

# *Climate Change Adaptation*

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# A Changing Climate

**Air temperature**

**Water temperature**

**Precipitation**

**Sea/Lake level change**

**Water chemistry**



***Climate change is affecting all ecosystems and will continue to do so for centuries to come, so...***

**We need to *incorporate climate change into long-term planning***

- **Minimize** risk of wasting time, money, and effort
- **Maximize** likelihood of success



# Responding to Climate Change

**Mitigation** is what we do to decrease the potential of climate change itself.

**Adaptation** is insurance given a non-zero probability that climate change will have an adverse effect on our investments.



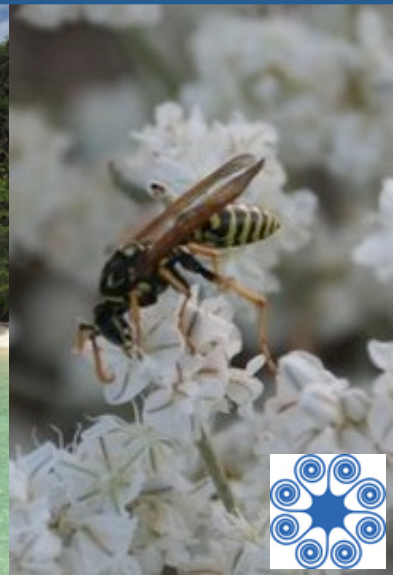
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# What are all the changes that will happen and how can I respond?

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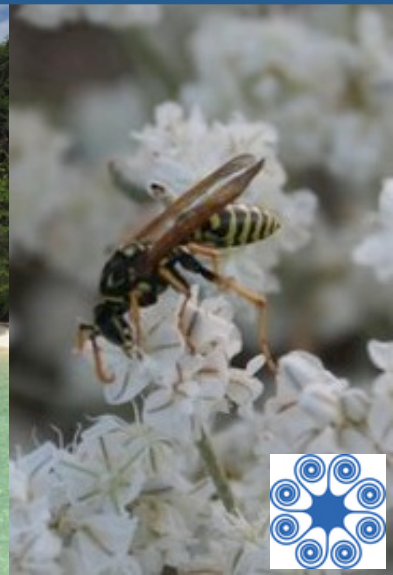


**What are all the changes that will happen and how can I respond?**

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**What do I do, and how should I adjust that for the reality of climate change?**

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# Adaptation

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$$\text{Vulnerability} = \text{exposure} + \text{sensitivity} - \text{adaptive capacity}$$

↓ *Reduce exposure*

↓ *Sensitivity*

↑ *Increase adaptive capacity*



# Vulnerability



## Adaptation Options



**Resistance**



**Resilience**



**Response**



# What are climate adaptation tactics?

Actions that explicitly incorporate climate change and aim to alleviate the impacts of climate change by increasing resilience and/or decreasing vulnerability.

# Examples?

Enhance connectivity and increase areas under protection

- Prioritizing protection of climate refugia

Restore habitat to enhance overall system resilience

- Restoring fire-adapted ecosystems and species

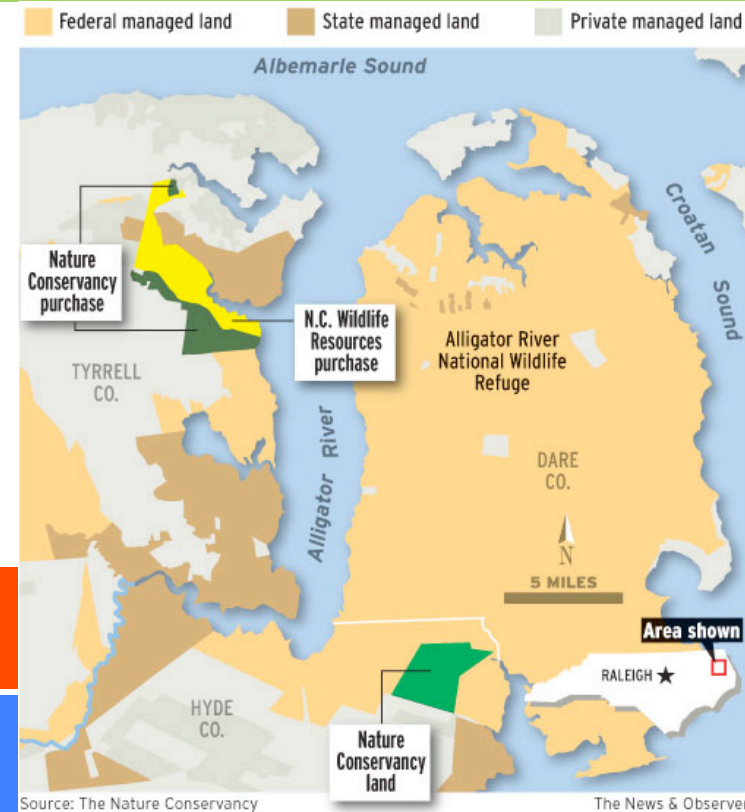
Reduce non-climate stressors

- Thinning to reduce stand densities and risk of insect and disease outbreaks

# Managing Land at the Alligator River NWR



Sea Level Rise,  $\Delta$  Hydrology  
Solutions!



- Restoring oyster reefs
- Using water control structures
- Planting salt- and flood-tolerant vegetation



# Reducing non-climate stressors in the Estero de Limantour watershed



Flooding,  $\Delta$  Hydrology,  $\Delta$  Species movement

Solutions!

- **Dam removal**
- **Restoration of natural ecological processes and functions**



# Example: Salmon



- Altered stream flows
- Altered timing and intensity of seasonal flooding (more in fall and winter, less in spring and summer)
- Increased severe floods



# Salmon



- Altered stream flows
- Altered timing and intensity of seasonal flooding (more in fall and winter, less in spring and summer)
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- Increase riparian vegetation for shading to minimize water temp increases
- Restore connectivity by removing dams and other stream blockages
- Limit water withdrawals
- Decrease land-based pollution

# Key Considerations

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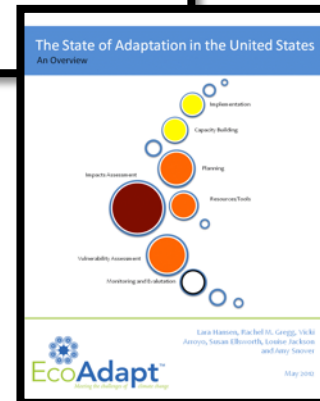
1. Failing to include climate change in your work means your work is vulnerable
2. Identify a clear purpose or goal (e.g., reduce vulnerability of existing management action, minimize effects of climate change on target species, etc.)
3. Context matters: YOU are an expert on your region/species/processes/mandate
4. Consider time scales
5. Pay attention to unintended consequences/effects on other sectors
6. Be creative!



# State of Adaptation



- Survey practitioners and assess adaptation efforts
- Develop case studies
- Synthesize trends, opportunities, and challenges
- Connect people to case studies, synthesis reports, and other resources to share lessons learned and build the adaptation field
  - *Climate Adaptation Knowledge Exchange*
  - *Adaptation Nation blog*
  - *National Adaptation Forum*



*“Climate change can be controversial but adaptation is something we all should be engaged in. It behooves each of us to consider the next steps on how to deal with this issue. [This] effort is a call to action to overcome the stubbornness and ennui towards climate change.”*

- Louisiana Coastal Manager



# State of Adaptation: 2009 – present

➤ 3000+ interviews and surveys

- Marine/coastal North America (2009-2011)
- Great Lakes (2011-2012)
- Western U.S./ Canada (2011-present)

➤ 450+ adaptation case studies, cited in

- U.S. Dept of State
- National Climate Assessment
- NFWPAS
- United Nations
- World Bank
- and many more!





# Climate Adaptation Knowledge Exchange

[www.CAKEx.org](http://www.CAKEx.org)

## Why Make a CAKE?

- Everything we do is vulnerable to climate change but few people know what to do about it
- Adaptation is a rapidly developing field
- We are spending more time **reinventing**, not enough **innovating**



## Sponsors, Partners, and

**Contributors:** Kresge Foundation, Wilburforce Foundation, Data Basin, EBM Tools Network, Model Forest Policy Program, Northern Institute of Applied Climate Science, NCAnet, Integrated Data Management Network, USGS, and many more!

## Why Join CAKE?

- **Explore** projects, people, and resources on the map
  - Map, text, and keyword searches
- **Publish and promote** your work on climate adaptation
- **Get advice** from adaptation experts
- **Request information** from your colleagues (advice, connections, training)

# Questions?

