



Adaptation to Climate Change: A rich and timely agenda

Thoughts from: *the United Nations Scientific Expert Group;*
the World Bank's World Development Report 2010;
The U.S. National Assessment, the National Adaptation Summit;
and many reports for the National Academy of Sciences...

Rosina Bierbaum

APEC Climate Symposium 2011

Harnessing and Using Climate Information for Decision Making

**NATURAL RESOURCES
AND ENVIRONMENT**
M UNIVERSITY OF MICHIGAN

Climate Change: What do we know?

- **Past is not prologue...and the pace of change is quickening**
 - The last 100 years are not indicative of the future
 - Design features of infrastructure & species' tolerances will be exceeded
- **Committed to further climate changes**
 - Adaptation is already occurring, but mostly unplanned
- **Rate of warming matters**
 - Mitigation makes a difference
- **It's not just the averages that matter...**
 - Regional and local variances; seasonal changes; Extreme events
- **Need a Portfolio Approach:**
 - Adaptation and Mitigation—but there are interlinkages across the two!
- **Adaptive planning and management is needed**
 - In all sectors and regions...simultaneously
- **Need integrative regional assessments involving stakeholders**
 - Best practices, learn by doing, over bigger spatial/temporal scales
 - Need prioritization of policy-relevant research needs across fields.

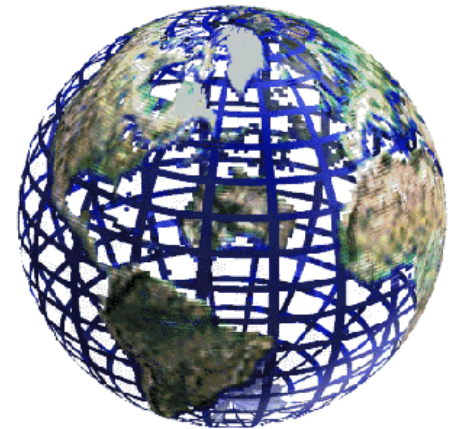
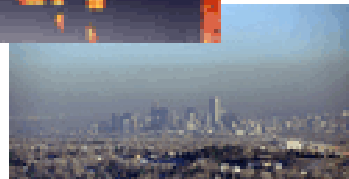
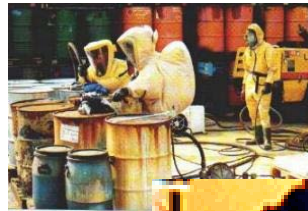
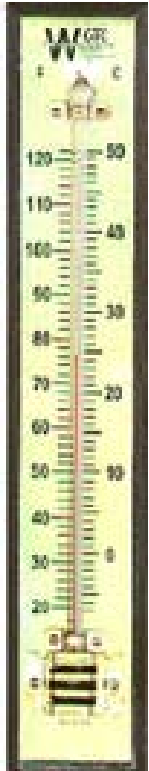
Climate Change: What do we know?

- **Patterns...and the pace of change is quickening**
 - Historical trends are not indicative of the future
 - Designing infrastructure and tolerances of species will be exceeded
- **Committed...climate changes**
 - Adaptation is ongoing, but mostly unplanned
- **Rate of warming...**
 - Mitigation makes a difference
- **It's not just the average matter...**
 - Regional and local variances; seasonal changes; Extreme events

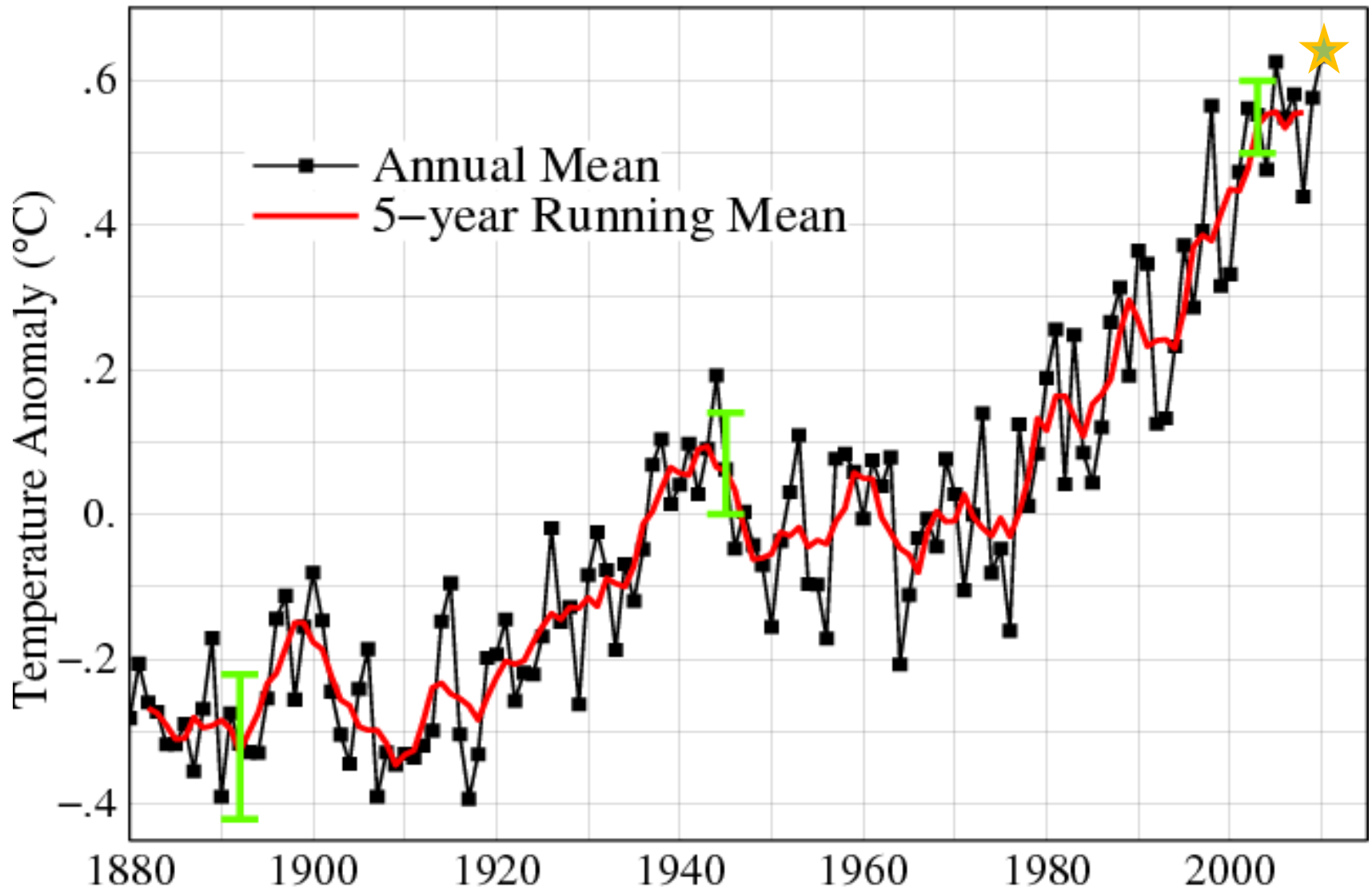
Finally, we are beginning to address these !!!

- **Need a Portfolio Approach:**
 - Adaptation and Mitigation—but there are interlinkages across the two!
- **Adaptive planning and management is needed**
 - In all sectors and regions...simultaneously
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Climate Change is the biggest environmental challenge: it's a matter of degrees...

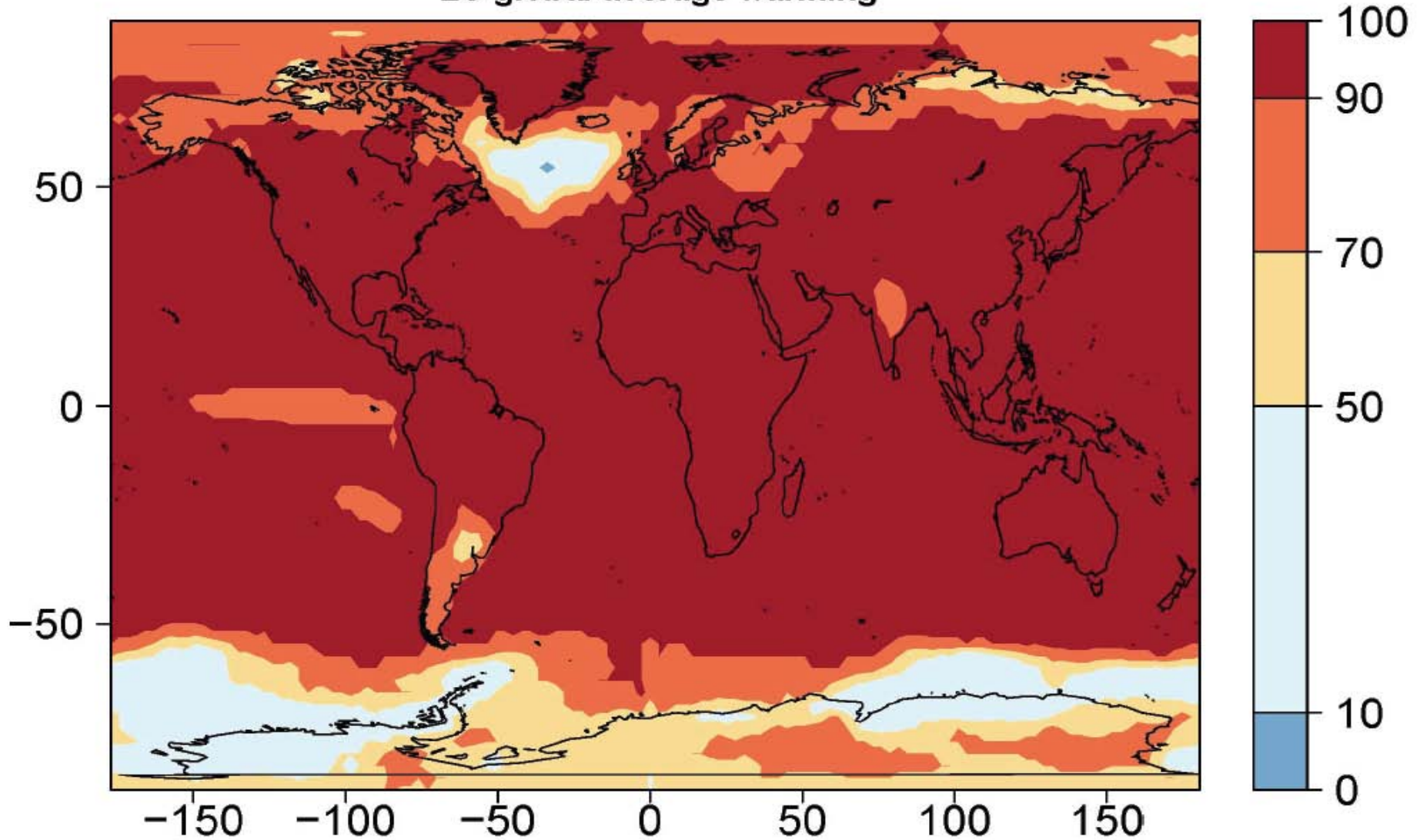


Global Land–Ocean Temperature Index

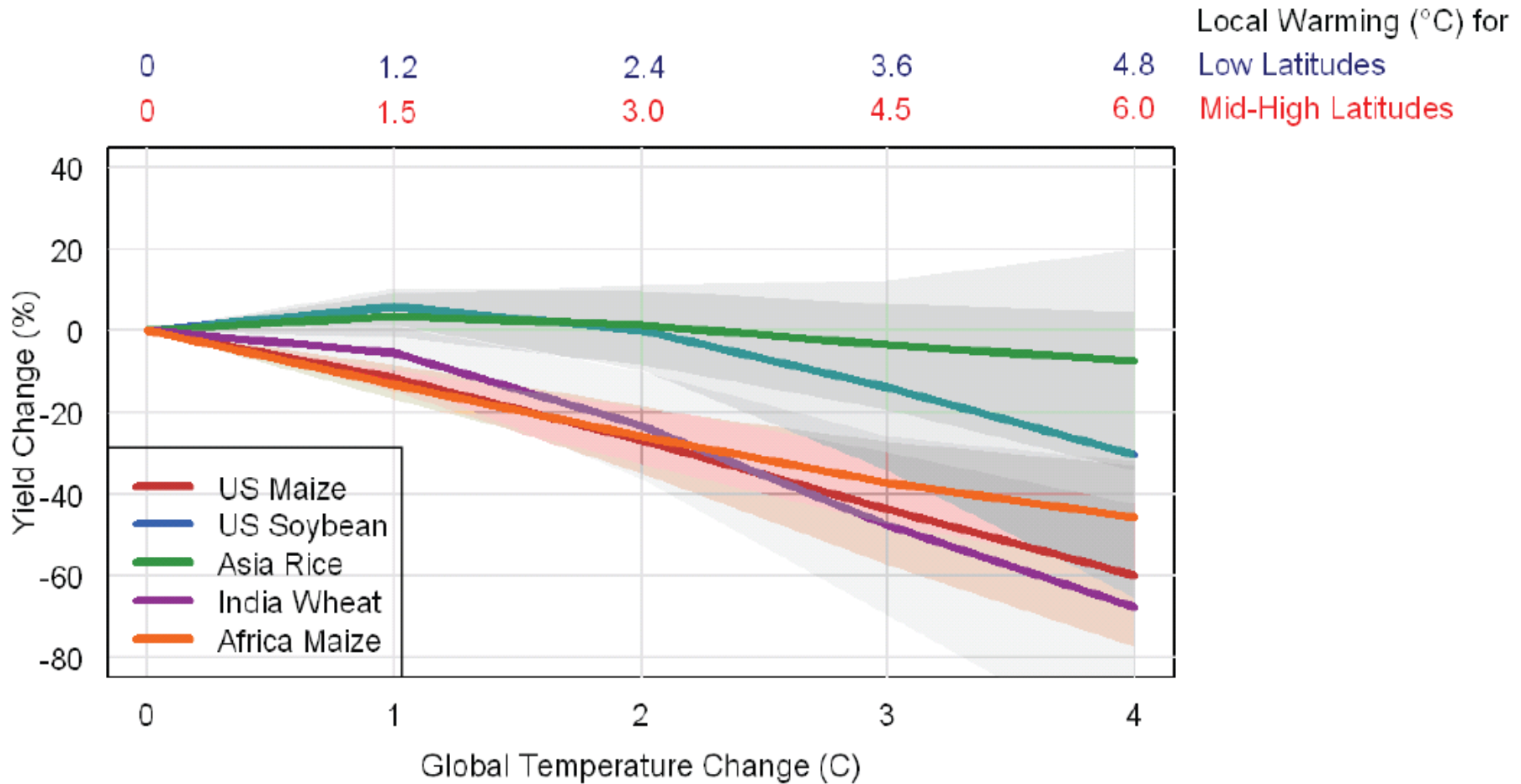


Summer heating in a warming world

% summers warmer than current 95th percentile
2C global average warming

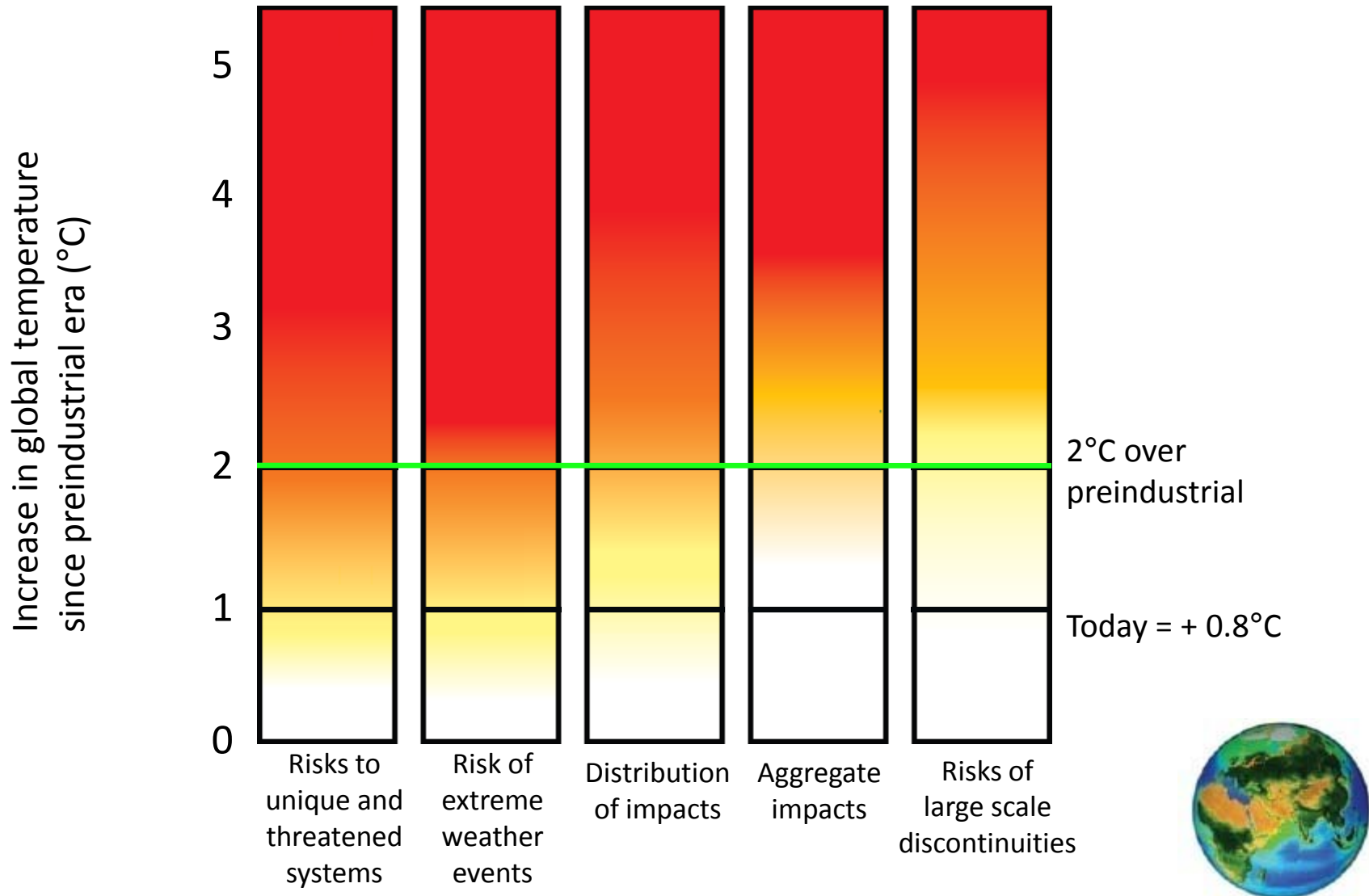


Crop yields vs global and local T increase



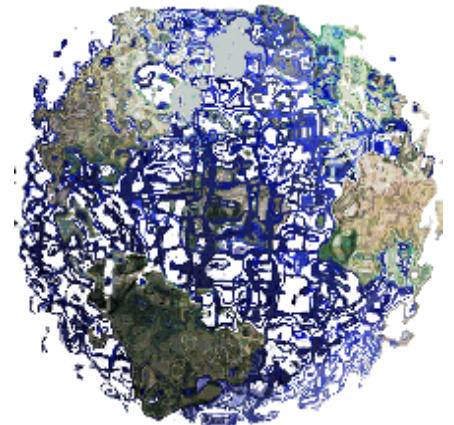
SCIENTIFIC CONSENSUS: SERIOUS AND IMMEDIATE

2007 assessment

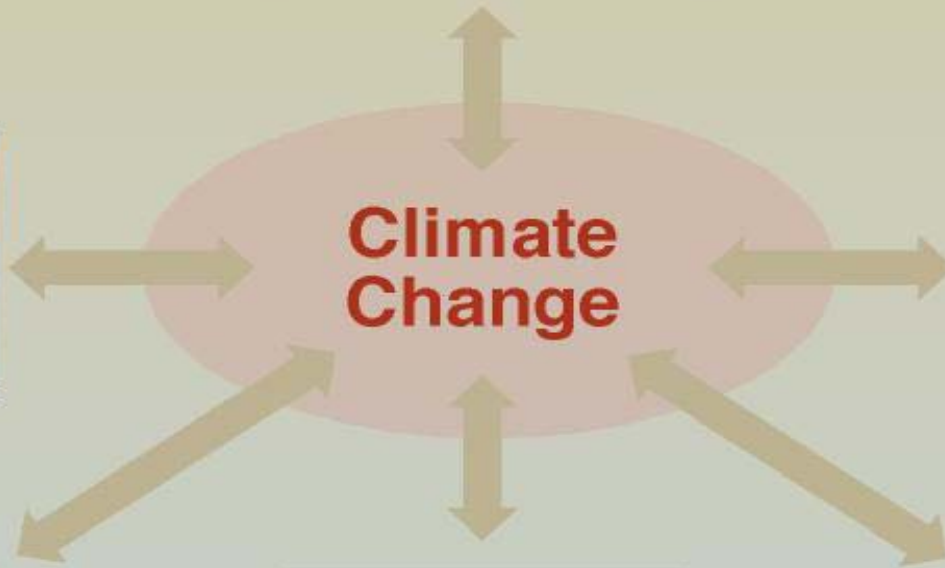
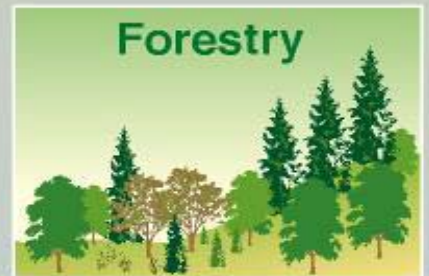


Source: Smith and others, 2009

A matter of degrees...



Linkages between climate change and other environmental issues



Noxious Weeds



Alliaria petiolata
(Garlic Mustard)

Lythrum salicaria L.
(Purple Loosestrife)

Pueraria lobata
(Kudzu)



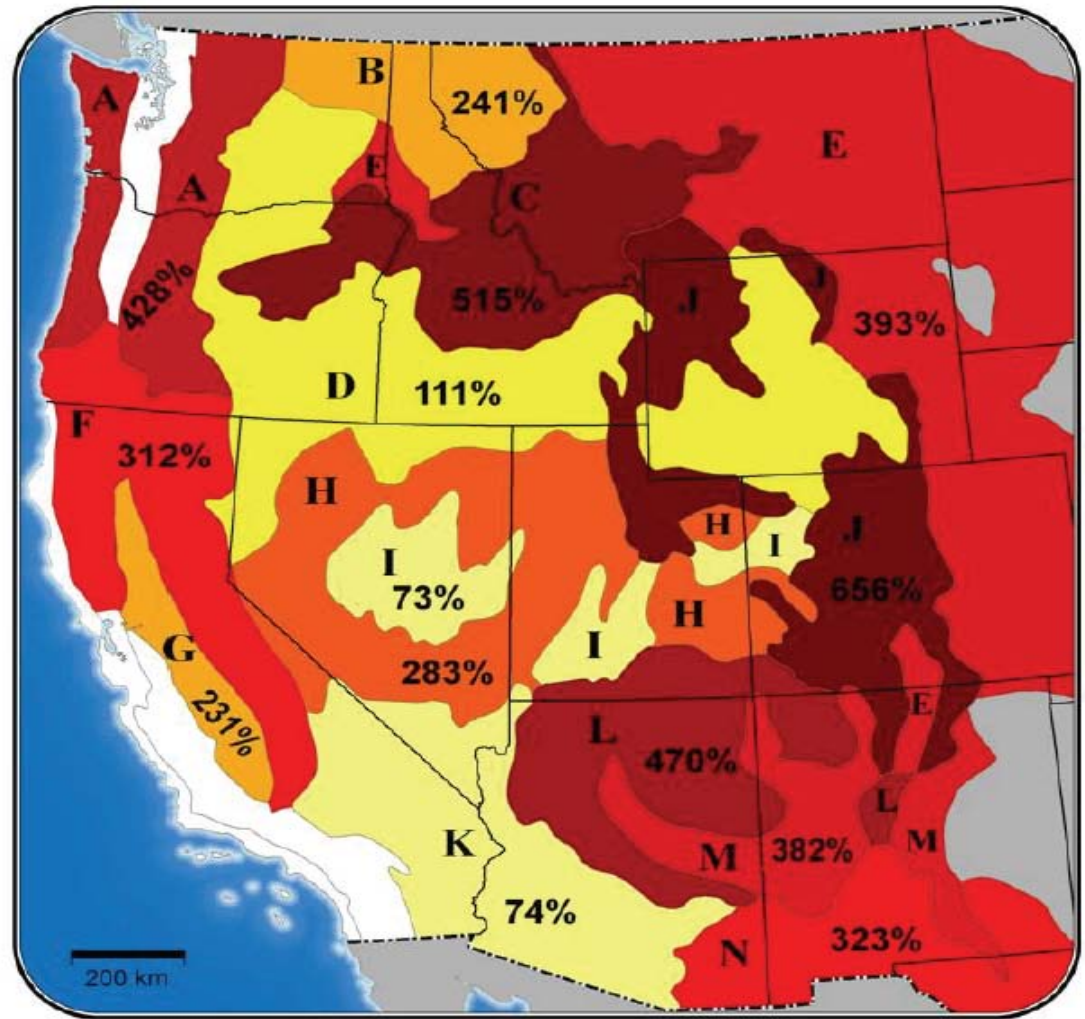
**Species Must
Move *Fast* to
Keep Up With
shifting climate:
9-14 m/day**

**Is it possible for
plants? Rates in
fossil record are**

3-5 m/day

US Western wildfires in a warming world

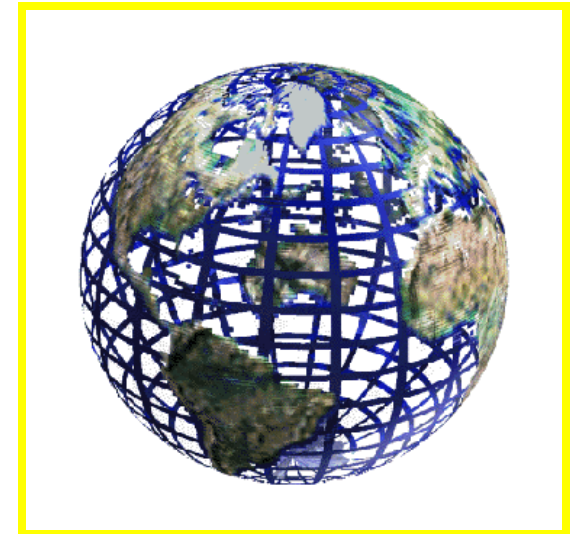
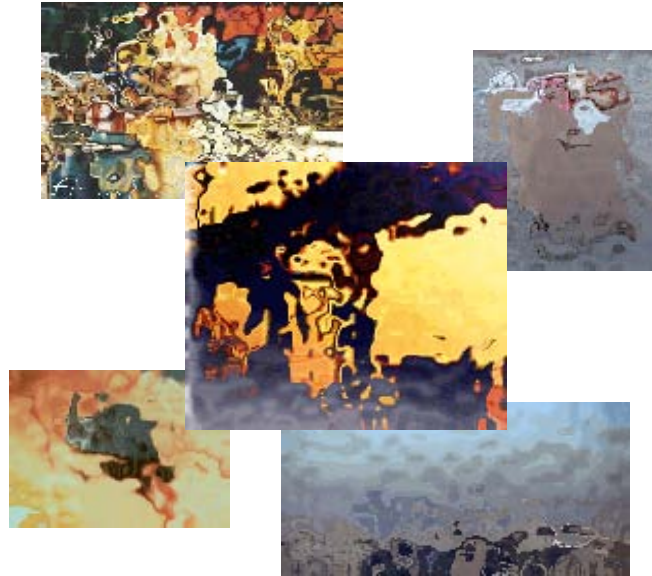
Percentage increases in median annual area burned for a 1°C increase in global average temperature



National Academies,
Stabilization Targets,
2010

- A - Cascade Mixed Forest
- B - Northern Rocky Mt. Forest
- C - Middle Rocky Mt. Steppe-Forest
- D - Intermountain Semi-Desert
- E - Great Plains-Palouse Dry Steppe
- F - Sierran Steppe-Mixed Forest
- G - California Dry Steppe
- H - Intermountain Semi-Desert / Desert
- I - Nev.-Utah Mountains-Semi-Desert
- J - South. Rocky Mt. Steppe-Forest
- K - American Semi-Desert and Desert
- L - Colorado Plateau Semi-Desert
- M - Ariz.-New Mex. Mts. Semi-Desert
- N - Chihuahuan Semi-Desert

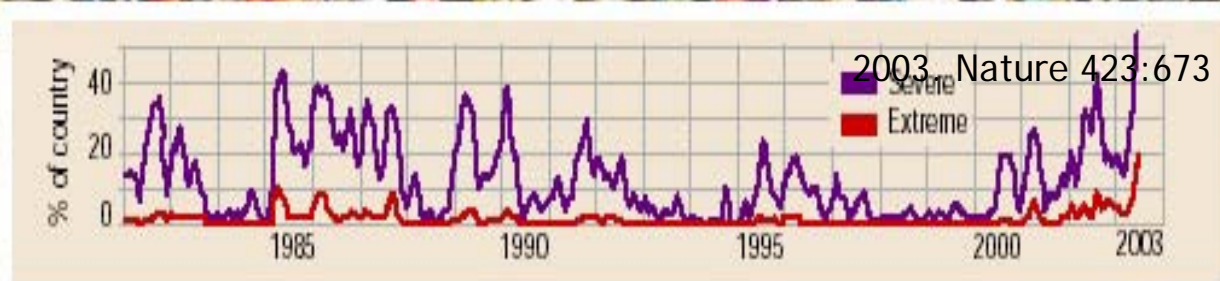
A matter of degrees...







India's worst drought for 20 years left people struggling to find water.

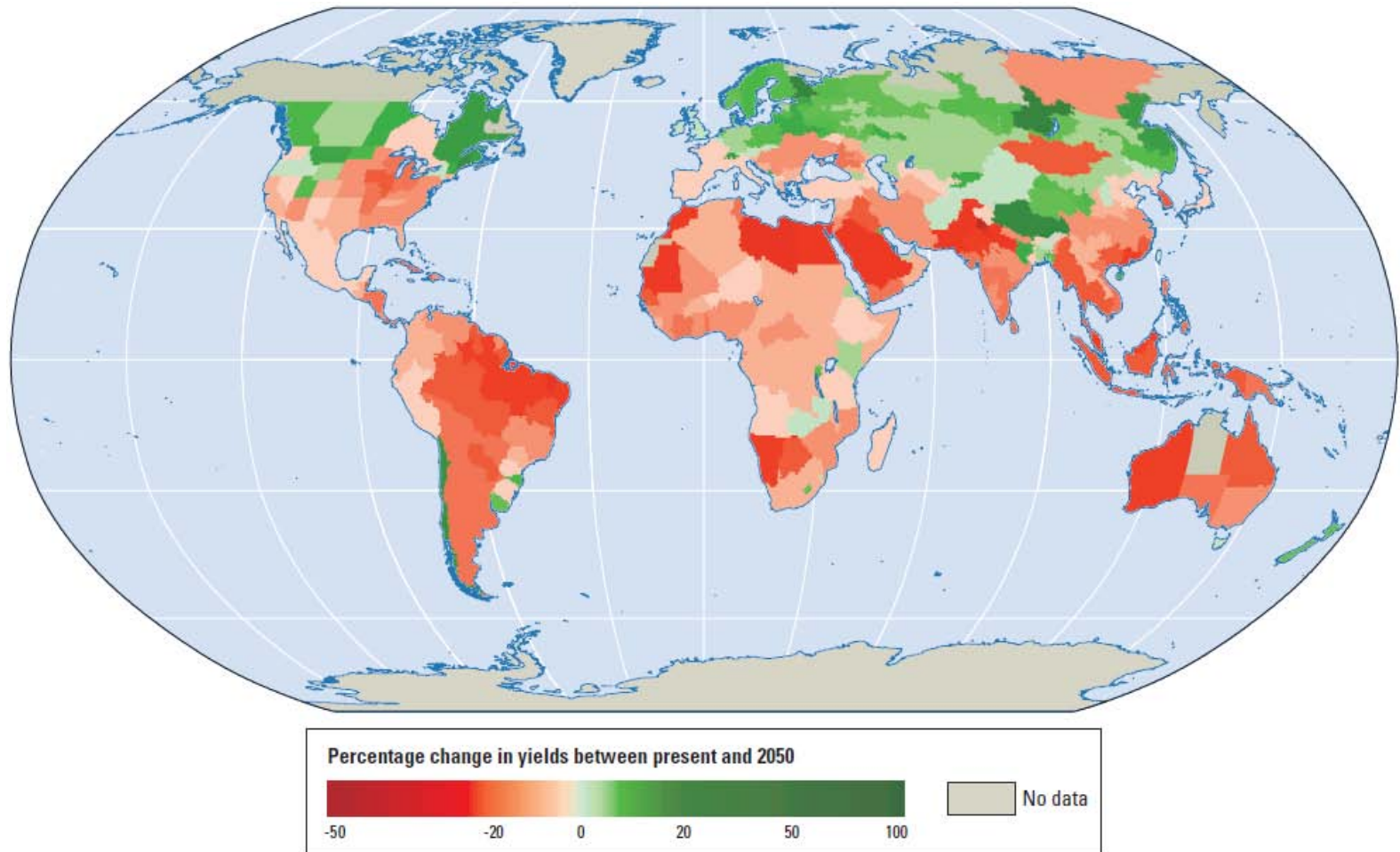


Tuvalu King tide flooding, 2005



The original image, February 9, 2005, seen by millions relating human effects of climate change. © 2005 Gary Braasch

Development consensus: The poor will suffer most



Composite of 13 crops: WDR, 2010

Today: an unsustainable world

- 1.4 billion people in poverty
- A quarter of children malnourished
- A quarter of women illiterate
- 1.6 billion without modern energy
- 1/6 without clean water



Tomorrow: climate change exacerbates inequities

- Most impacts will be negative, especially for poorest, most vulnerable nations.
- Water resources, coastal infrastructure, health, agriculture, and ecosystems will be challenged in virtually every region of the globe.
- International, regional, and national entities are ill-prepared to manage.
- Both mitigation and adaptation are needed because:

February 2007
Full Report



CONFRONTING CLIMATE CHANGE:
AVOIDING THE UNMANAGEABLE AND MANAGING THE UNAVOIDABLE

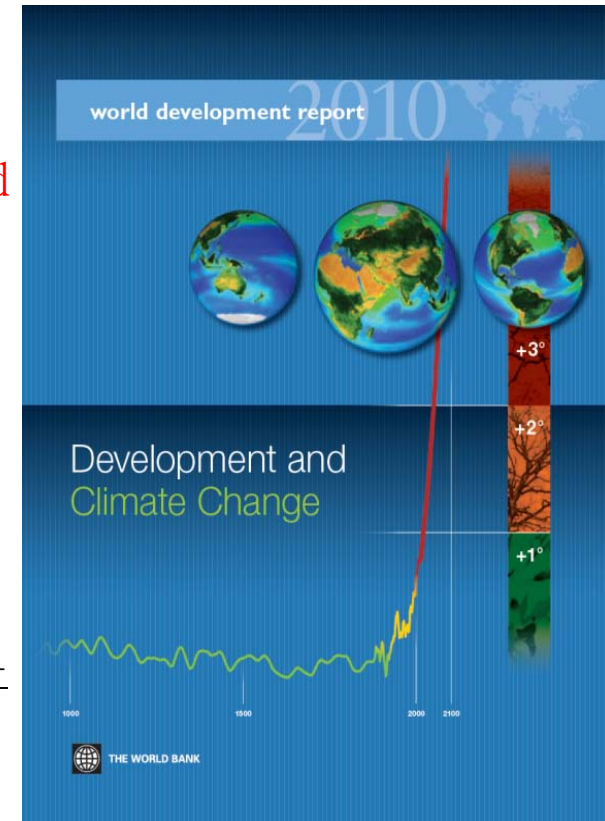
UNITED NATIONS FOUNDATION
SIGMA XI
THE SCIENTIFIC RESEARCH SOCIETY

Scientific Expert Group Report on Climate Change and Sustainable Development.
Prepared for the 15th Session of the Commission on Sustainable Development.

- It's already too late to avoid substantial climate change.
- Most adaptation measures more costly and less effective as magnitude increases.

<http://www.unfoundation.org/global-issues/climate-and-energy/sigma-xi.html>

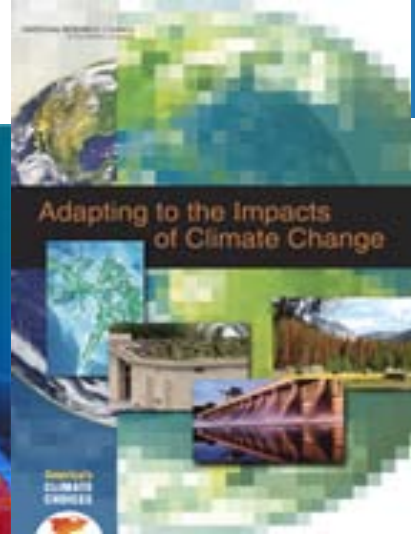
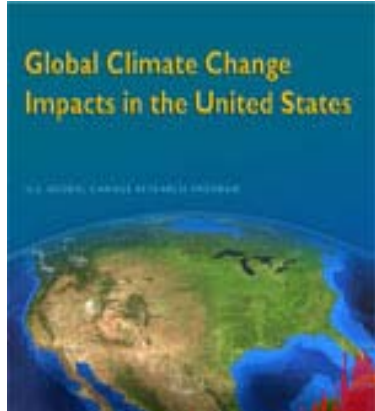
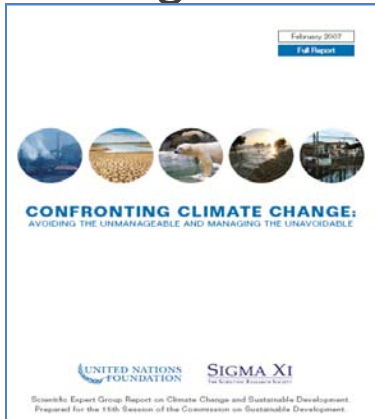
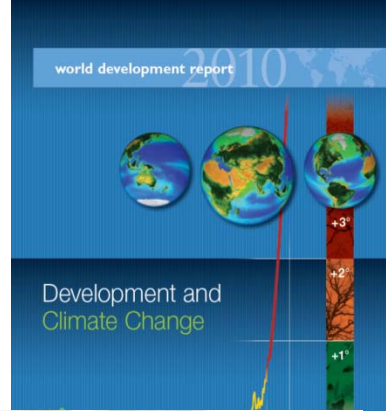
<http://worldbank.org/wdr/2010>



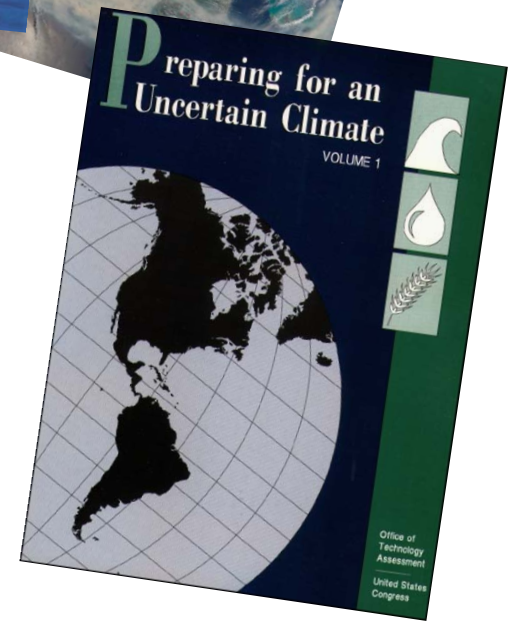
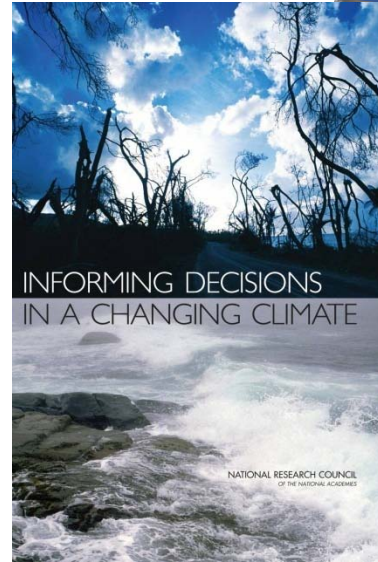
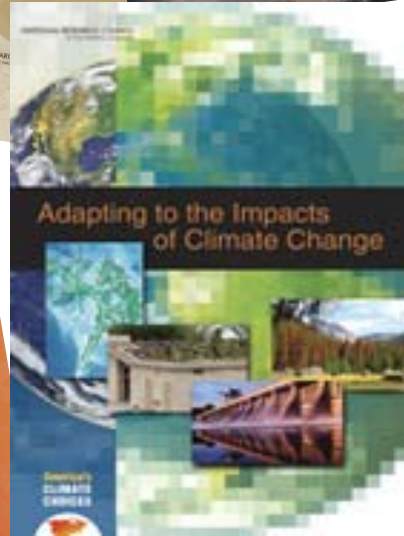
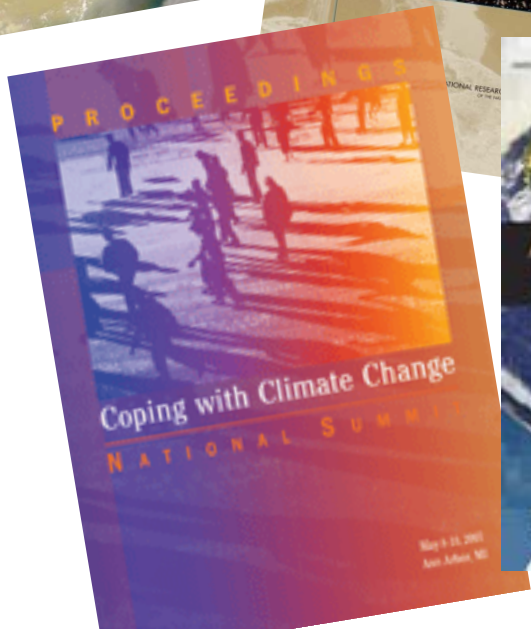
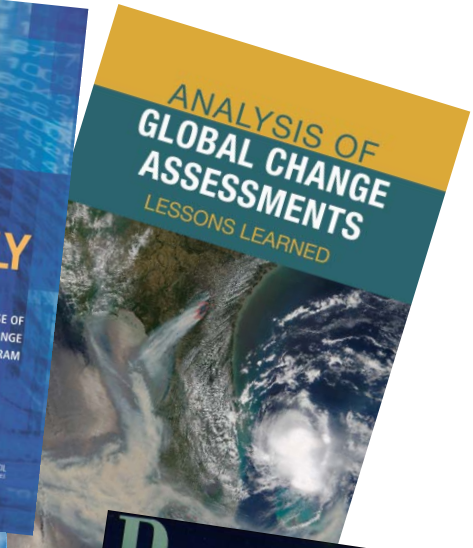
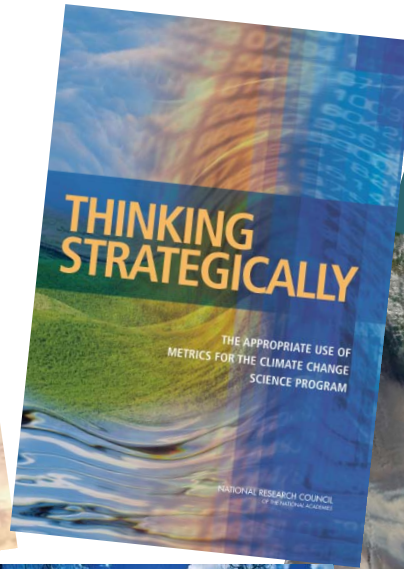
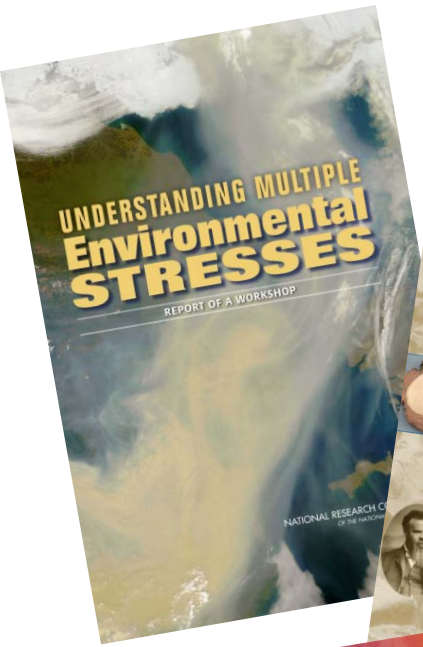
We must Adapt to climate change, adaptively: how can we help make *robust* rather than optimal decisions

- Infrastructure to with
 - Seed varieties
 - Prioritize
 - Emer
 - D
 - I
 - Wea
 - Regional assessments -
done iteratively
- ...at; seed banks
- ...reats
- ...systems
- ...practices
- ...monitoring and services

**This is a HUGE research agenda that has not been tackled seriously domestically OR internationally!
IT IS TIME TO GET ON WITH IT!**



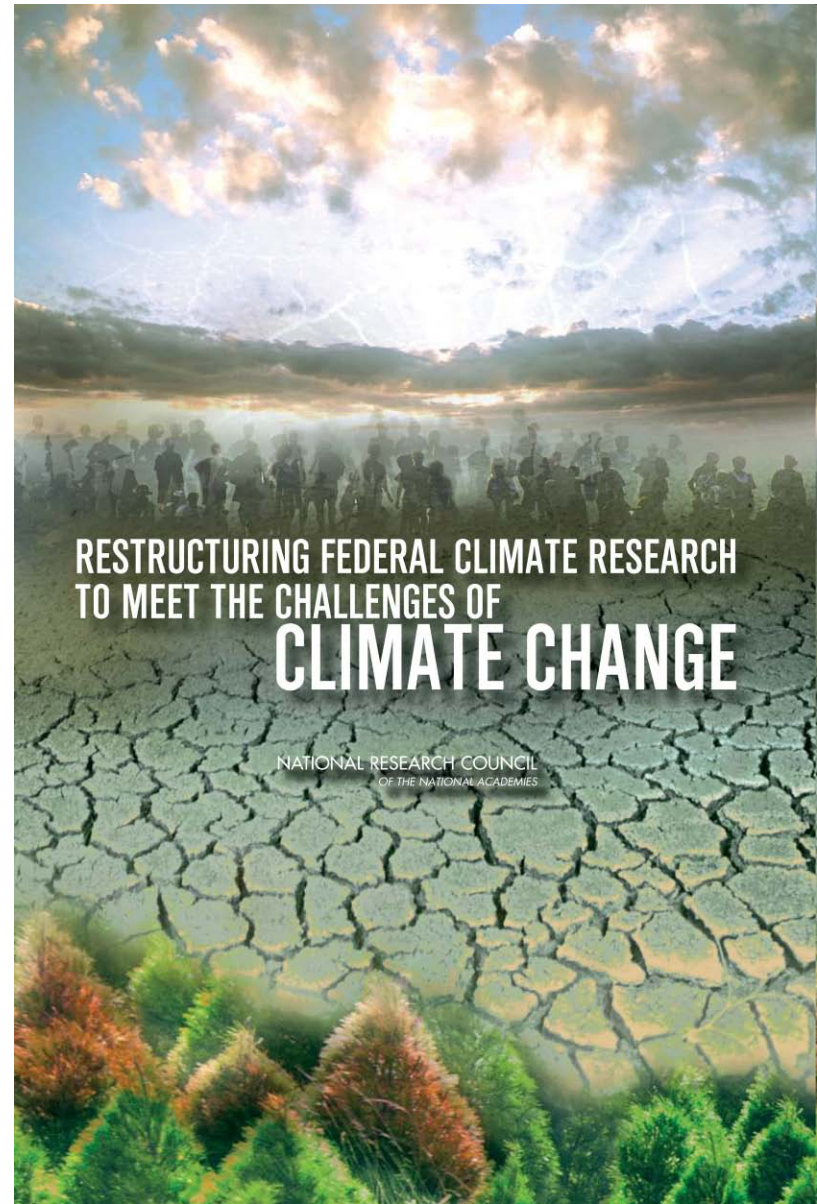
Lots of guidance on improving climate change information



Adaptation research needs bolstering*

- Understanding and predicting physical climate change is progressing well
- Inadequate human dimensions funding
- Need enhanced focus on:
 - assessing impacts on human well being and vulnerabilities
 - providing knowledge to support decision making and risk analyses
 - communicating results and engaging stakeholders in a 2-way dialogue
 - providing climate services routinely to decision makers

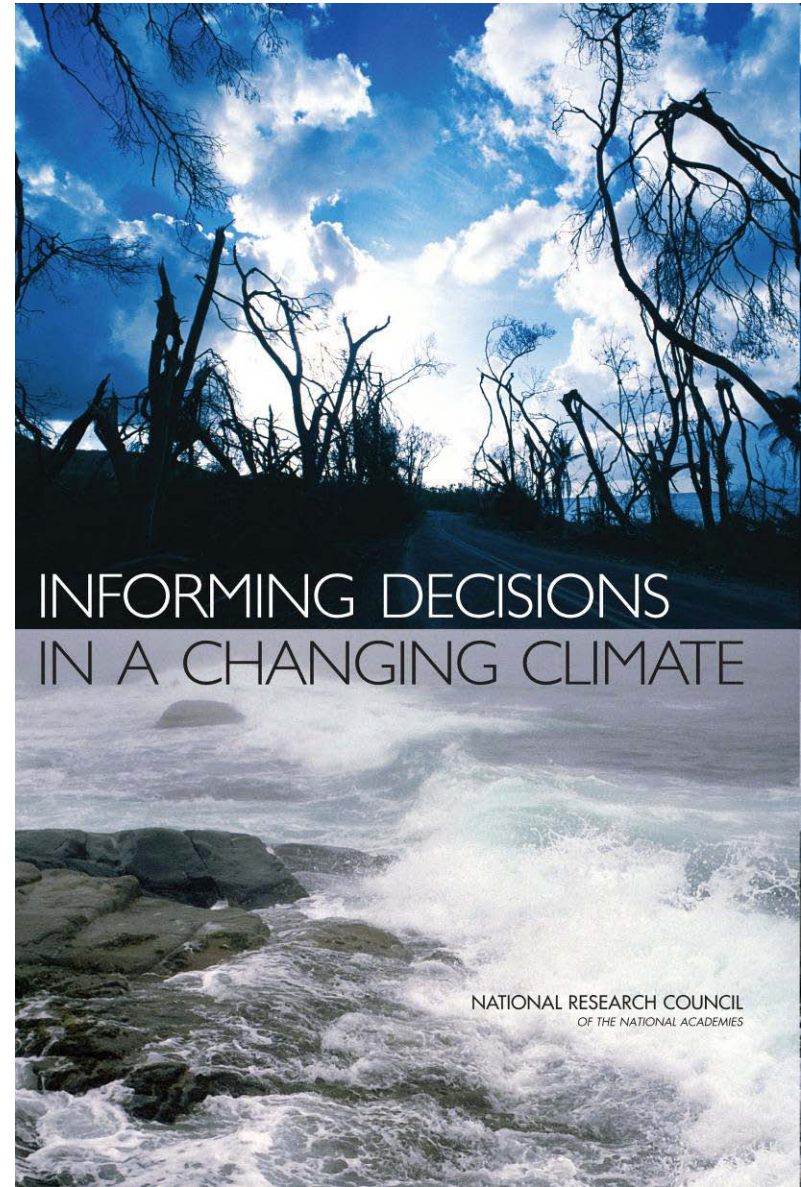
**Restructuring Federal Climate Research to Meet the Challenge of Climate Change (NRC, 2009)*



Five key foci for decision support research: *

Understanding...

- climate change vulnerabilities.. for regions, populations, and sectors
- the potential for mitigation...and consequences of mitigation options
- adaptation contexts and capacities, including consequences of adaptive responses
- how mitigation and adaptation interact
- taking advantage of emerging opportunities associated with climate variability and change



Research needs related to multiple stresses, extreme events, nonlinearities... (NRC & others, 2007)

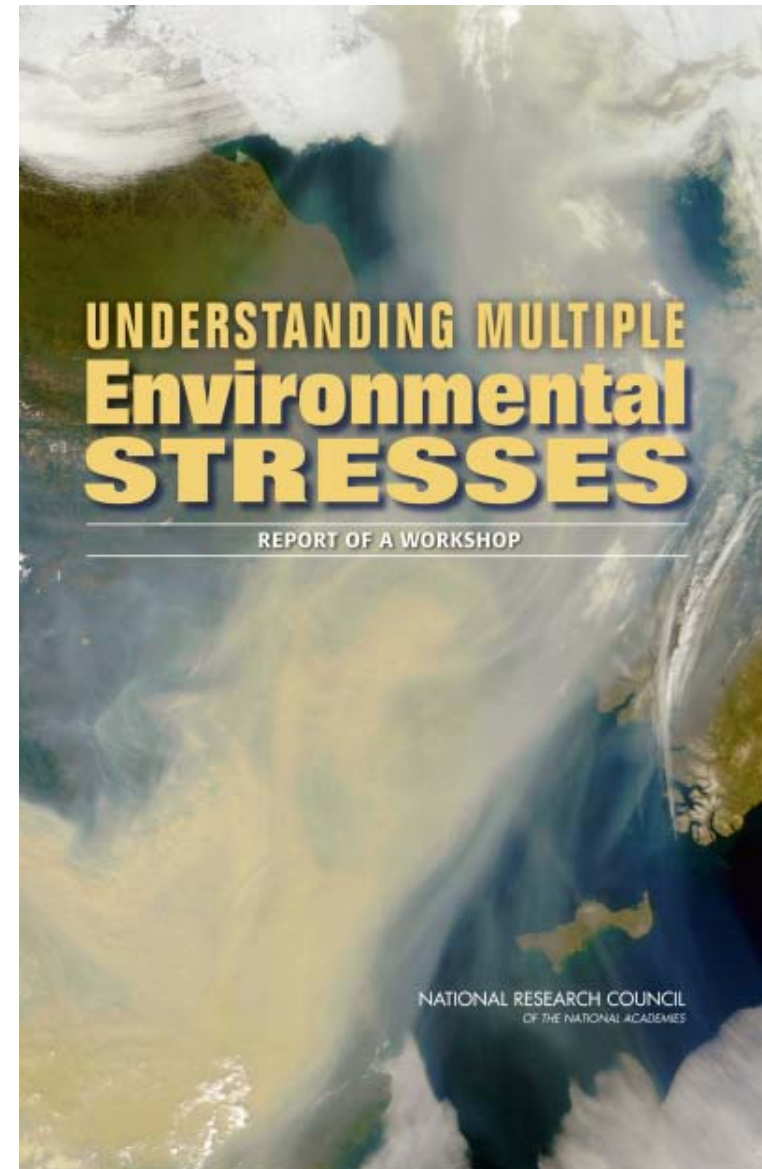
Better drought & flood planning; improve tools for municipalities & methods for testing

Enhance monitoring/surveillance systems, early warning systems, evacuation routes & response mechanisms for extreme events

Use of historical records and “What If?” scenarios to evaluate ‘break points’

Models that can provide quantitative predictions of multiple environmental stresses

Prediction of threshold effects such as climate/pest interactions; megadrought, ecosystem thresholds, cascading effects



“Outcome” metrics that can be applied

Has the program ...reduced uncertainties that **support decision making or facilitate the advance of other areas of science.**

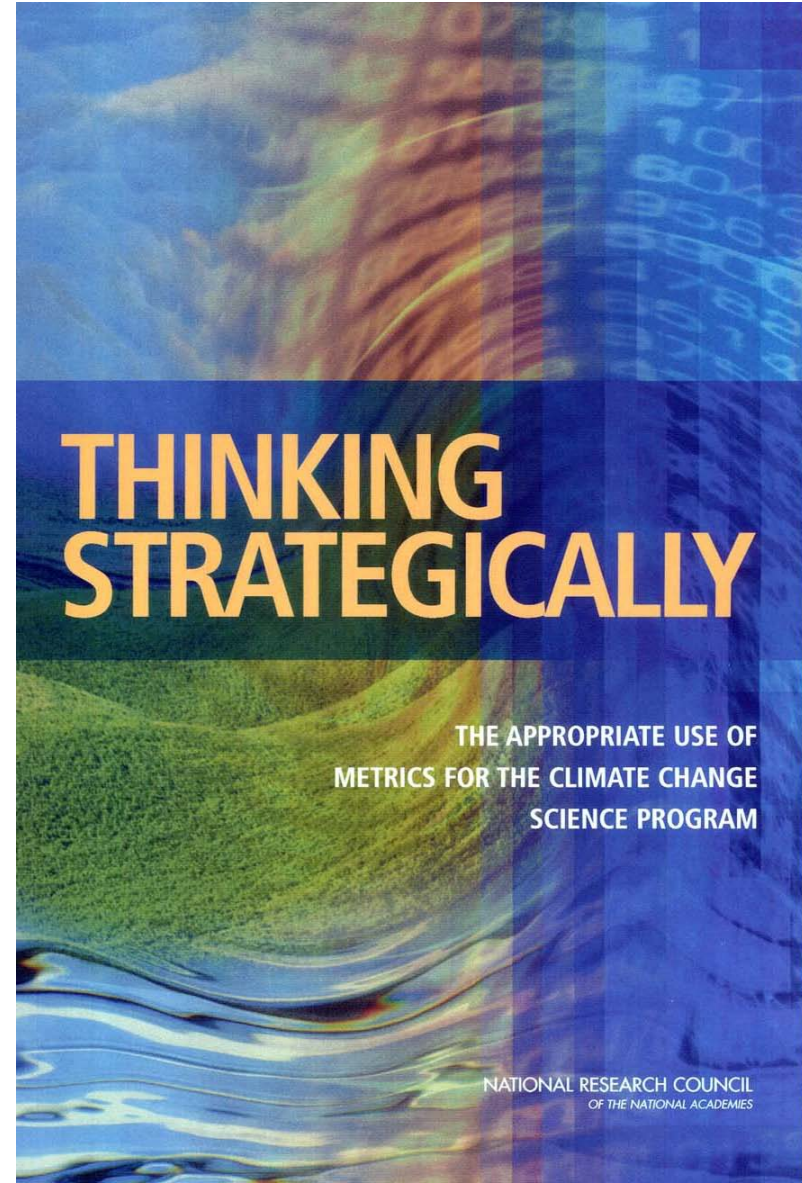
Has the program yielded **improved understanding** such as...broadly accepted conclusions about key issues or relationships.

Research results have been **transitioned to operational use.**

Institutions and human capacity have been created that can better address a range of related problems and issues.

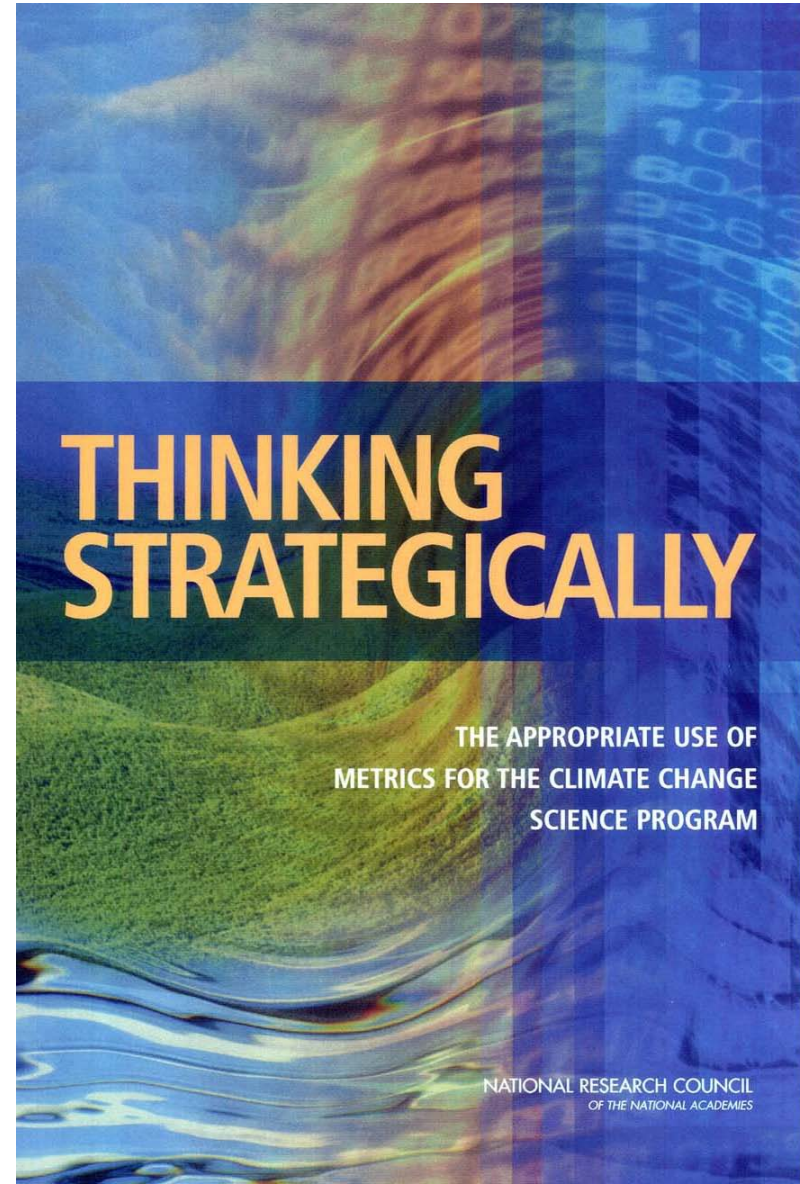
Measurements, analysis, and **results are being used** ...to support beneficial applications and decision making, such as forecasting, cost-benefit analysis, or improved assessment and management of risk.

Thinking Strategically: The Appropriate Use of Metrics for the Climate Change Research Program (NRC 2005)

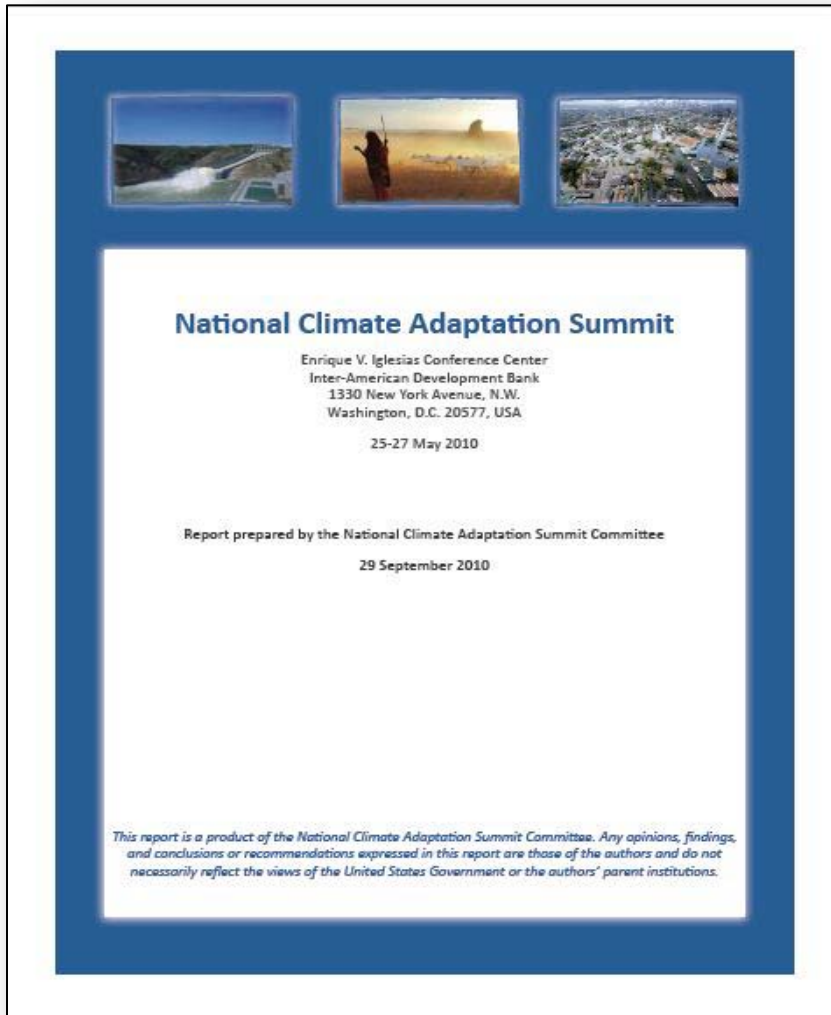


“Impact” metrics that can be applied

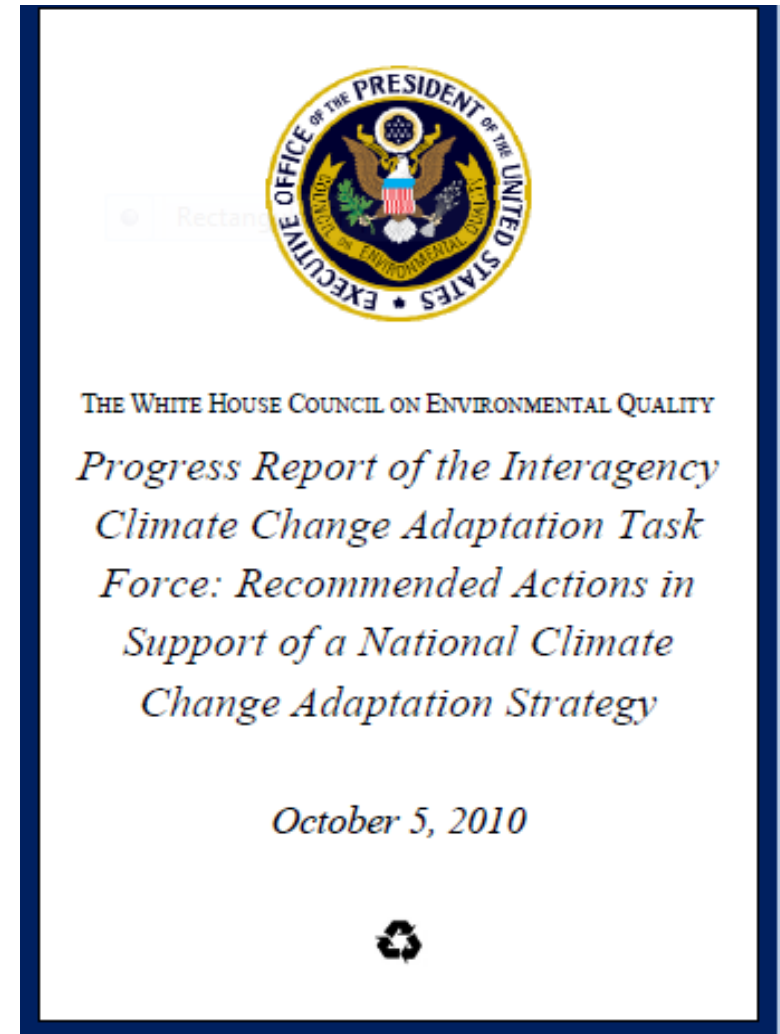
- Have the results of the program **informed policy and improved decision making**.
- Has the program **benefited society** in terms of enhancing economic vitality, promoting environmental stewardship, protecting life and property, and reducing vulnerability to the impacts of climate change.
- **Public understanding** of climate issues has increased.



Research Needs for U.S. Adaptation

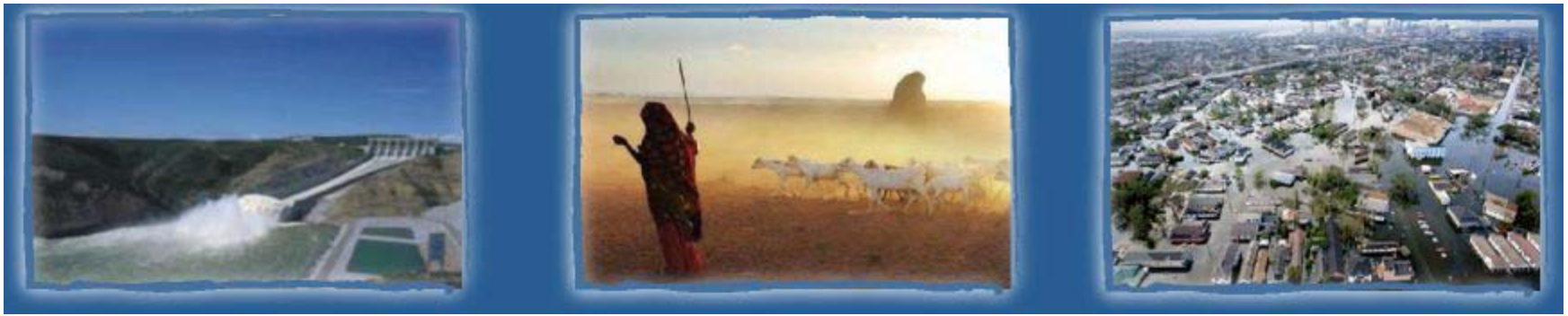


Draft Adaptation Strategy



http://joss.ucar.edu/events/2010/ncas/summit_report.html

<http://www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation>



National Climate Adaptation Summit

Some conclusions on information needs.....

- One size doesn't fit all but all scales need similar information
- Providing access to data/models/outputs is not the same as providing "usable" data --need an interface and 2-way communication
- Need help in analyzing the costs of adaptation and the costs of NOT adapting (and additionality). PILOT PROJECTS!
- Need a clearing house of 'best practices' and toolkits that exist
- Need data layers that help identify adaptation hotspots—such as the intersection of urban heat island effects, water scarcity,
- Assessment should focus on progress in mitigation and adaptation efforts --not just on state of systems

WE CAN PLAN AHEAD... OR WE CAN REACT

Wildlife can only react



But humans can anticipate



As we work to improve the scientific underpinnings, and ALSO to harness and use climate information for decisionmaking...

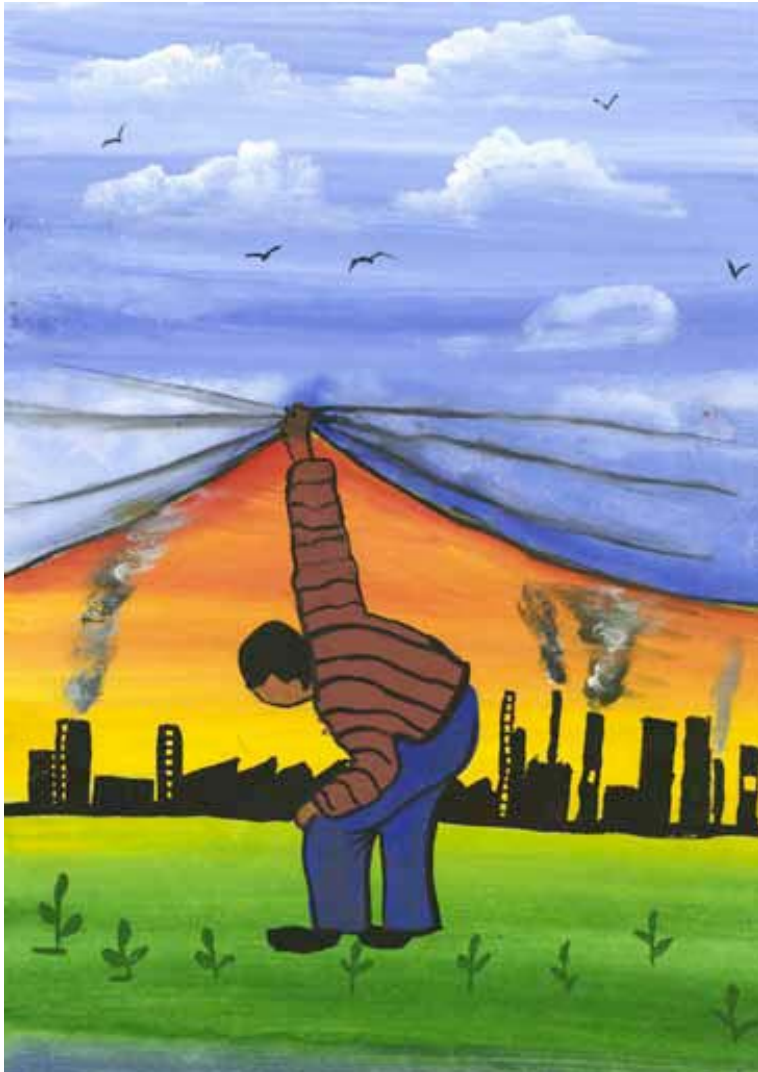
- Information must be both available and “usable”
- Must understand composite of multiple stresses
- Users and providers are equal participants
- Need a clearing house of ‘best practices’; toolkits
- Link across scales and across sectors
- Focus on interactions between mitigation and adaptation
- Identify what research is ‘most important to do’ and in particular, what you need to know to cope with climate change
- Help create a research and policy strategy with priorities so we get the answers we need in a timely fashion



What needs to be resolved...



- What metrics would regions/sectors have for success?
- What ways can we measure outcomes and impacts?
- How best to network our networks and engage the private sector?
- How to integrate from the top-down and bottom-up?
- How much “process” and how many “products” – and at what intervals?



“It is our collective responsibility to find ‘unselfish’ solutions and fast before it’s too late to reverse the damage caused every day.”

Maria Kassabian, age 10, Nigeria