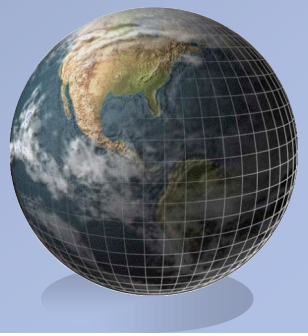
Evaluating and Communicating the Known and the Speculative: The Case of the National Assessment

Anthony C. Janetos
Vice President
The Heinz Center

Goals for Talk

- Use National Assessment as a backdrop
- Present some of the challenges we faced in describing known and speculative
- What did we do?
- Where are there successes and failures in communicating what is known and what is guessed at?



CLIMATE CHANGE IMPACTS ON THE UNITED STATES

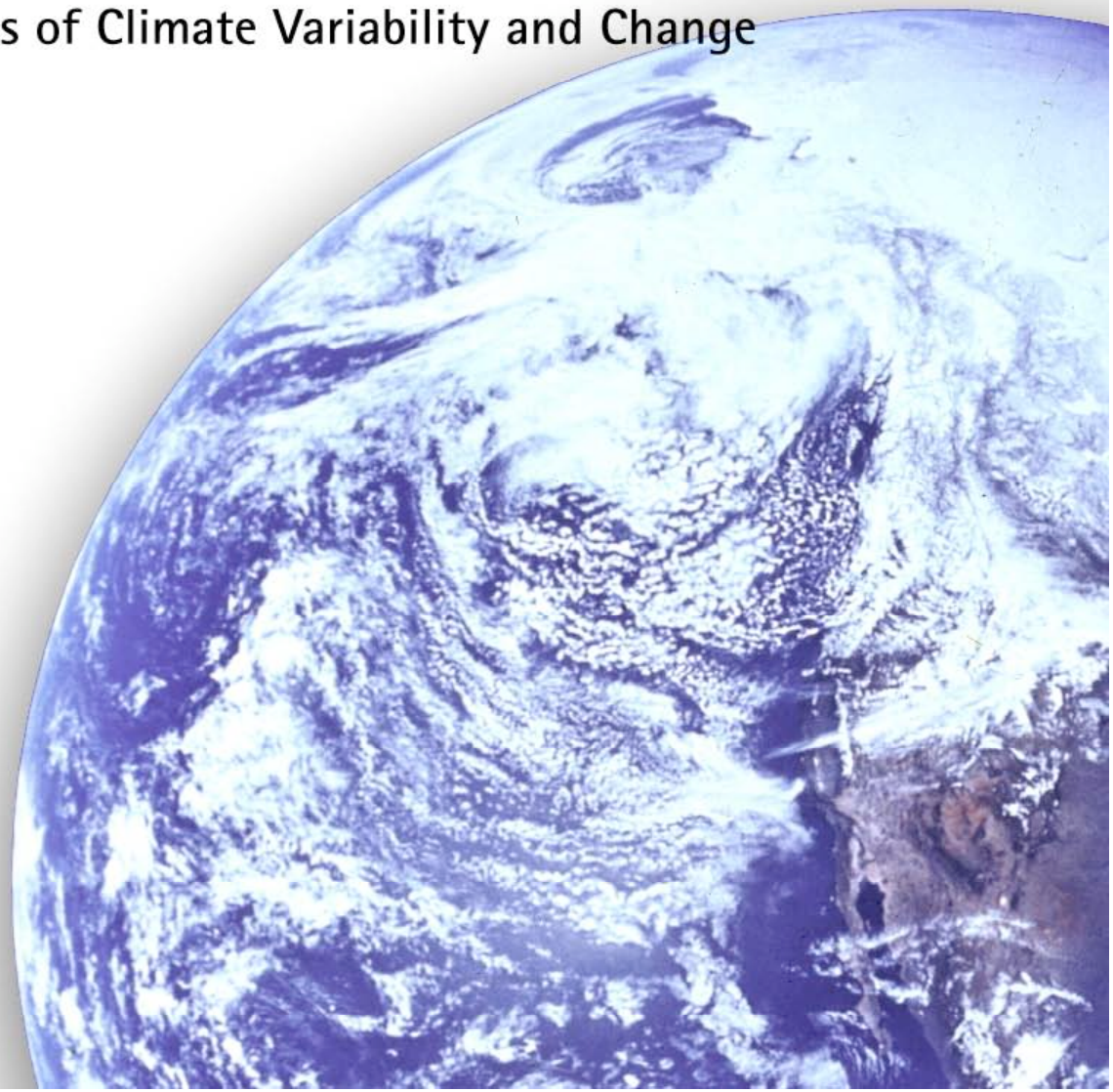
The Potential Consequences of Climate Variability and Change

National Assessment
Synthesis Team

US Global Change
Research Program

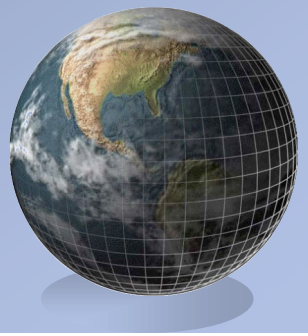
Public Comment Period:

June 12 to August 12



National Assessment

- Called for in Global Change Act
- Multiple workshops around the US: stakeholder involvement
- National team to oversee and write National Synthesis
- Both regional and multiple sectoral analyses
- Very visible national products/hundreds of papers in reviewed literature



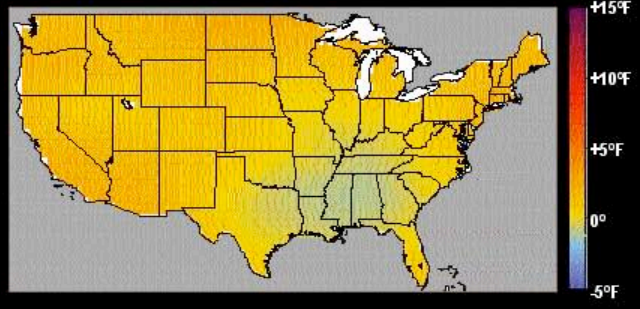
CLIMATE CHANGE IMPACTS ON THE UNITED STATES

TEMPERATURE CHANGE

Temperature Change

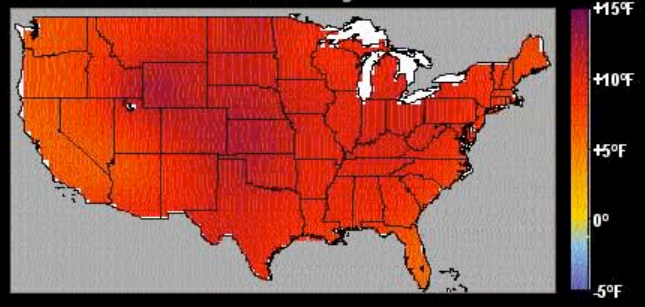
How to read these maps: The color scale indicates changes in temperature in °F over a 100 year period. For example, at 0°F there is no change; at +10°F there is a 10°F increase from the begining to the end of the century.

Observed 20th Century



The change in the annual average temperature over the 20th century has a distinctive pattern. Most of the US has warmed, in some areas by as much as 4°F. Only portions of the southeastern US have experienced cooling, and this was primarily due to the cool decades of the 1960s and 1970s, and temperatures since then have reached the highest levels of the century.

Canadian Model 21st Century



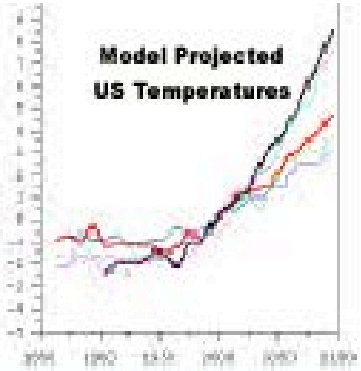
Hadley Model 21st Century

Both the Canadian and Hadley model scenarios project substantial warming during the 21st century. The warming is considerably greater in the Canadian model, with most of the continental US experiencing increases from 5 to 15°F. In this model, the least warming occurs in the West and along the Atlantic and Gulf Coasts. In the Hadley model, annual temperatures are projected to increase from 3 to 7°F, with the largest warming occurring in the western half of the country.

KEY FINDINGS

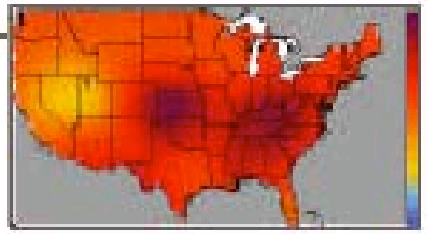
1. Increased warming

Assuming continued growth in world greenhouse gas emissions, the primary climate models used in this Assessment project that temperatures in the US will rise 5-9ºF (3-5ºC) on average in the next 100 years. A wider range of outcomes is possible.



2. Differing regional impacts

Climate change will vary widely across the US. Temperature increases will vary somewhat from one region to the next. Heavy and extreme precipitation events are likely to become more frequent, yet some regions will get drier. The potential impacts of climate change will also vary widely across the nation.

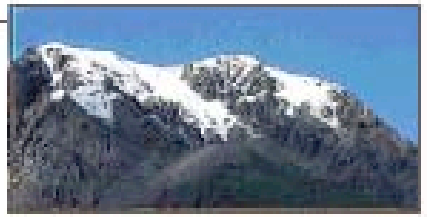


3. Vulnerable ecosystems

Many ecosystems are highly vulnerable to the projected rate and magnitude of climate change. A few, such as alpine meadows in the Rocky Mountains and some barrier islands, are likely to disappear entirely in some areas. Others, such as forests of the Southeast, are likely to experience major species shifts or break up into a mosaic of grasslands, woodlands, and forests. The goods and services lost through the disappearance or fragmentation of certain ecosystems are likely to be costly or impossible to replace.

4. Widespread water concerns

Water is an issue in every region, but the nature of the vulnerabilities varies. Drought is an important concern in every region. Floods and water quality are concerns in many regions. Snowpack changes are especially important in the West, Pacific Northwest, and Alaska.

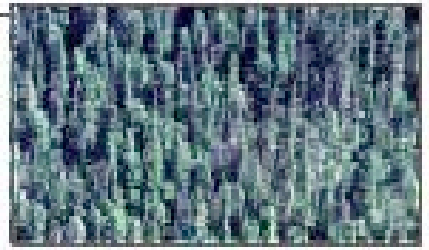


5. Secure food supply

At the national level, the agriculture sector is likely to be able to adapt to climate change. Overall, US crop productivity is very likely to increase over the next few decades, but the gains will not be uniform across the nation. Falling prices and competitive pressures are very likely to stress some farmers, while benefiting consumers.

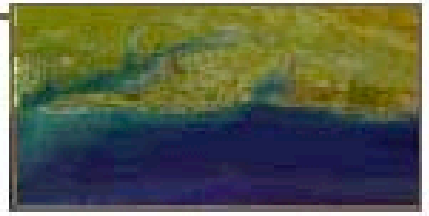
6. Near-term increase in forest growth

Forest productivity is likely to increase over the next several decades in some areas as trees respond to higher carbon dioxide levels. Over the longer term, changes in larger-scale processes such as fire, insects, droughts, and disease will possibly decrease forest productivity. In addition, climate change is likely to cause long-term shifts in forest species, such as sugar maples moving north out of the US.



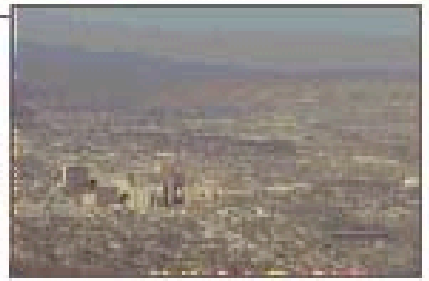
7. Increased damage in coastal and permafrost areas

Climate change and the resulting rise in sea level are likely to exacerbate threats to buildings, roads, powerlines, and other infrastructure in climatically sensitive places. For example, infrastructure damage is related to permafrost melting in Alaska, and to sea-level rise and storm surge in low-lying coastal areas.



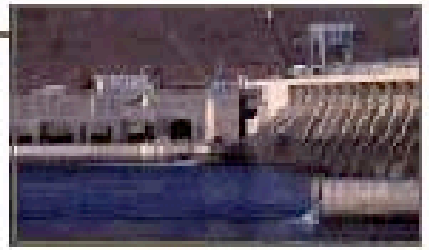
8. Adaptation determines health outcomes

A range of negative health impacts is possible from climate change, but adaptation is likely to help protect much of the US population. Maintaining our nation's public health and community infrastructure, from water treatment systems to emergency shelters, will be important for minimizing the impacts of water-borne diseases, heat stress, air pollution, extreme weather events, and diseases transmitted by insects, ticks, and rodents.



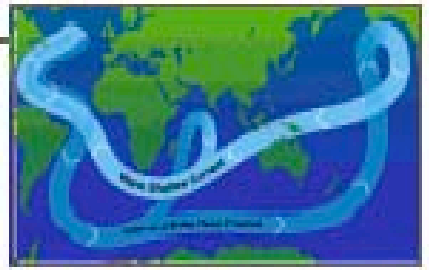
9. Other stresses magnified by climate change

Climate change will very likely magnify the cumulative impacts of other stresses, such as air and water pollution and habitat destruction due to human development patterns. For some systems, such as coral reefs, the combined effects of climate change and other stresses are very likely to exceed a critical threshold, bringing large, possibly irreversible impacts.



10. Uncertainties remain and surprises are expected

Significant uncertainties remain in the science underlying regional climate changes and their impacts. Further research would improve understanding and our ability to project societal and ecosystem impacts, and provide the public with additional useful information about options for adaptation. However, it is likely that some aspects and impacts of climate change will be totally unanticipated as complex systems respond to ongoing climate change in unforeseeable ways.



Regional Overview

There are both important commonalities and important differences in the climate-related issues and consequences faced around the country. For example, water is a key issue in virtually all regions,but the specific changes and impacts in the West,in the Great Lakes, and the Southeast will differ. Regional texture is thus critical in thinking through how to best respond to the changing climate we will face in the coming decades and century.

Twenty regional workshops involving a wide range of researchers and stakeholders helped identify key issues facing each region and began identifying potential adaptation strategies. This report groups the findings of these efforts into larger regions to offer a glimpse of the regional mosaic of consequences that are possible due to climate change and variability. The impacts highlighted here suggest that it is vital that people everywhere start to learn about this issue and consider it in their short- and long-term decisions about infrastructure,land use,and other planning. In many cases, research is needed to assess the feasibility,effectiveness,and costs of the adaptation strategies identified in the regional overviews.

Alaska

Sharp winter and springtime temperature increases are very likely to cause continued thawing of permafrost,further disrupting forest ecosystems, roads,and buildings.

Northwest

Increasing stream temperatures are very likely to further stress migrating fish,complicating restoration efforts.

Mountain West

Higher winter temperatures are very likely to reduce snowpack and peak runoff and shift the peak to earlier in the spring, reducing summer runoff and complicating water management for flood control, fish runs, cities,and irrigation.

Southwest

With an increase in precipitation,the desert ecosystems native to this region are likely to decline while shrublands expand.

Great Plains

Prairie potholes, which provide important habitat for ducks and other migratory waterfowl,are likely to dry up in a warmer climate.

Midwest/Great Plains

Higher CO_2 concentrations are likely to offset the effects of rising temperatures on forests and agriculture for several decades,increasing productivity.

Great Lakes

Lake levels are likely to decline,leading to reduced water supply and more costly transportation. Shoreline damage due to high water levels is likely to decrease.

Northern and Mountain Regions

It is very probable that warm weather recreational opportunities like hiking will expand while cold weather activities like skiing contract.

East/Midwest/South

Rising temperatures are very likely to increase the heat index dramatically in summer, with impacts to health and comfort. Warmer winters are likely to reduce cold-related stresses.

Appalachians

Warmer and moister air will very likely lead to more intense rainfall events,increasing the potential for flash floods.

Southeast

Under warmer wetter scenarios,the range of southern tree species is likely to expand. Under hotter and drier scenarios,it is likely that far southeastern forests will be displaced by grasslands and savannas.

Southeast Atlantic Coast

It is very probable that rising sea levels and storm surge will threaten natural ecosystems and human coastal development and reduce buffering capacity against storm impacts.

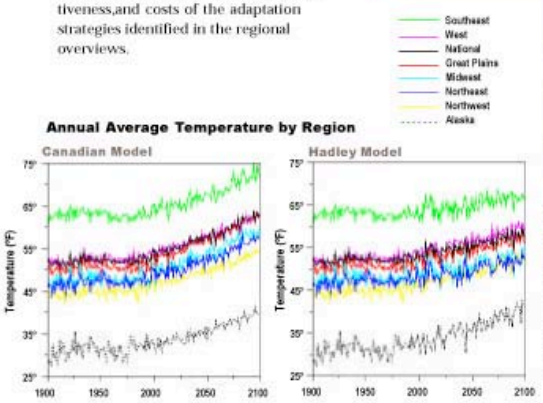
Southeast Gulf Coast

Inundation of coastal wetlands will very likely increase,threatening fertile areas for marine life,and migrating birds and waterfowl.

Islands

More intense El Niño and La Niña events are possible and are likely to create extreme fluctuations in water resources for island citizens and the tourists who sustain local economies.

Annual Average Temperature by Region



Average temperature is shown for each region in °F. Both the significant year-to-year variability and the projected upward slope of each line are clearly evident. Temperatures are projected to increase more in some regions than in others, with generally larger increases projected by the Canadian model scenario than by the Hadley model scenario.

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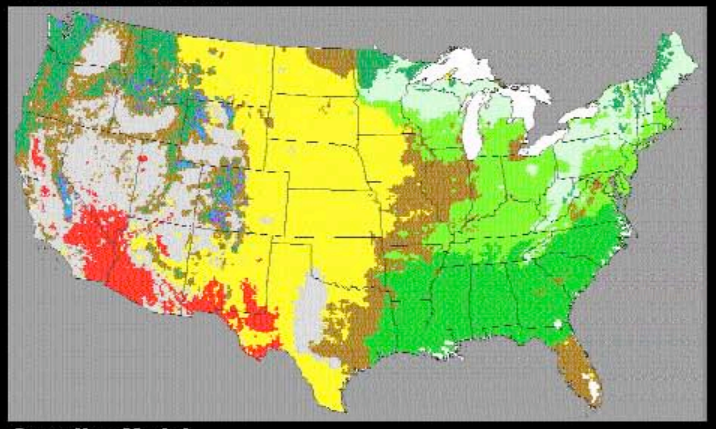
CLIMATE CHANGE IMPACTS ON THE UNITED STATES

Ecosystem Models

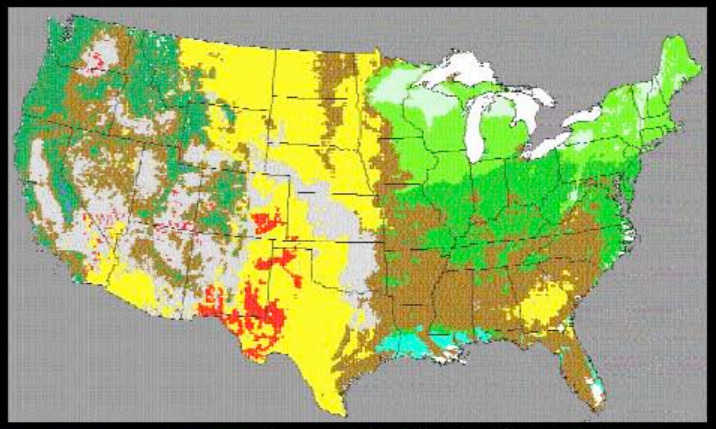
Maps of current and projected potential vegetation distribution for the conterminous US. Potential vegetation means the vegetation that would be there in the absence of human activity. Changes in vegetation distribution by the end of the 21st century are in response to two climate scenarios, the Canadian and the Hadley. Output is from MAPSS (Mapped Atmosphere-Plant-Soil System).

- Tundra
- Taiga / Tundra
- Conifer Forest
- Northeast Mixed Forest
- Temperate Deciduous Forest
- Southeast Mixed Forest
- Tropical Broadleaf Forest
- Savanna / Woodland
- Shrub / Woodland
- Grassland
- Arid Lands

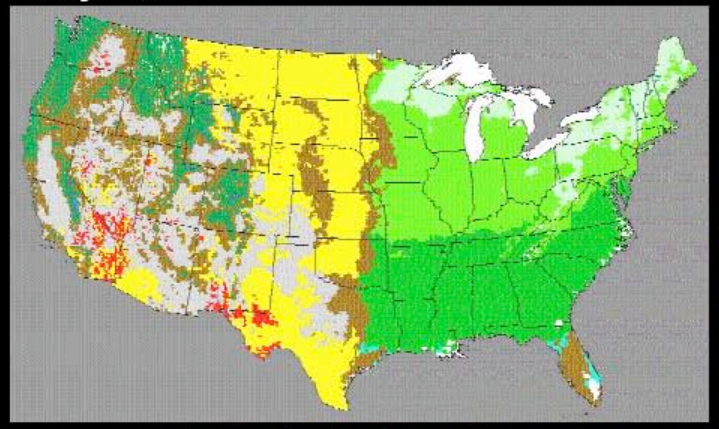
Current Ecosystems



Canadian Model

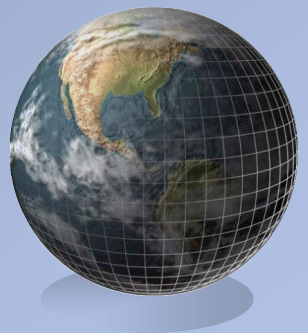


Hadley Model



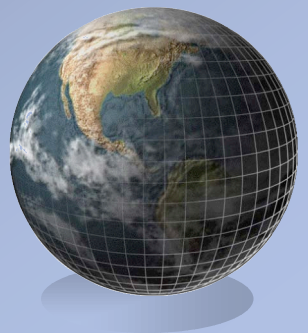
Challenges

- Ecosystem response to multiple stresses, climate change in a broader context
- Degree to which CO_2 fertilization operates
- Dependencies of impacts on particular CO_2 concentrations
- Costs and effectiveness of adaptation strategies
- Interaction of domestic and international effects
- Linkages to other issues, especially losses of biological diversity



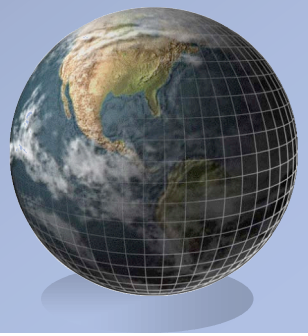
Known and Speculative

- Differentiate between levels of confidence:
  - Proven to satisfaction of scientific community
  - Most scientists believe evidence warrants
  - Theoretically sound, but lacking lots of evidence
  - Best guesses on part of knowledgeable community



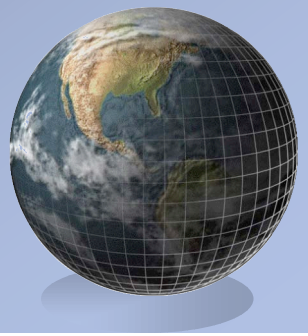
Known and Speculative

- Differentiate between unknown and unknowable
  - Understood in general terms, but unknowable in specific instances
  - Challenge of forecasting human decisions
  - Multiple influences on future social and/or economic condition



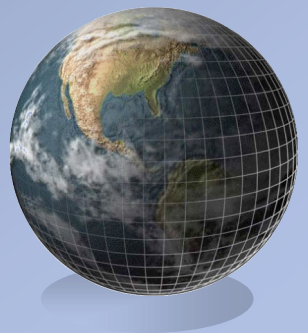
Known and Speculative

- How to communicate?
  - Multiple simulations and model statistics
  - Reasoning by analogy to history
  - Mahlman's odds
  - Expert judgment



Known and Speculative

- Failures in communication
  - Terms used imprecisely or inconsistently
  - Too much sophistication
  - Too many degrees of differentiation
  - Using extremes in visual presentation to capture range
  - Caricature



Known and Speculative

- Successes in communication
  - Consistently used and understood terms
  - Simple enough for multiple audiences to understand
  - Participatory development
  - Analogy to every-day decision making