

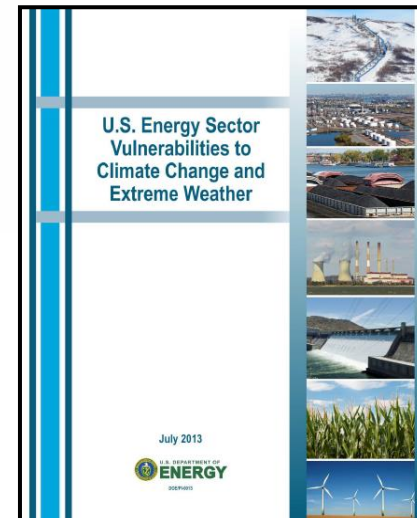
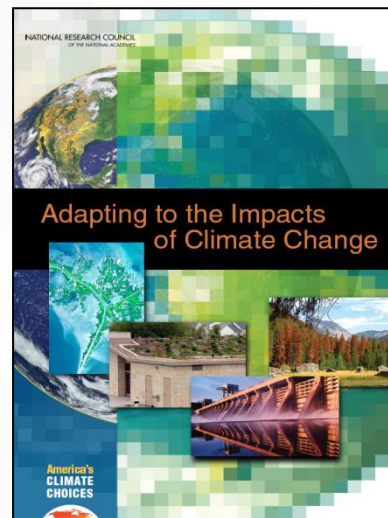
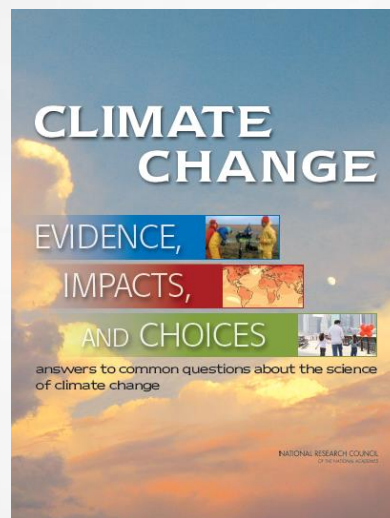
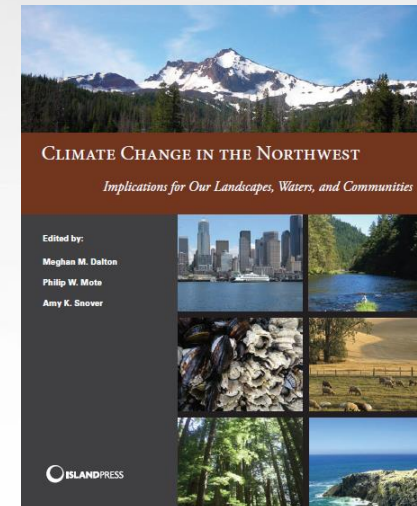
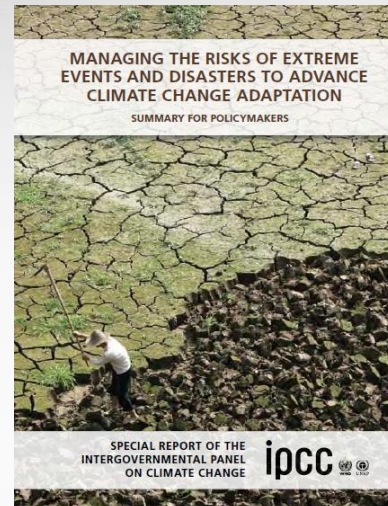
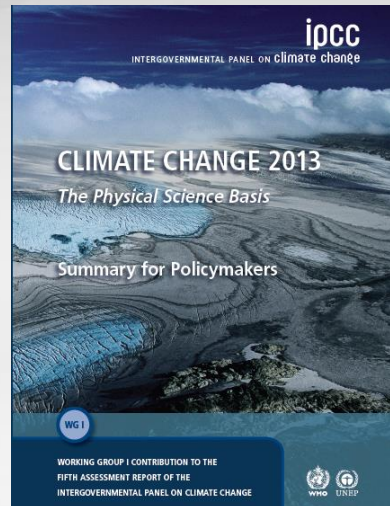
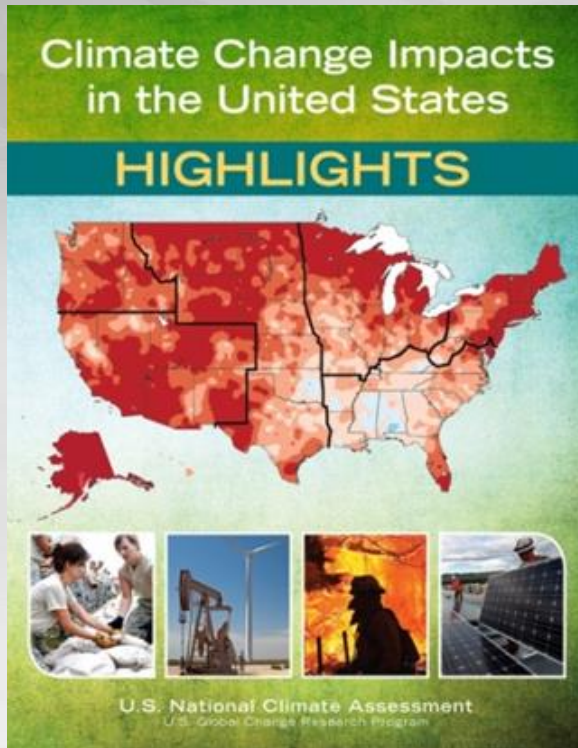
National Security and Climate Change: What do we know, and what else do we need to know?

IAN KRAUCUNAS

For: The Henry M. Jackson Foundation, Pacific Northwest National Laboratory, and the Woodrow Wilson Center's Environmental Change and Security Program

July 29, 2014

The basic causes and consequences of climate change are now well established



Human-induced climate change is here, now

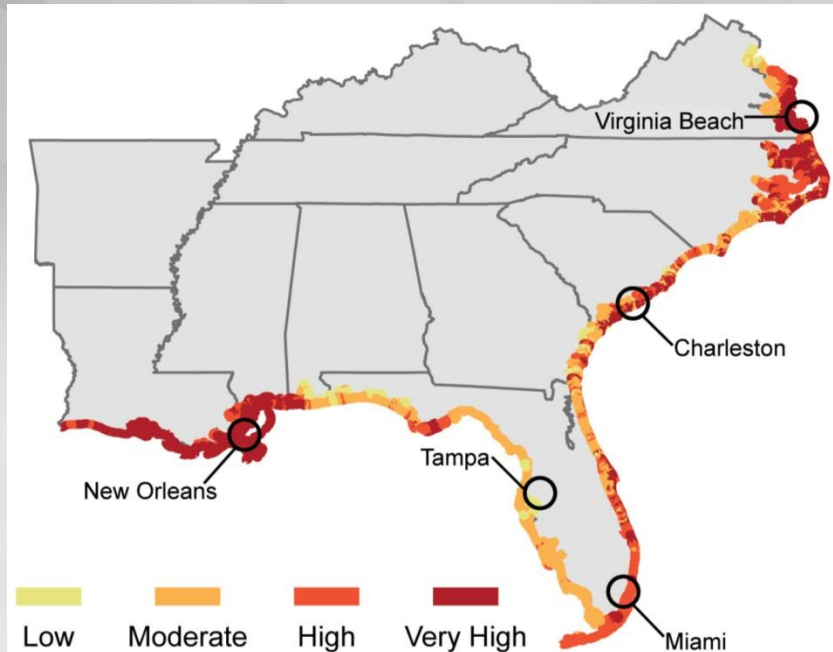


Climate change affects things people care about...



...including national security

Coastal vulnerability



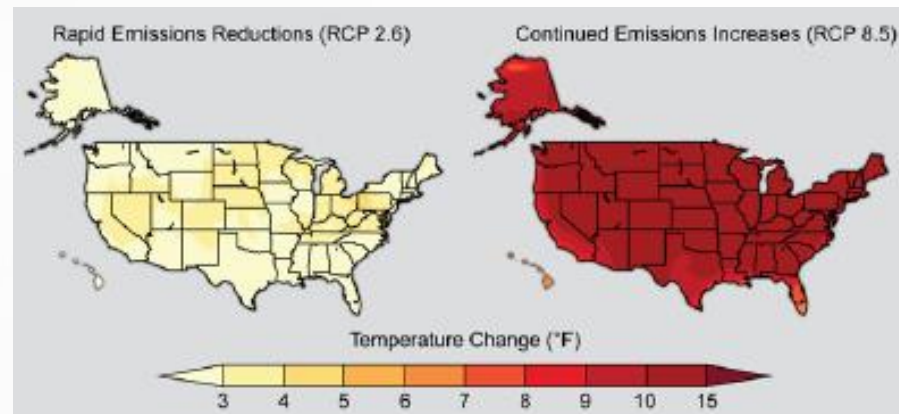
Decline in Arctic sea ice



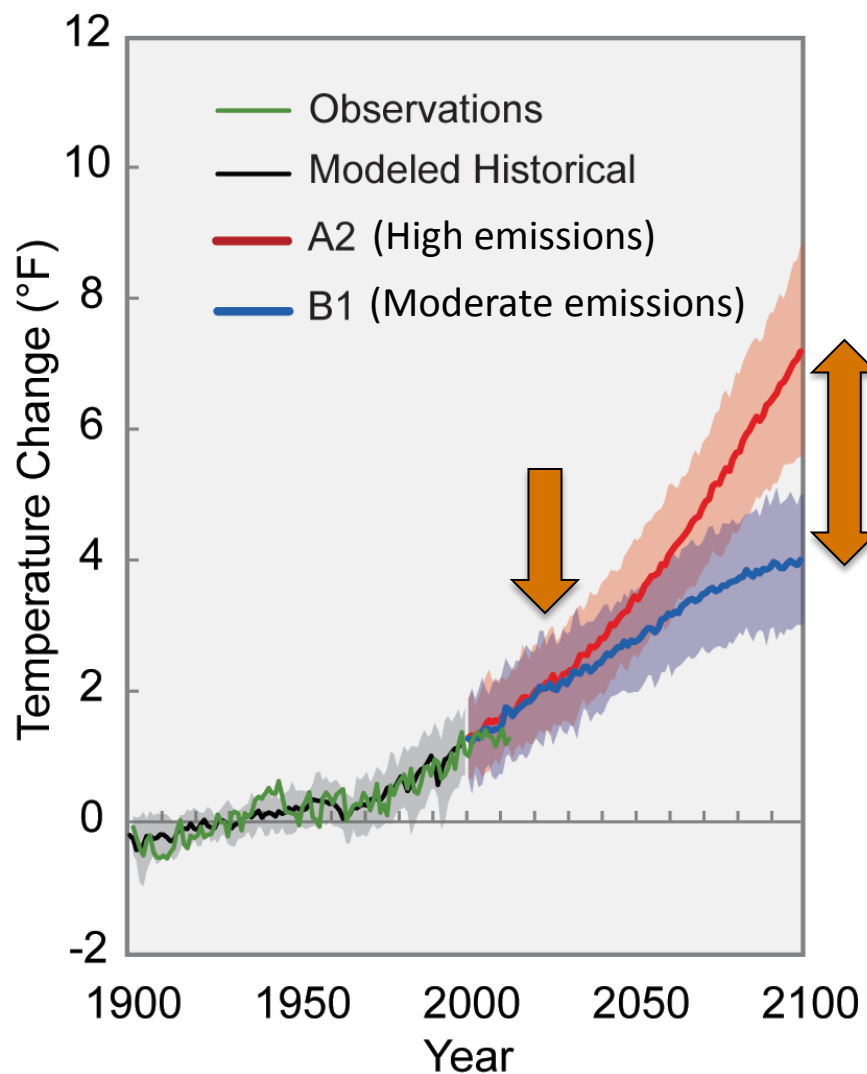
Food security



Extreme heat



The impacts of climate change are projected to increase...



...but there are things we can do to avoid the unmanageable and manage the unavoidable



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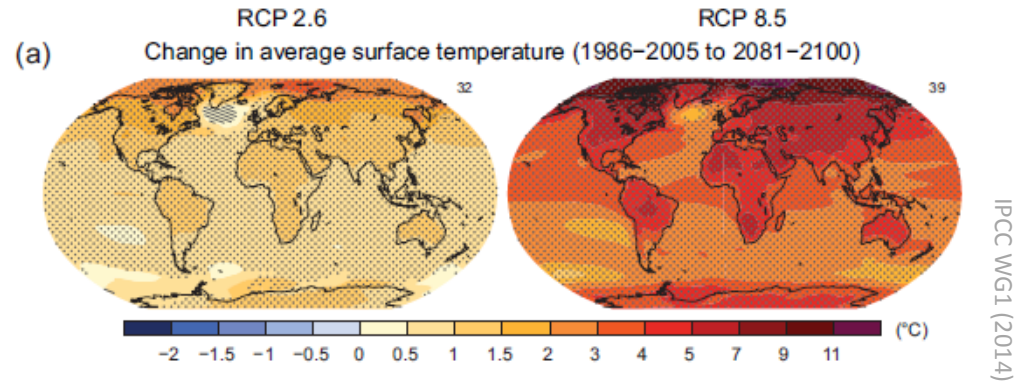
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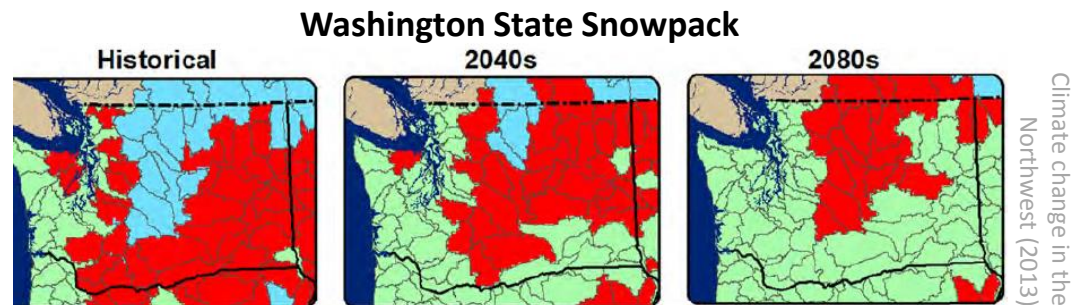
FEMA photo by Wendell A. Davis Jr.

The scientific community has an important role to play in guiding responses

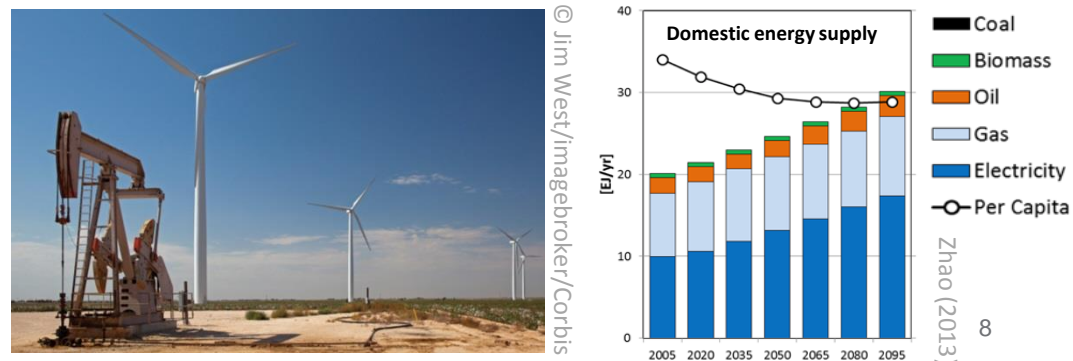
- What are the likely impacts of climate change under different scenarios?



- How will these changes affect me? My community? My sector? My nation?



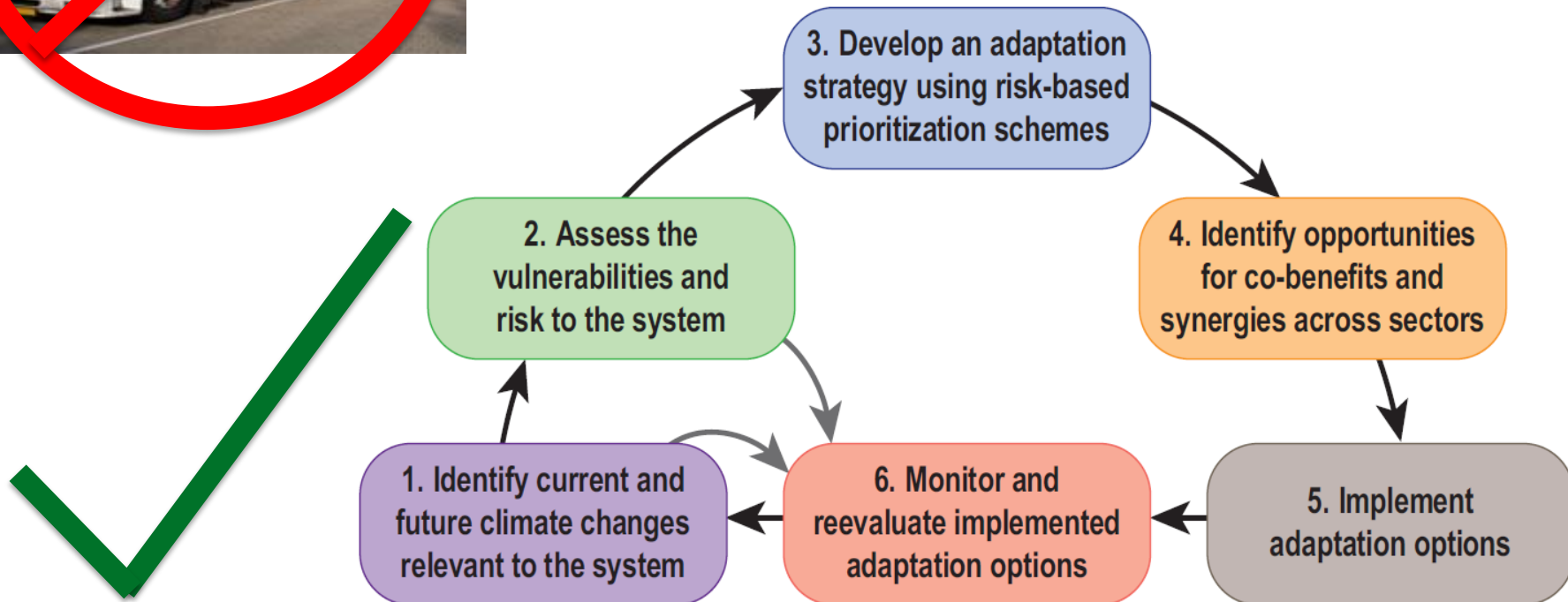
- What can be done to increase resilience, security, and sustainability?



But it's not easy! Being useful requires working with stakeholders and being flexible...



- ▶ Information about current and projected future changes is necessary, but not sufficient
- ▶ To inform decision making, information needs to be well-targeted and put in context



...and noting that many security risks are indirect and/or involve multiple stresses

- For example, health outcomes are affected by biological, ecological, and social factors as well as climate

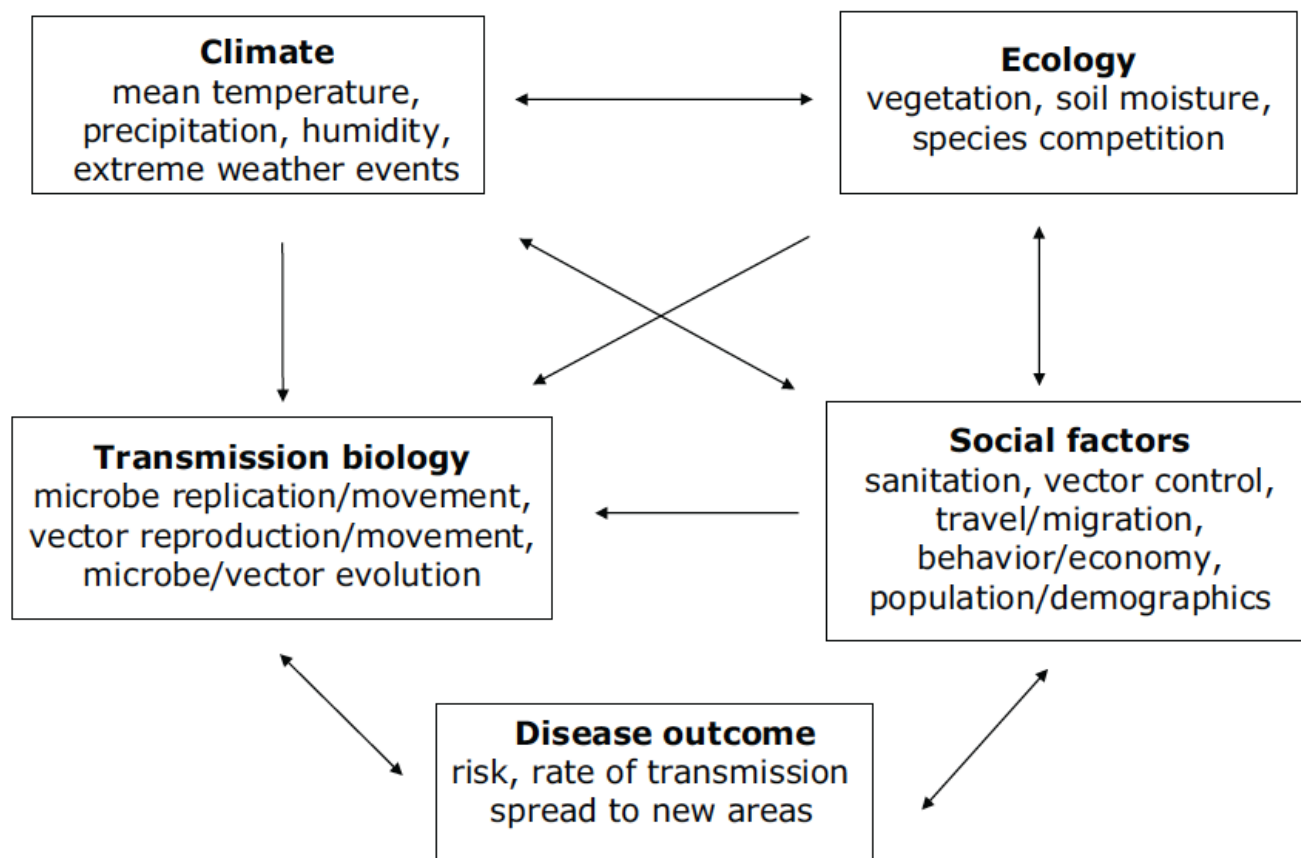
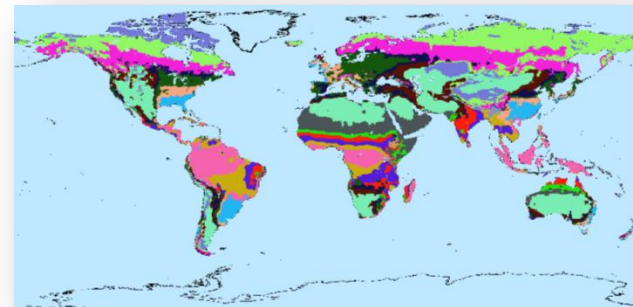
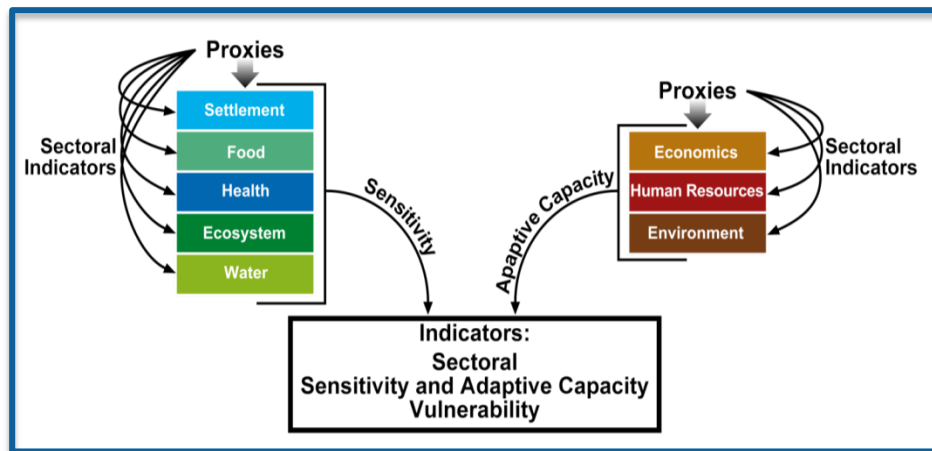
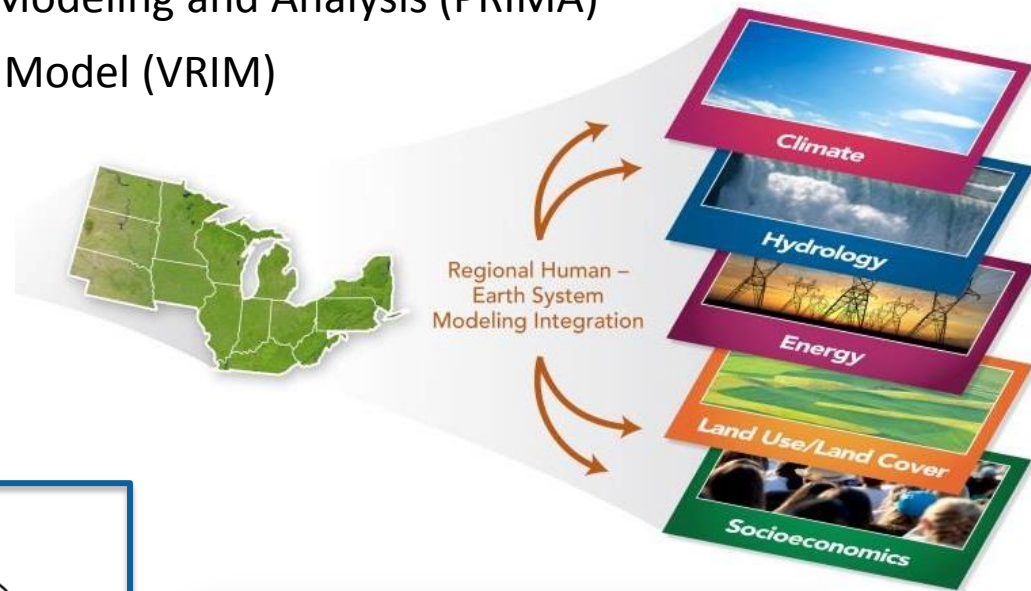


FIGURE 5-1 Causal relationships linking climate change to disease outcomes.

Source: NRC 2013

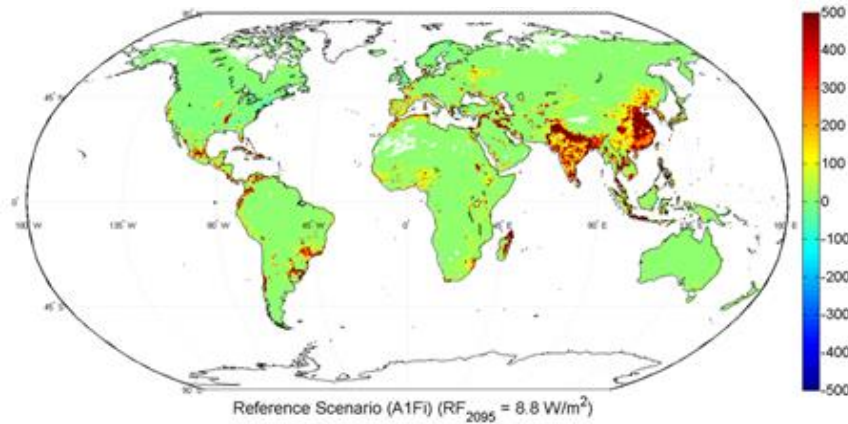
Integrated modeling systems can help assess impacts and evaluate responses

- ▶ At PNNL, we have developed a range of integrated data and modeling systems to address different aspect of climate change relevant to national security:
 - Global Change Assessment Model (GCAM)
 - Platform for Regional Integrated Modeling and Analysis (PRIMA)
 - Vulnerability-Resilience Indicator Model (VRIM)
 - ...and others
- ▶ Other national labs, universities, and NGOs are also developing tools to address different aspects of climate change

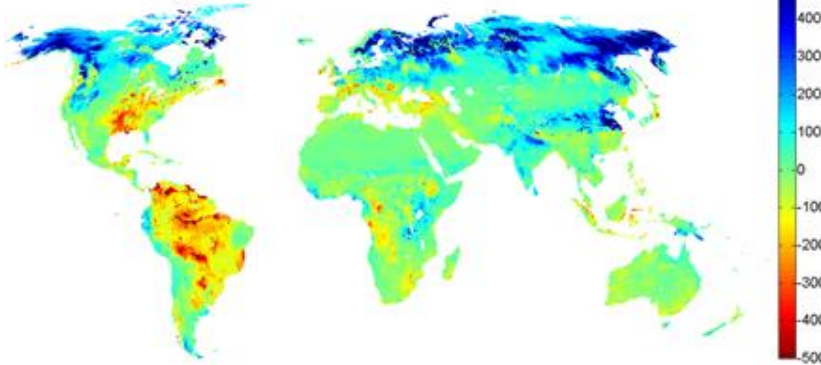


Water scarcity can be driven by changes in the water supply, water demand, or both

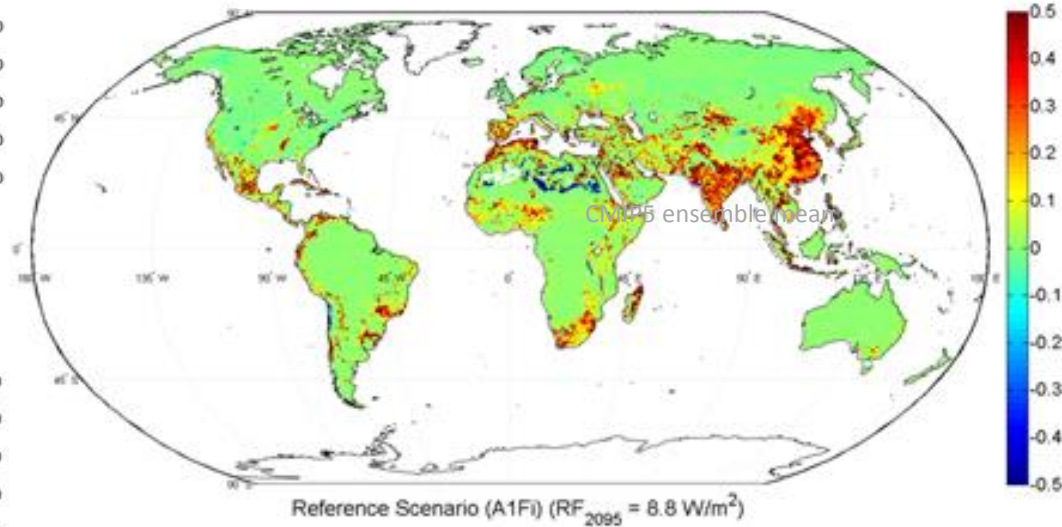
Projected water demand (GCAM)



Projected water supply (CMIP5)

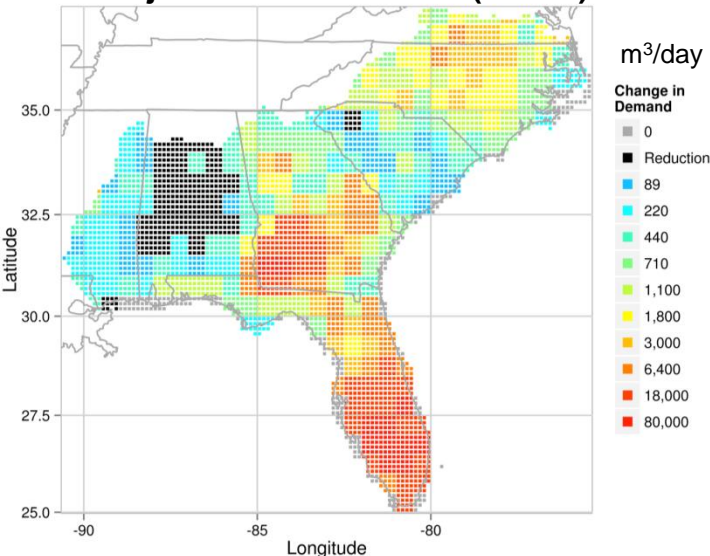


Change in water scarcity



High-resolution models allow us to see the local manifestations of large-scale trends

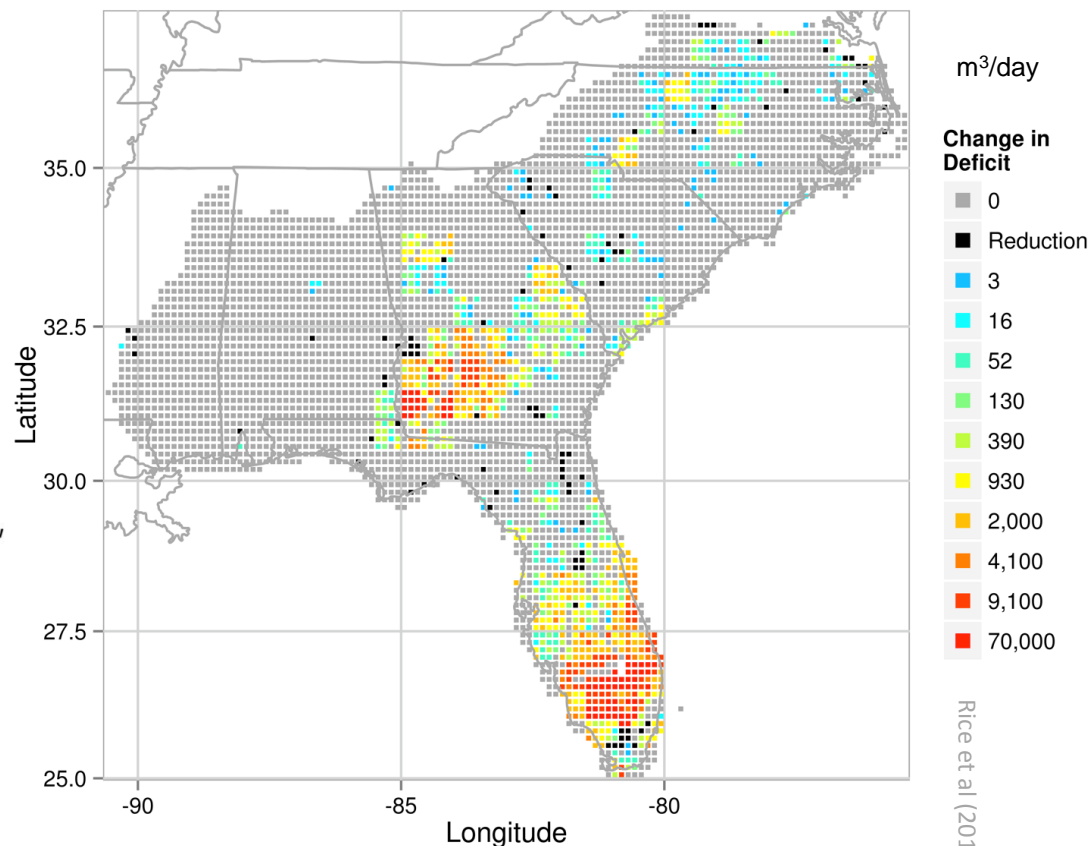
Projected water demand (GCAM)



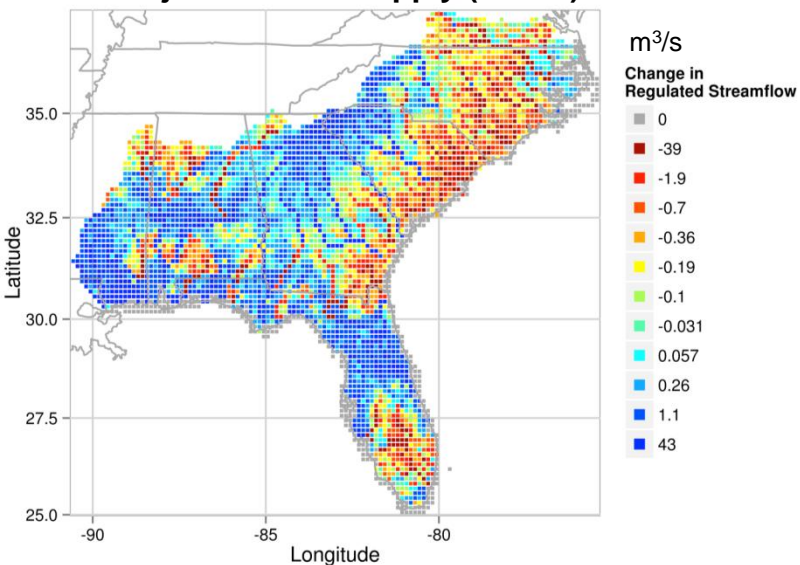
Change in August daily averages

2020-2039 compared to historical period (1985-2004);
RCP8.5 Scenario; 1/8th degree

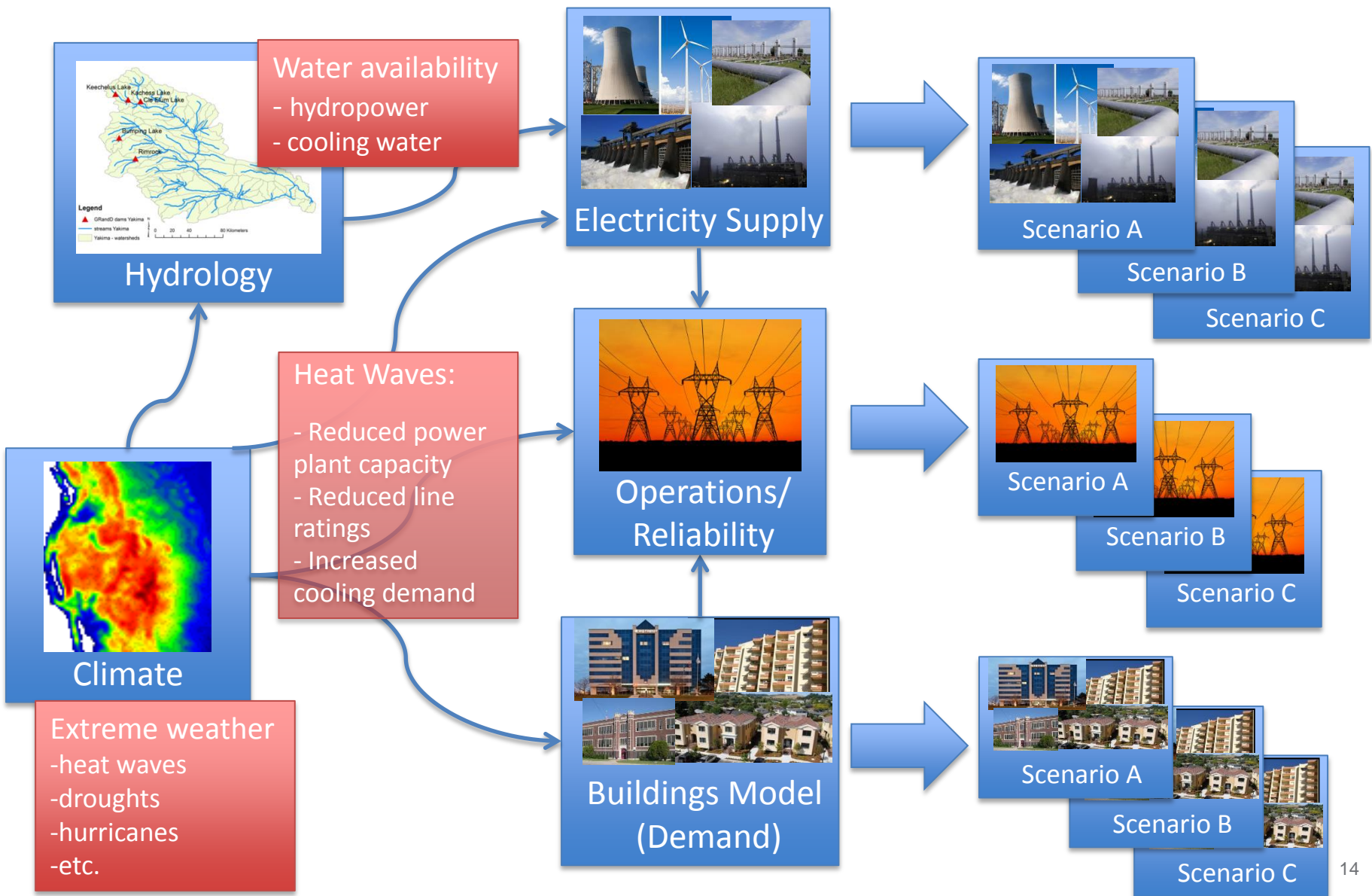
Projected surface water deficit



Projected water supply (RESM)

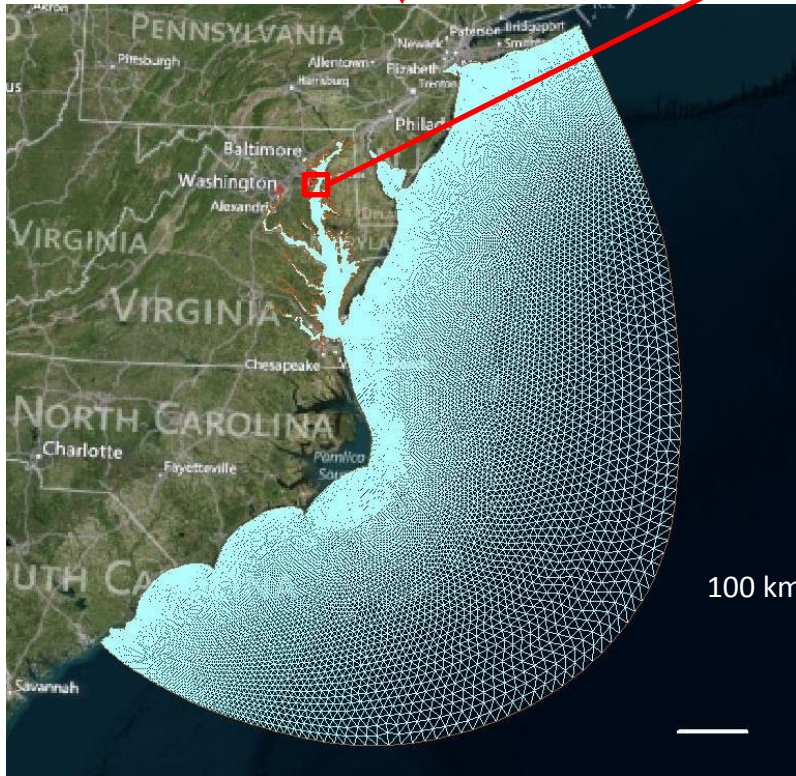


Assessing impacts on electricity supply, demand, and operations requires an integrated approach

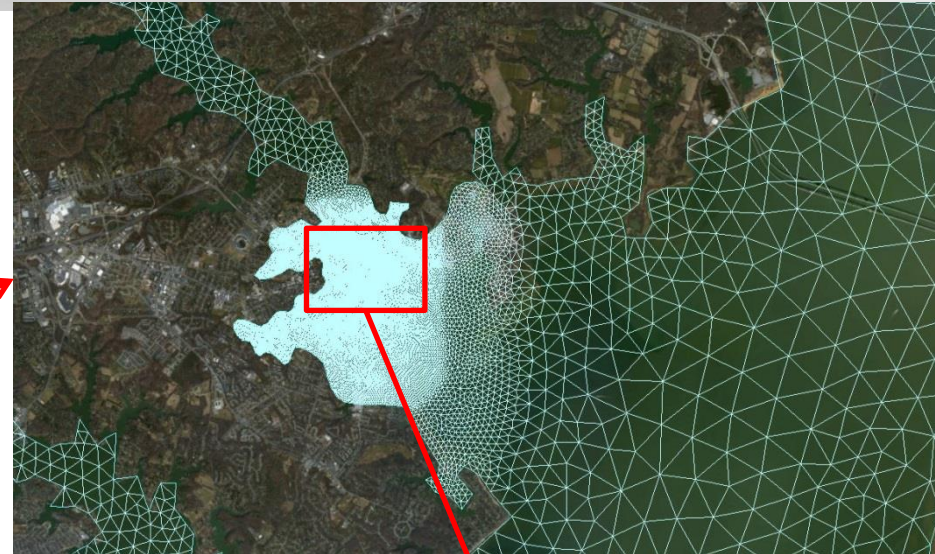


Storm surge modeling to assess vulnerability of the U.S. Naval Academy

Future climate
model / scenario



Yang et al. (work in progress)



Summary and Closing Thoughts

- ▶ Climate change complicates existing threats to national security and raises new ones
- ▶ Additional work is needed to connect climate change research to national security issues and decision making
- ▶ There are a number of modeling, monitoring, and risk assessment frameworks on which we can build...
- ▶ ...but safeguarding national security requires leveraging, extending, and applying these capabilities in a thoughtful and strategic way