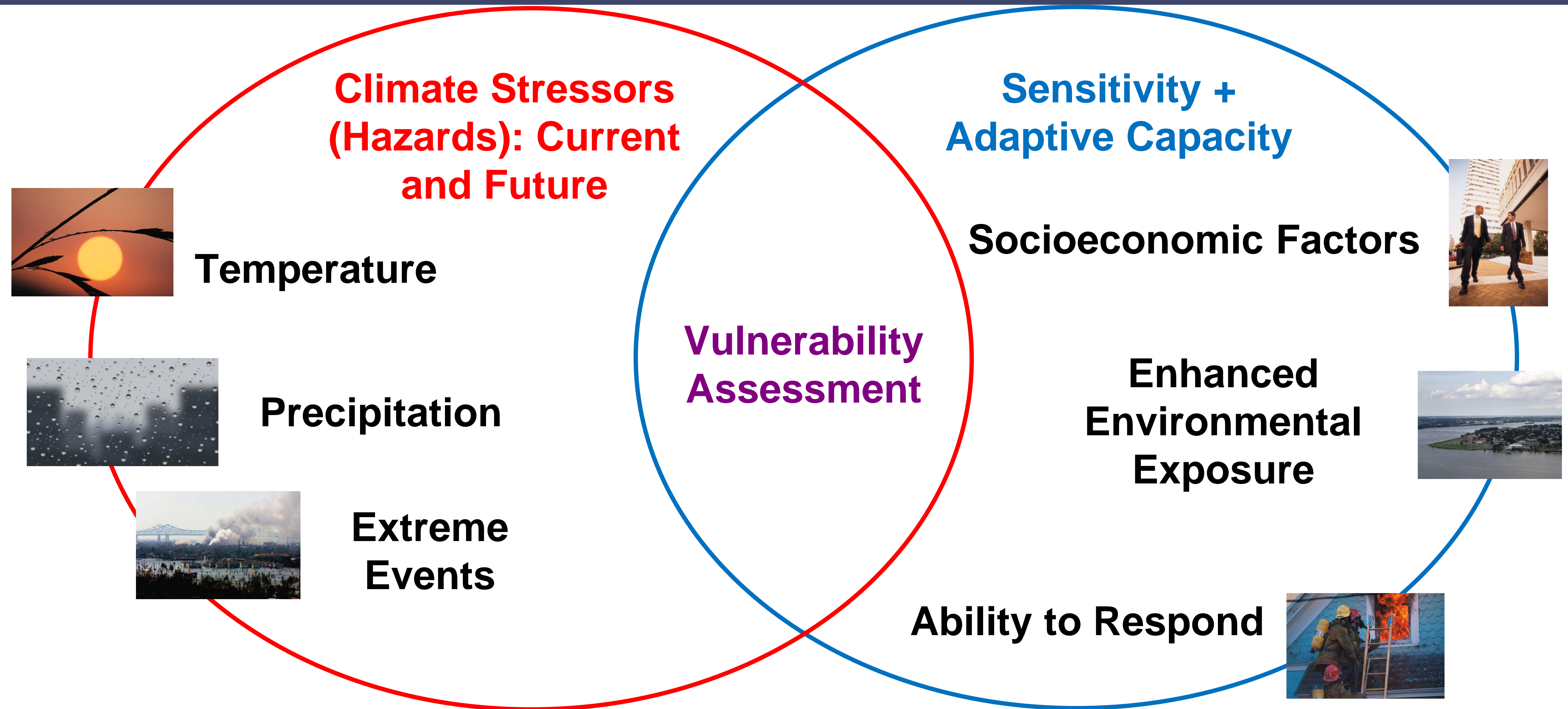
Definitions of Vulnerability

1. "an aggregate measure of human welfare that integrates environmental, social, economic and political exposure to a range of harmful perturbations" (Bohle et al. 1994)
2. "...the exposure to contingencies and stress, and difficulty in coping with them. (Chambers 1989)
3. "*Vulnerability*: the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. (IPCC 2001)



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Vulnerability Assessments examine many factors



Exposure

- The degree of climate stress upon a particular unit of analysis
- Climate stress:
 - long-term climate conditions
 - climate variability
 - magnitude and frequency of extreme events



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Sensitivity

Sensitivity
How big is
the impact of
the hazards?

What climate related hazards you are exposed to depends on where you are.

For example, with precipitation variability and semi-arid areas, Oklahoma is exposed to drought.

Sensitivity: the degree to which a given community or ecosystem is affected by climate stresses.

In Oklahoma increased heat during already hot summers might have significant impacts. That could include

- Crop damage

- Stress on water resources

- Dangers to public health (increases in heat stress / heat stroke)



Adaptive Capacity

**Adaptive
Capacity
Is it possible
to cope or
adapt?**

Adaptive capacity or resilience coping is the ability to withstand negative impacts from a hazard and adapt to a given climate impact.

Coping actions are things people do to protect themselves from harm, like getting help from friends or neighbors.

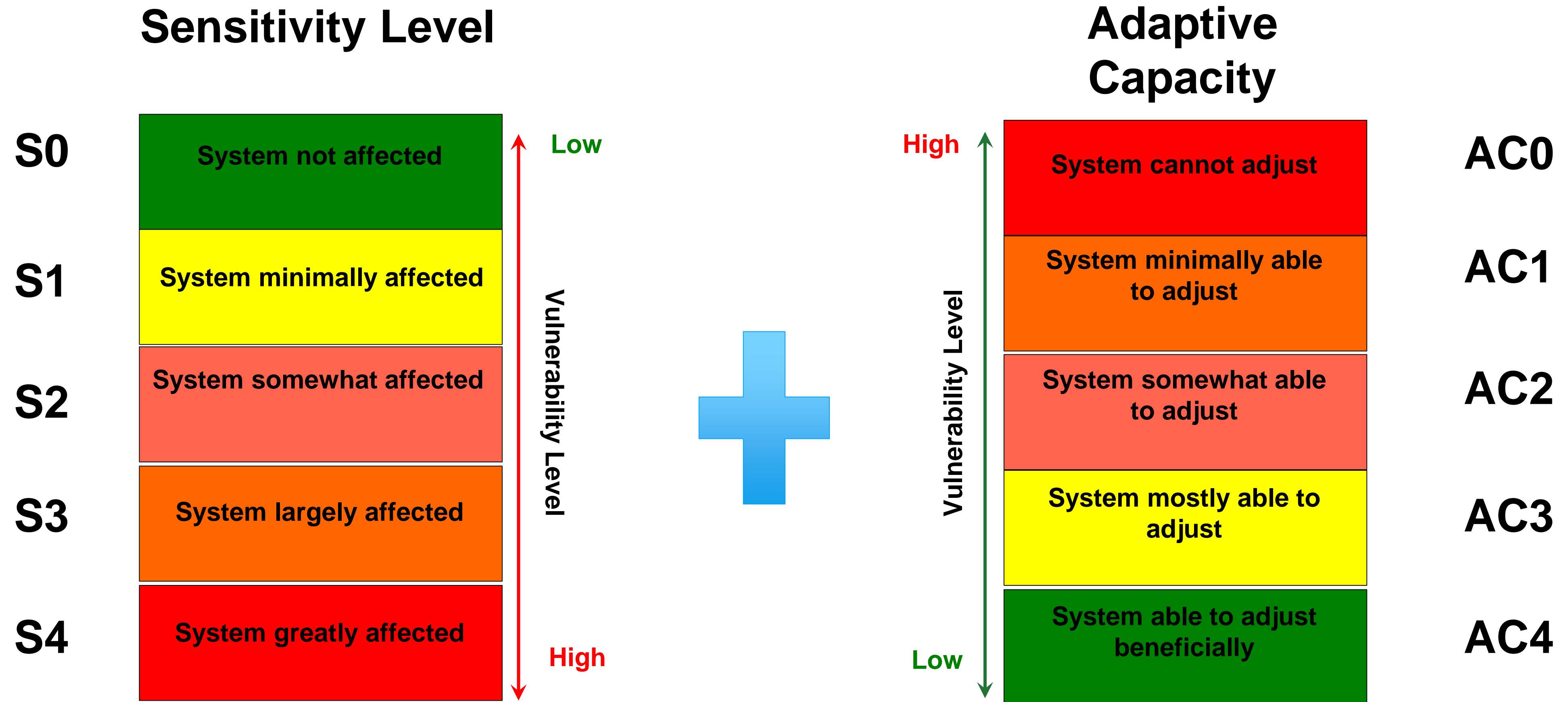
Examples:

- mutual aid agreements
- conservation
- reliable water resources
- insurance
- knowledge of developing risks (like drought or severe weather monitoring)



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Some things are less vulnerable than others



Navajo Vulnerability Assessment Report



More Vulnerable

	Golden Eagle
Man-made barriers	
Dispersal Ability	
Temperature	
Precipitation	
Habitat requirements	
Interspecies interactions	
Diet	
Population/Genetics	
Human interactions	



Less Vulnerable

	Mountain Lion
Man-made barriers	
Dispersal Ability	
Temperature	
Precipitation	
Habitat requirements	
Interspecies interactions	
Diet	
Population/Genetics	?
Human interactions	

http://conbio.org/images/content_publications/Final_Navajo_Vulnerability_Assessment_Report_2.pdf

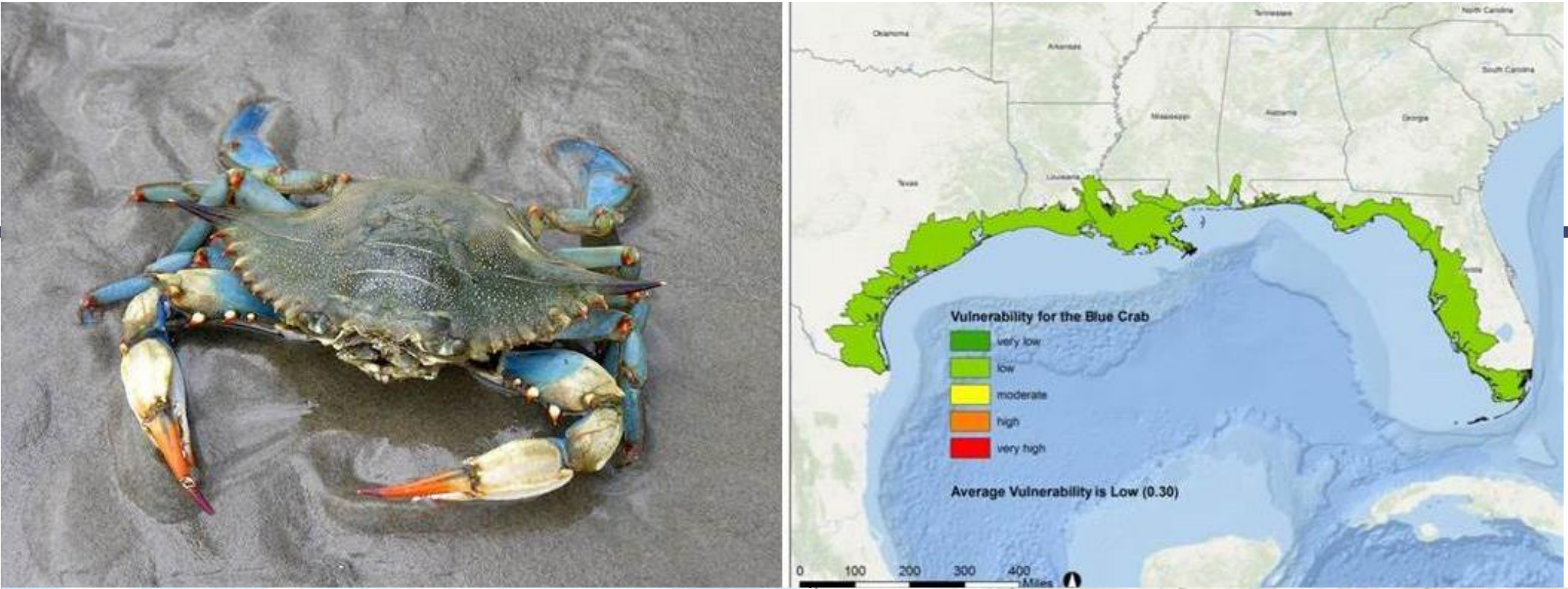


Vulnerability Assessments Include Planning

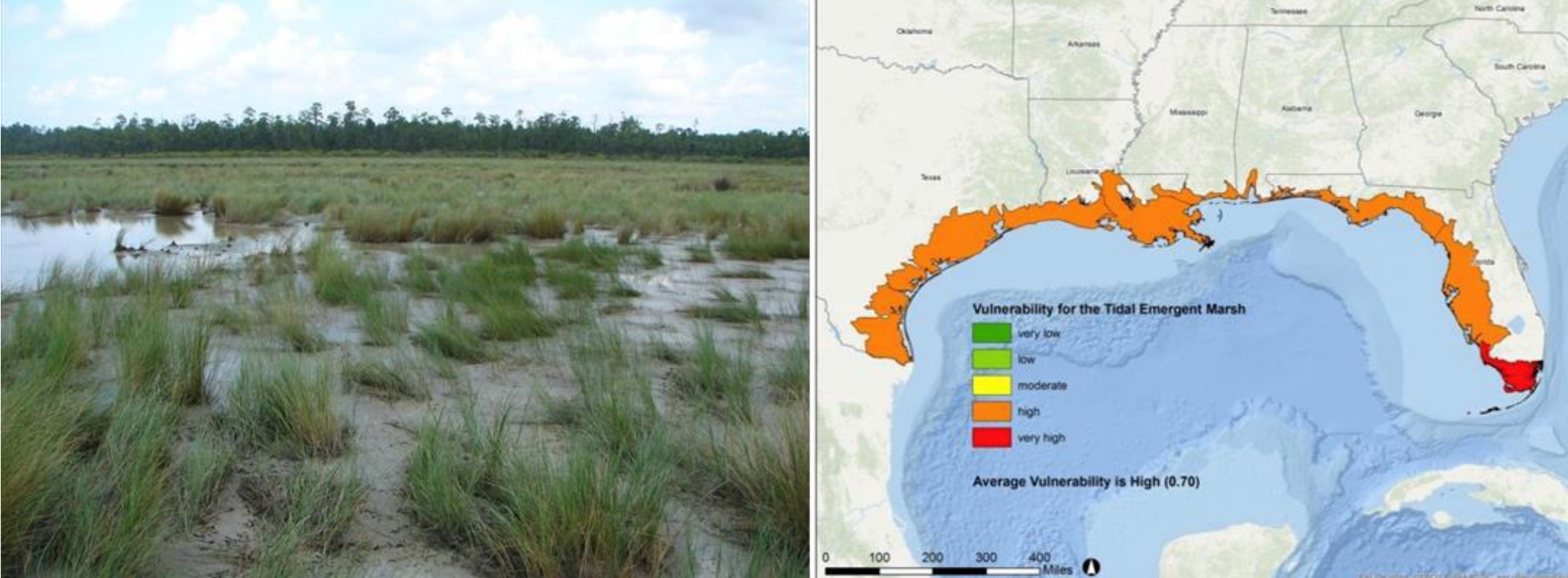


“...oyster reefs with marginal water quality could be targeted for habitat restoration to promote future population growth or recruitment in extreme years when isohalines have moved up or down estuary.” – Gulf Coast Vulnerability Assessment 2015, p.80, Adapted from Stein et al. 2014, emphasis added

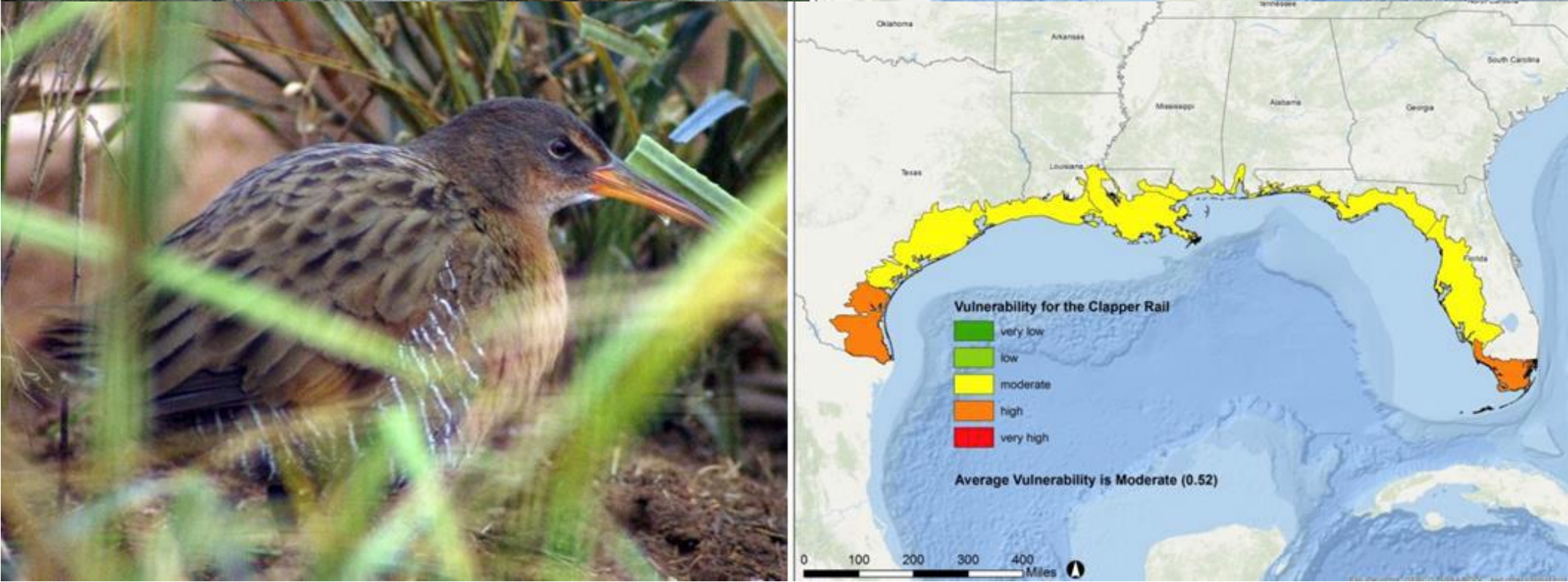
Blue Crab



Tidal Emergent Marsh



Clapper Rail



Gulf Coast
Vulnerability
Assessment 2015

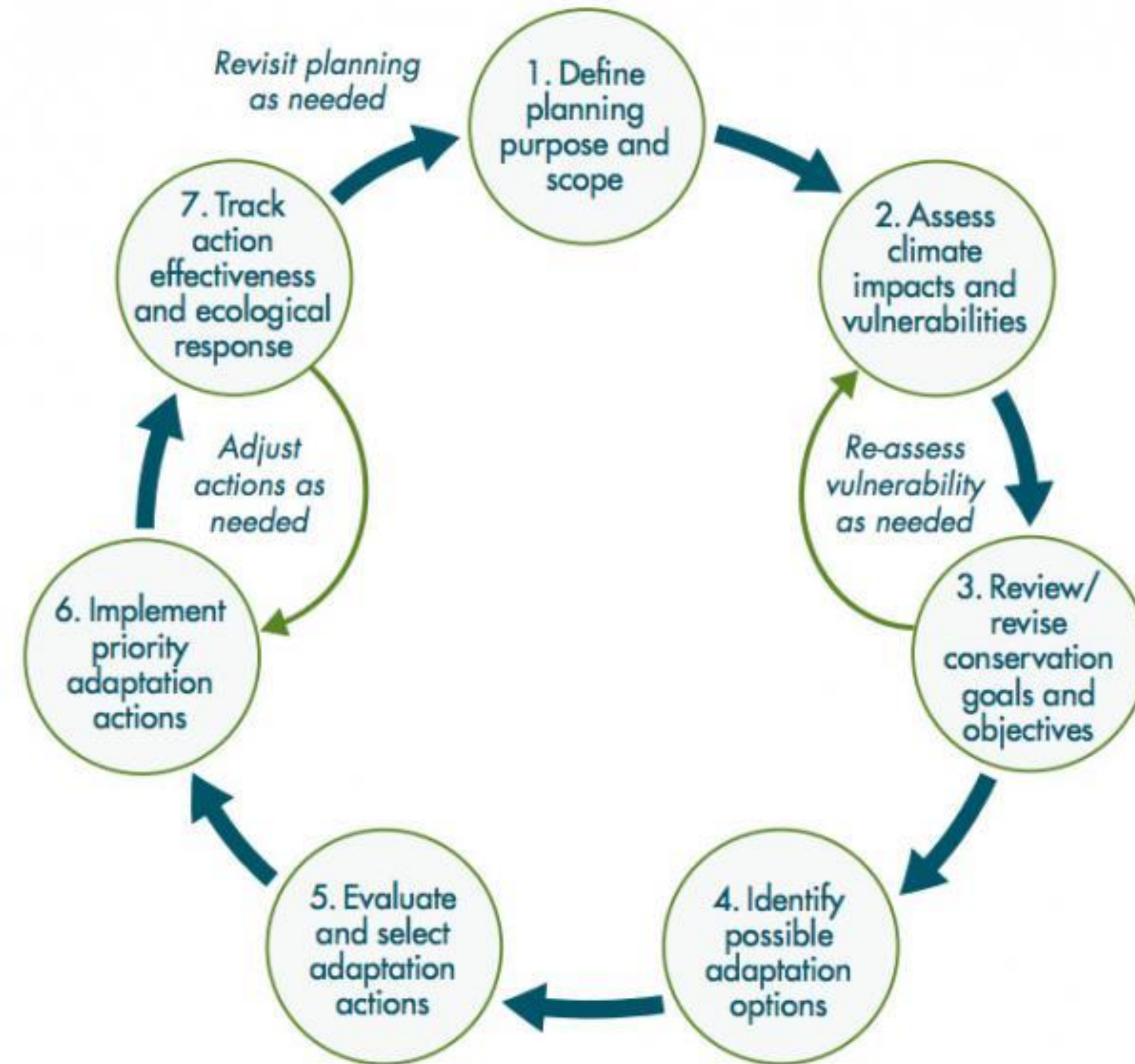


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GATHERING VULNERABILITY INFORMATION

- Example:
 - Who has the data for farmers in our jurisdiction? What do they grow or raise?
 - Are farmers able to adapt to more intense and reoccurring droughts?
 - Why are they not able to adapt? Economic?
 - How bad is the economic impact of a drought?
 - What would be needed to adapt over time? Irrigation equipment; new equipment and knowledge to grow a different crop?
 - Does your organization assist farmers respond currently? Are there things they could assist with?

CLIMATE ADAPTATION PLANNING CYCLE



GUIDEBOOKS AND FRAMEWORKS



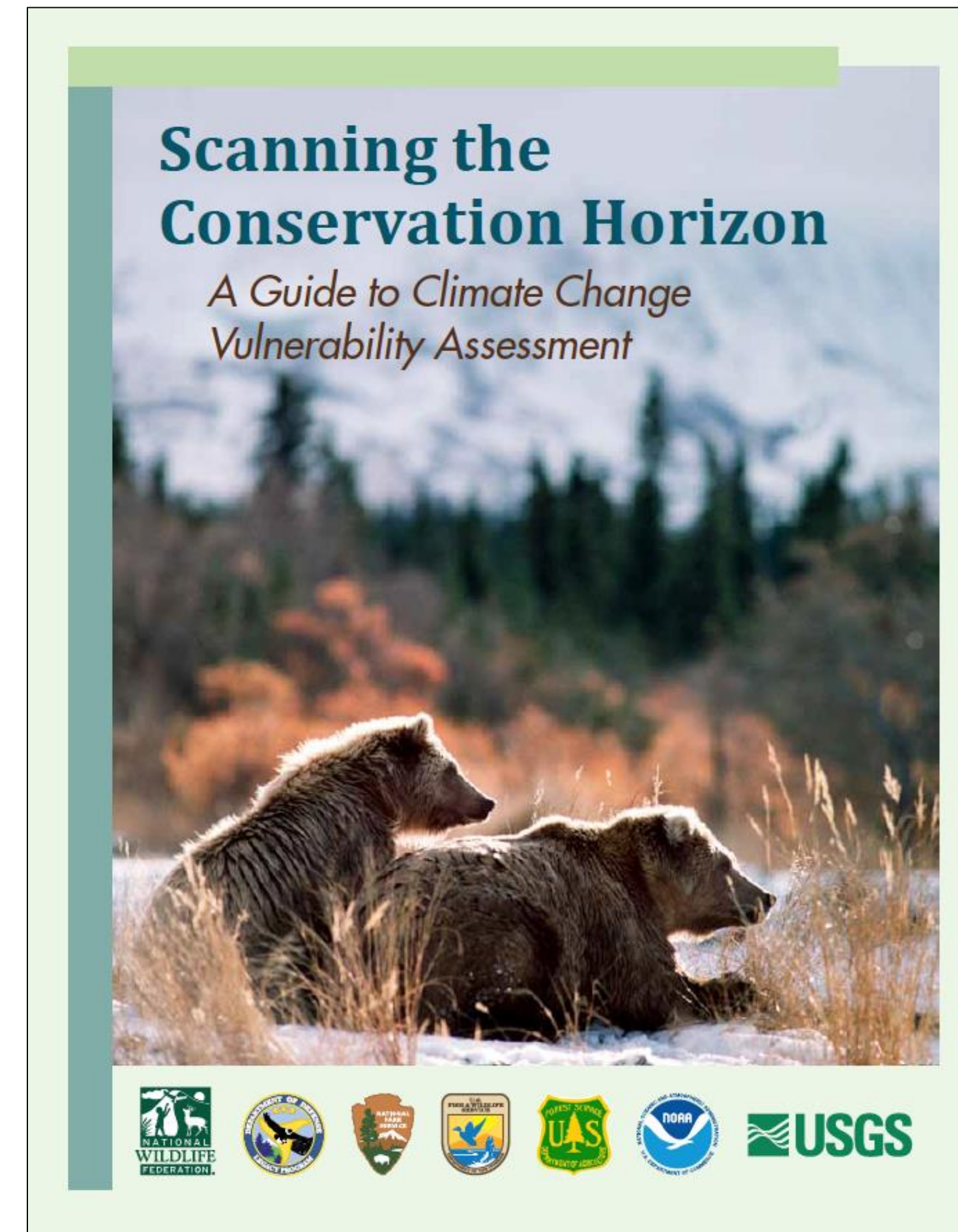
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Species Guidebook

Scanning the Conservation Horizon is a vulnerability assessment guide focusing on ecological impacts and resource management.

The document covers vulnerability basics and features case study examples from around the US.

Online pdf:
www.nwf.org/vulnerabilityguide



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NATURESERVE- CLIMATE CHANGE VULNERABILITY INDEX

- The Index separates vulnerability into its three primary components:
 - a species' exposure to climate change within a particular assessment area,
 - its inherent sensitivity to climate change, and
 - its capacity to adapt to change.
- Results fall into five categories:
 - Extremely Vulnerable
 - Highly Vulnerable
 - Moderately Vulnerable
 - Less Vulnerable
 - Insufficient Evidence

Con: Uses Climate Wizard (which is not recommended by the SC CASC)

Download the tool and training available: <https://www.natureserve.org/conservation-tools/climate-change-vulnerability-index>

SAVS: A SYSTEM FOR ASSESSING VULNERABILITY OF SPECIES

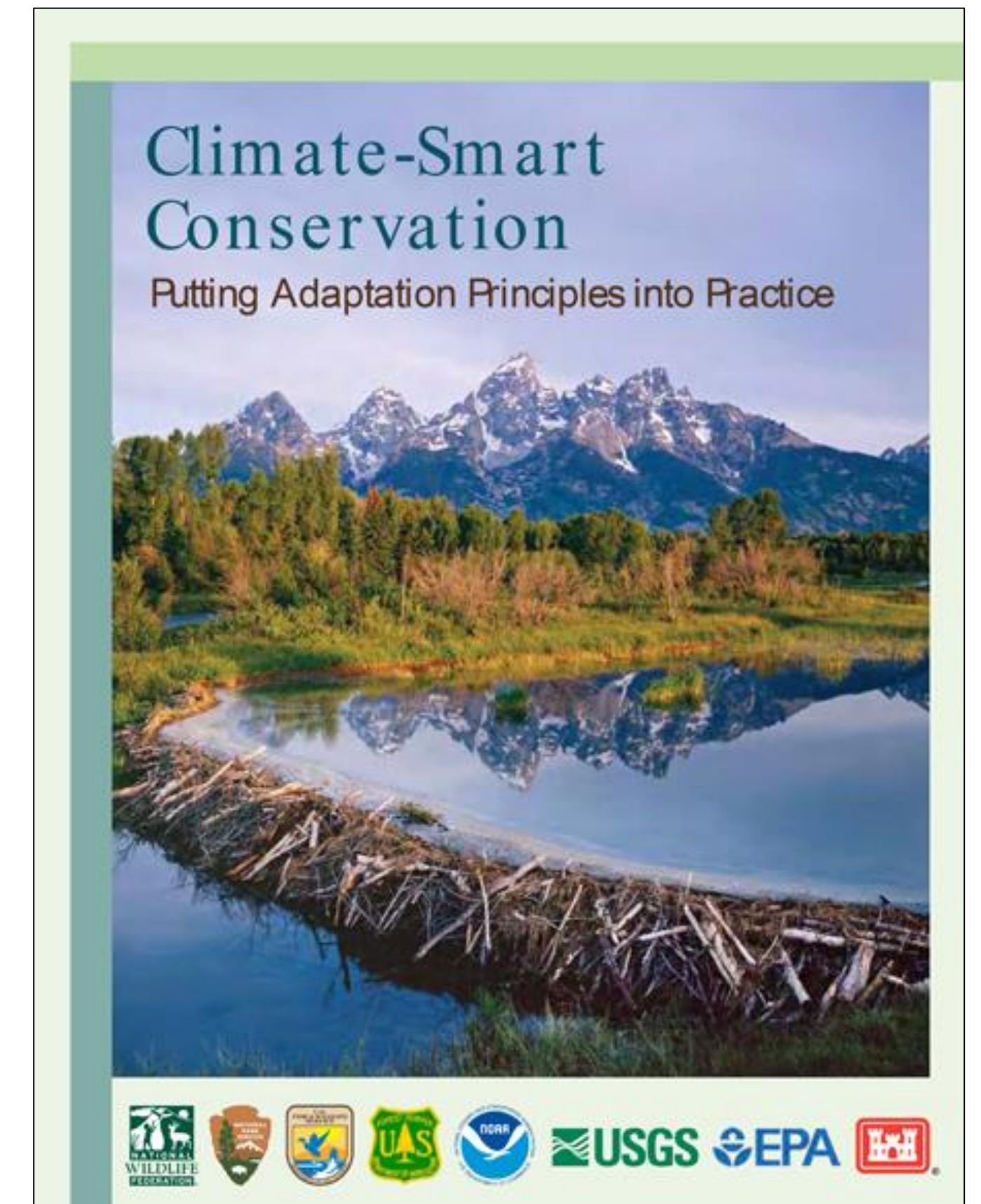
- uses 22 criteria related to expected response or vulnerability of species in a questionnaire to provide a framework for assessing vulnerability to climate change.
 - gathered from published materials,
 - personal knowledge, or
 - expert consultation.

Calculate and apply scores: This tool generates an overall score that scales from -20 (most resilient) to +20 (most vulnerable) and scores for each category that scale from -5 to +5. **Overall scores** can be used to identify highly vulnerable (or resilient) species or to rank species according to their vulnerabilities.

Link: <https://www.fs.fed.us/rm/grassland-shrubland-desert/products/species-vulnerability/>

CLIMATE SMART FRAMEWORK

- Integrate climate change adaptation into other plans or types of projects
- Not look at the past or previous conditions but to ensure they persist for decades to come. Thus manage for change.
- Minimize loss
- Avoid maladaptation
- Consider GHGs of the adaptation strategies/ minimize the carbon footprints of our actions
- Climate smart monitoring plans



NAICS-CLIMATE ADAPTATION WORKBOOK

- created by the Northern Institute of Applied Climate Science
- [Forest Adaptation Resources: Climate change tools and approaches for land managers, 2nd Edition](#)
- Forested Watershed: https://adaptationworkbook.org/niacs-strategies/forested_watershed
- [Adaptation Resources for Agriculture: Responding to Climate Variability and Change in the Midwest and Northeast.](#)
- [Link: https://adaptationworkbook.org/](https://adaptationworkbook.org/)

Focus Areas:

Forests

Urban Forests

Forested Watersheds

Wildlife

Forest Carbon

Coastal

Tribal

Wetlands

Fire Adapted

Ecosystems

Grasslands

Recreation



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EPA CREAT: RISK ASSESSMENT APPLICATION FOR WATER UTILITIES

- Generate reports describing the costs and benefits of your risk reduction strategies for decision makers and stakeholders.
- [Resilient Strategies Guide](#),
- EPA's [Vulnerability Self-Assessment Tool \(VSAT\)](#).
 - the risk and resilience assessment requirement in [Section 2013 of America's Water Infrastructure Act](#)
- Link: <https://www.epa.gov/crwu/creat-risk-assessment-application-water-utilities>

EPA DROUGHT RESPONSE AND RECOVERY GUIDE FOR WATER UTILITIES

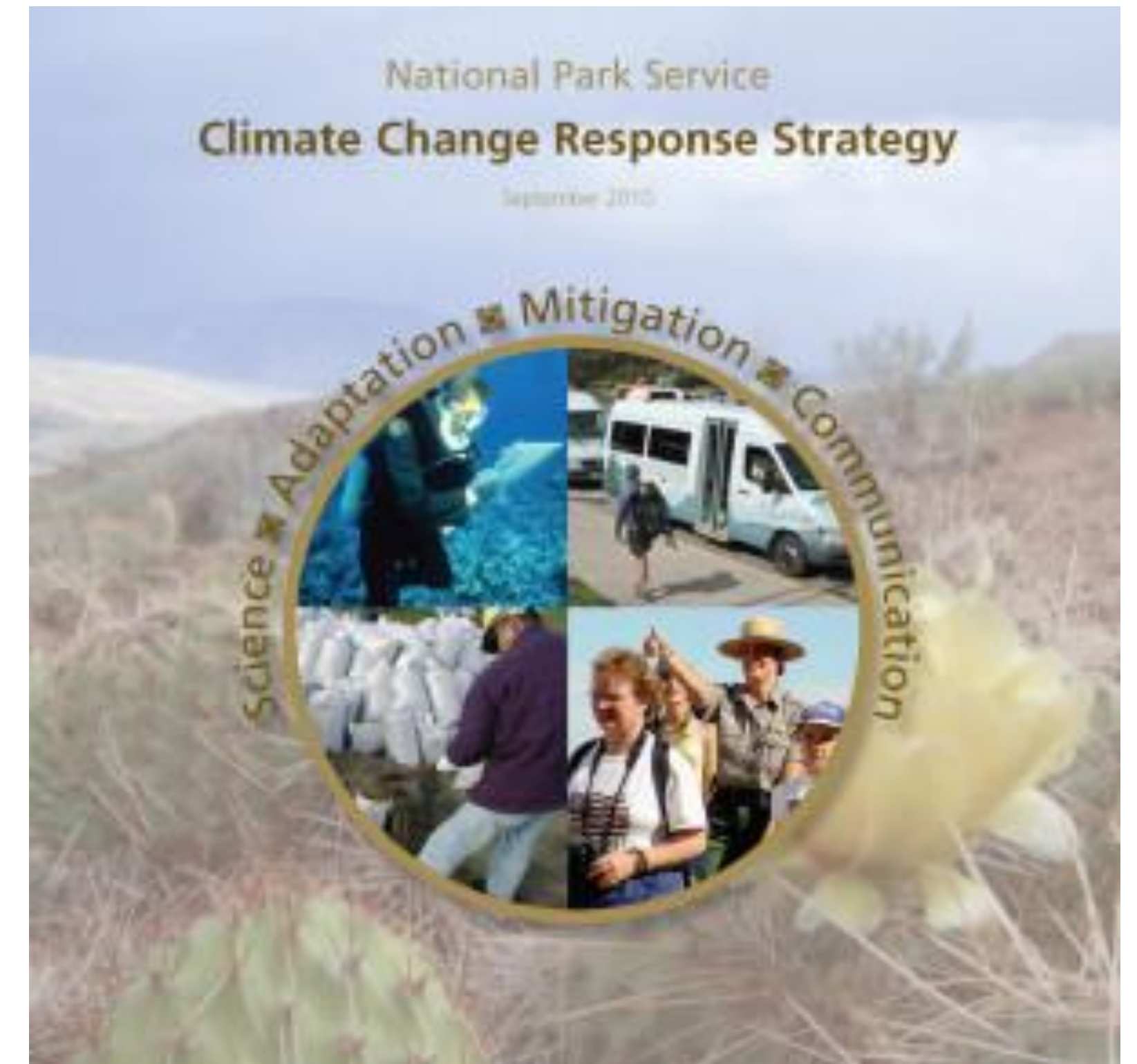
- <https://www.epa.gov/waterutilityresponse/drought-response-and-recovery-guide-water-utilities>



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NPS CLIMATE STRATEGY

- <https://www.ncptt.nps.gov/articles/climate-change/>



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NPS- CLIMATE AND CULTURAL RESOURCES WORKING GROUP

- Initiated by NPS, Intermountain Regional Office programs, (specifically the Anthropology Program, Vanishing Treasures Program, and the Landscape Conservation & Climate Change programs) in recognition of the need to integrate stronger tribal engagement into several new and on-going climate change response focused projects.
- NPS is hiring 2 Cultural Resources and Climate Change Staff



VULNERABILITY ASSESSMENTS FOR CULTURAL HERITATGE

- They are developing a framework for doing climate change vulnerability assessments on cultural resources (including structures).
- Expected completion- Spring 2020
- Asking for tribal input/ review.



ANALYSIS OF CLIMATE CHANGE VULNERABILITY ASSESSMENTS FOR NPS CULTURAL RESOURCES

- Developing a report on existing cultural resources vulnerability assessments:
 - Data Gaps
 - Best Practices
 - Opportunities
 - Recommendations
- Expected Spring 2020





The Franciscan church of San Jose de Tumacácori is a more than 200-year-old adobe church and one of the fundamental resources of (TUMA) in southern Arizona. In 2010, following an intense early winter rainfall, a hole developed around the west sanctuary window and caused the loss of nearly a ton of adobe and two lintels. Later the same year, after the summer monsoon, a large portion of the north wall of the sacristy collapsed. In 2015, a fireplace in the convento collapsed following an intense and unusually timed autumn rainfall.

Tumacácori National Historical Park

View of wall collapse in the sacristy, Tumacácori National Historical Park (July, 2010)(NPS Photos)





Examples of Adaptation Options for Cultural Resources:

1. **No Active Intervention**
2. **Offset Stress** (*Examples include: temporary measures such as sandbags or levee plugs; an offsite retaining wall, living shoreline, or engineered logjam to reduce shore erosion; upstream re-vegetation to reduce flood hazards, or changes in adjacent forest management to reduce wildfire risk.*)
3. **Improve Resilience/Resistance** (*Examples include: treatment of structural materials to better withstand increased moisture, wind, or an invasive species; elevation of a building to raise it above projected flood levels; addition of a cap over an archeological site; changes in landscape plantings or soil treatments; and alternate storage arrangement of museum materials).*)
4. **Manage Change** (*Examples include: change in tree species on cultural landscapes by removing an original species that has died and replacing it with a species that is healthy in that environment and will provide similar visual characteristics including shade and foliage conditions).*)
5. **Relocate/ Facilitate Movement** (*Relocating/facilitating movement includes two types of action: (a) moving a resource, and (b) allowing movement to happen).*)
6. **Document and Prepare for Loss**

Cape Hatteras National Seashore

Adaptive Management decision to move the Cape Hatteras Light Station inland is an iconic example of relocation of a valued cultural resource to protect the historic structure from ongoing impacts resulting from climate change (NPS photo).

QUESTIONS?



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