

America's Climate Choices, Maryland's Climate Choices

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University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE



The National Research Council

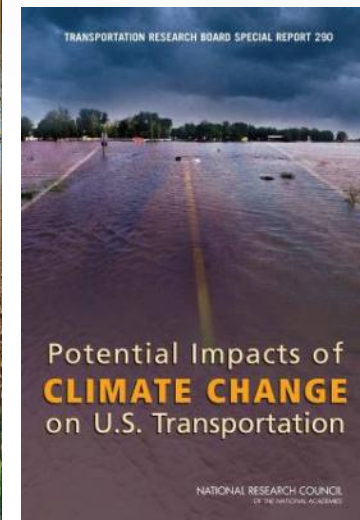
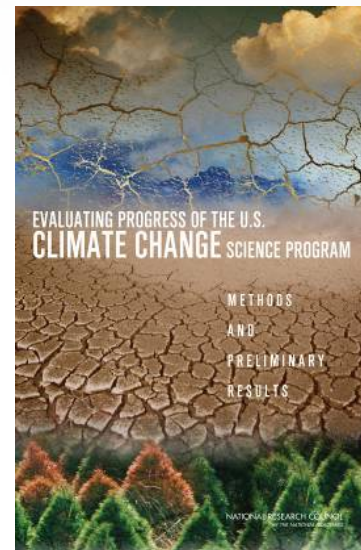
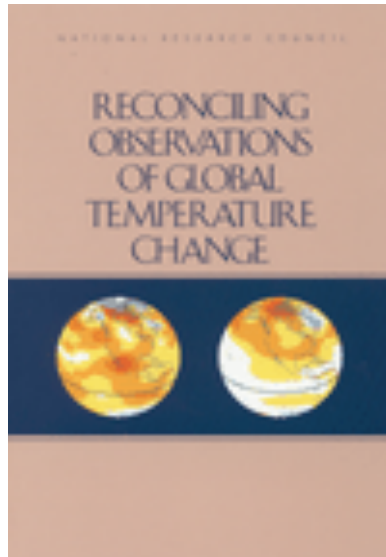
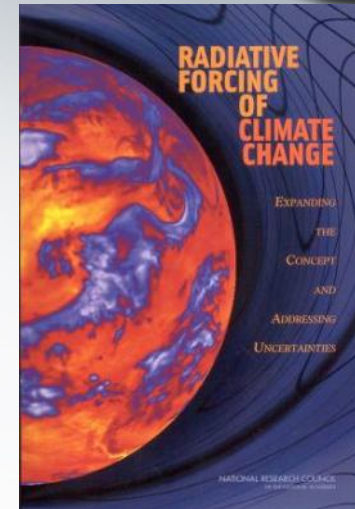
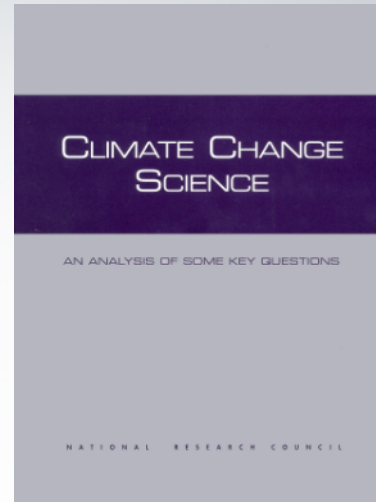
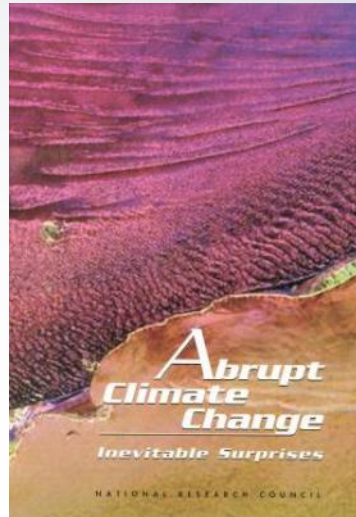
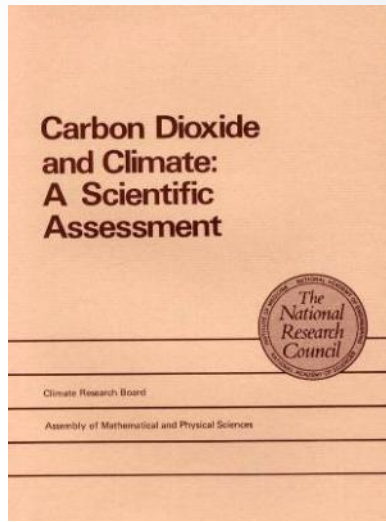


THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

- ✿ A private, non-profit organization charged to provide advice to the nation on science, engineering, and medicine.
- ✿ Study committees produce 250+ consensus reports each year, on a wide range of topics.
- ✿ Committees are composed of experts who serve pro bono, carefully chosen for expertise, balance, and objectivity
- ✿ All reports go through stringent peer-review and must be approved by both the study committee and the institution.
- ✿ Further information at: <http://nationalacademies.org>

Dozens of Reports on What We Know about Climate Change





Congress Requested Guidance about What to Do About It



The Department of Commerce Appropriations Act of 2008 (Public Law 110-161) called for the National Academy of Sciences to:

“...investigate and study the serious and sweeping issues relating to global climate change and make recommendations regarding **what steps must be taken and what strategies must be adopted** in response to global climate change, including the science and technology challenges thereof.”

Former Congressman Alan Mollohan





America's Climate Choices Was the Response



Four ACC panels :

- *Advancing the Science of Climate Change*
- *Limiting the Magnitude of Climate Change*
- *Adapting to the Impacts of Climate Change*
- *Informing an Effective Response to Climate Change*

and an **overarching committee (CACCC)**, to coordinate study activities and write a *Final Report*



Volunteers for America

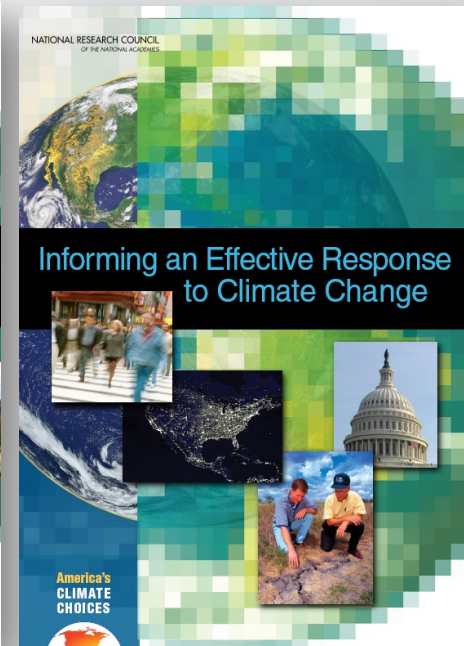
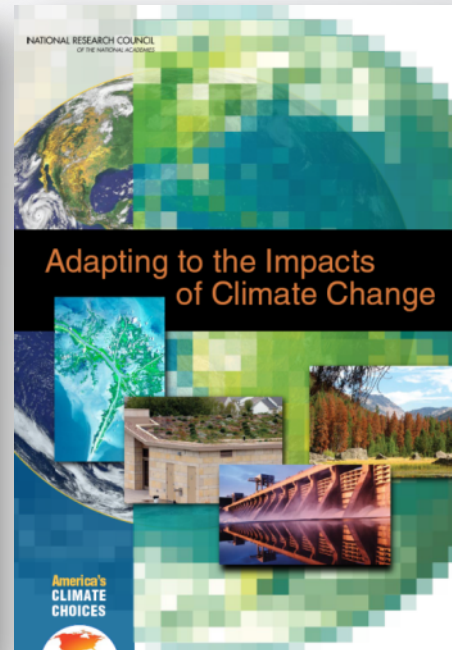
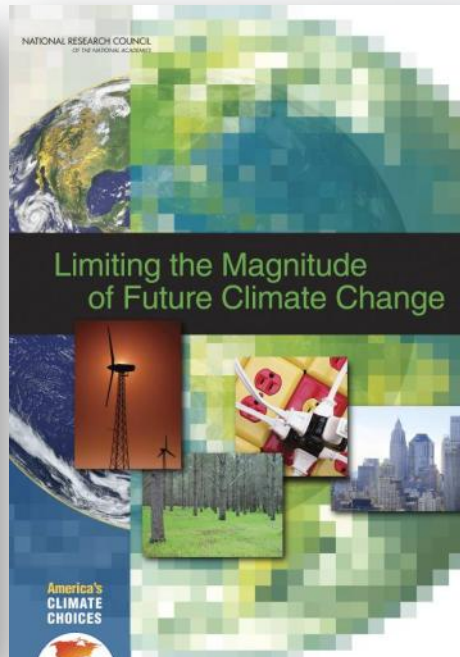
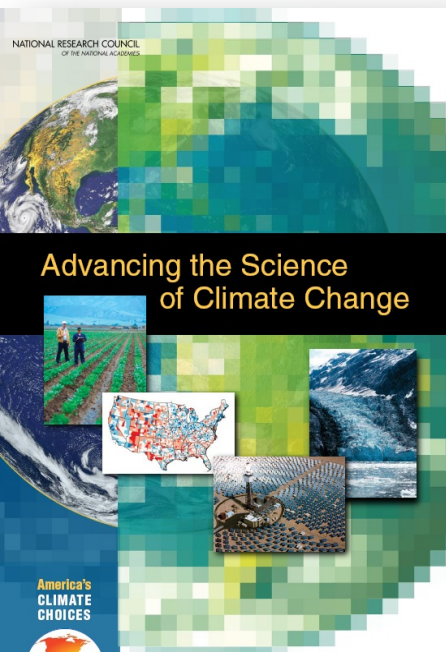


Over 90 volunteers, including climate scientists, ecologists, energy specialists, transportation and land-use experts, economists, sociologists, political scientists, lawyers, engineers, former public officials, community organizers, business leaders, and many others.





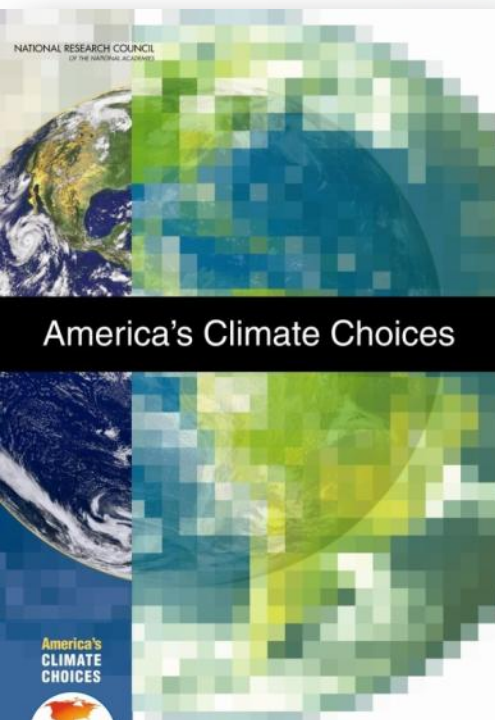
Four Panel Reports: 2010



www.americasclimatechoices.org



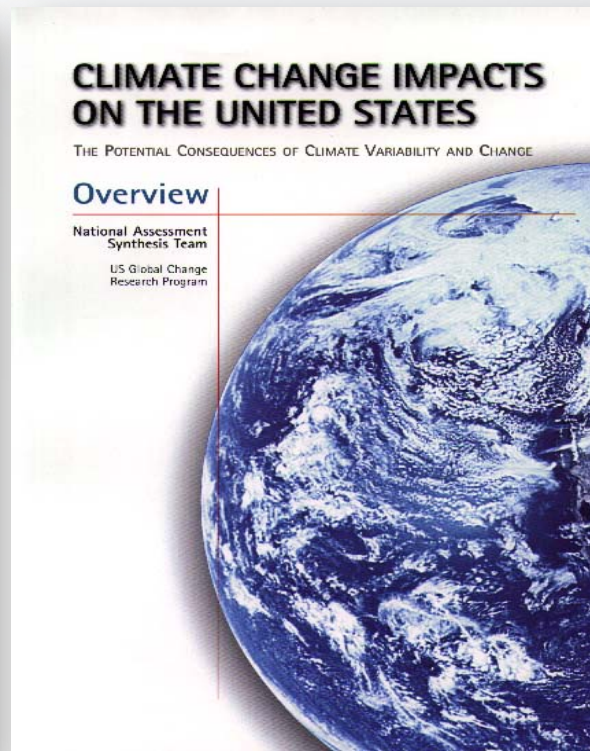
Final Report: 2011



ALBERT CARNESALE ([Chair](#)), University of California, Los Angeles
WILLIAM CHAMEIDES ([Vice-Chair](#)), Duke University
DONALD BOESCH, University of Maryland CES
MARILYN BROWN, Georgia Institute of Technology [[LIMITING PANEL](#)]
JONATHAN CANNON, University of Virginia
THOMAS DIETZ, Michigan State University [[SCIENCE PANEL](#)]
GEORGE EADS, CRA Charles River Associates
ROBERT FRI, Resources for the Future [[LIMITING PANEL](#)]
JAMES GERINGER, Environmental Systems Research Institute
DENNIS HARTMANN, University of Washington
CHARLES HOLLIDAY, Bank of America
DIANA LIVERMAN, University of Arizona [[INFORMING PANEL](#)]
PAMELA MATSON, Stanford University [[SCIENCE PANEL](#)]
PETER RAVEN, Missouri Botanical Garden [[INFORMING PANEL](#)]
RICHARD SCHMALENSEE, Massachusetts Institute of Technology
PHILIP SHARP, Resources for the Future
PEGGY SHEPARD, WE ACT for Environmental Justice
ROBERT SOCOLOW, Princeton University
SUSAN SOLOMON, National Oceanic and Atmospheric Administration
BJORN STIGSON, World Business Council for Sustainable Development
THOMAS WILBANKS, Oak Ridge National Laboratory [[ADAPTING PANEL](#)]
PETER ZANDAN, Public Strategies, Inc.



Why Me?



www.usgcrp.gov/usgcrp/nacc/



www.globalchange.gov/



Take-home Messages



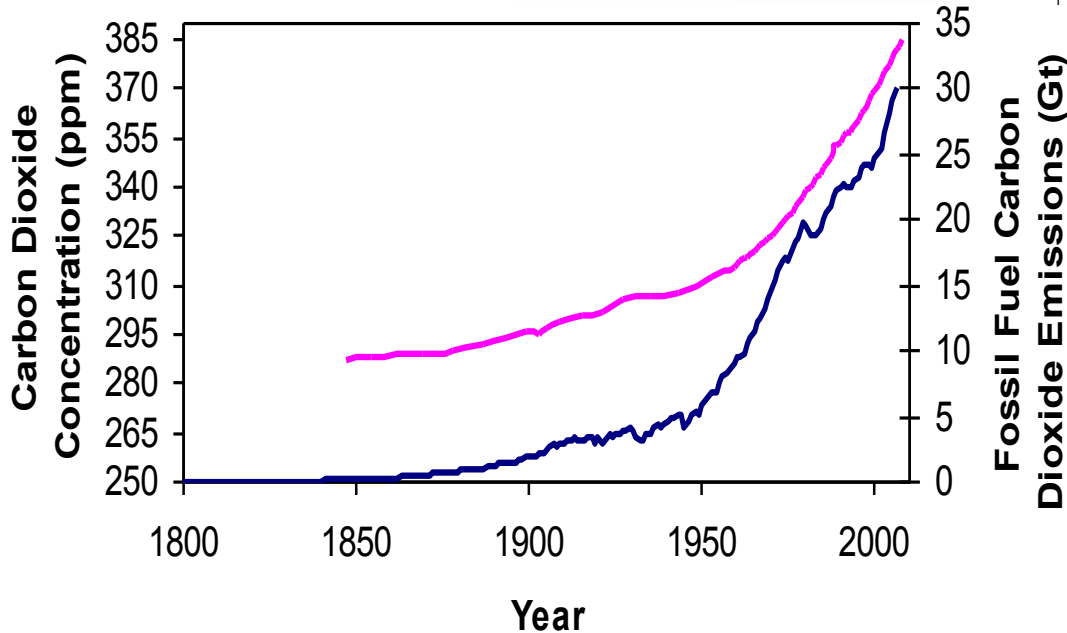
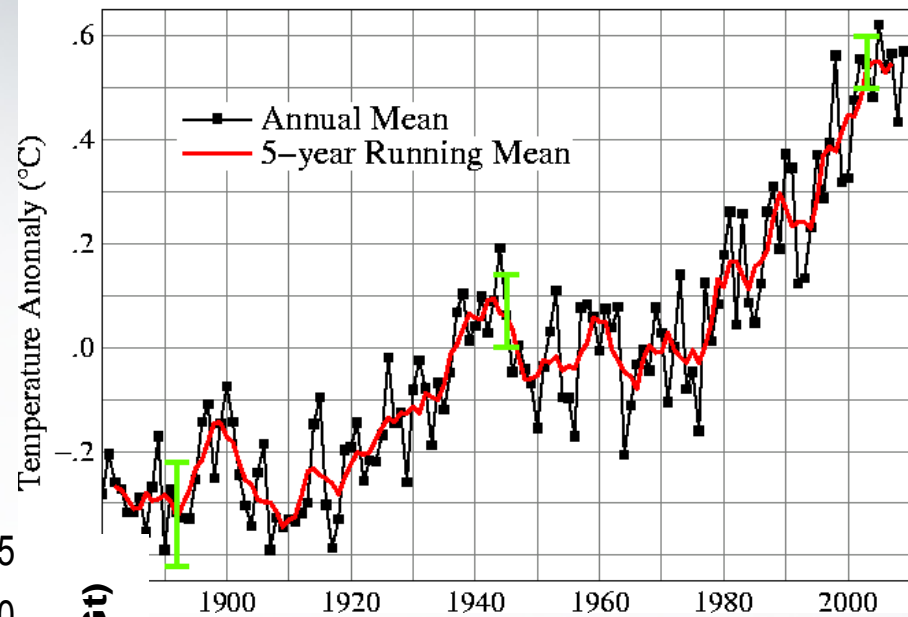
- (i) The Committee confirms that
 - climate change is occurring,
 - is very likely caused primarily by human activities, and
 - poses significant risks to human society and the natural environment.
- (ii) These risks indicate a **pressing** need for substantial action to
 - limit the magnitude of climate change and
 - prepare for adapting to its impacts



Trend and Attribution



Warming is unequivocal



Human activities are very likely responsible for most of the global warming that has occurred in the past several decades

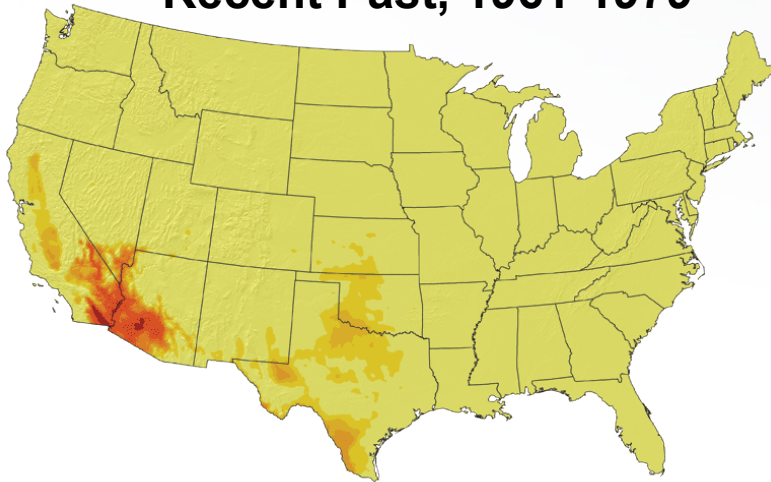


Risks Increase with Emissions

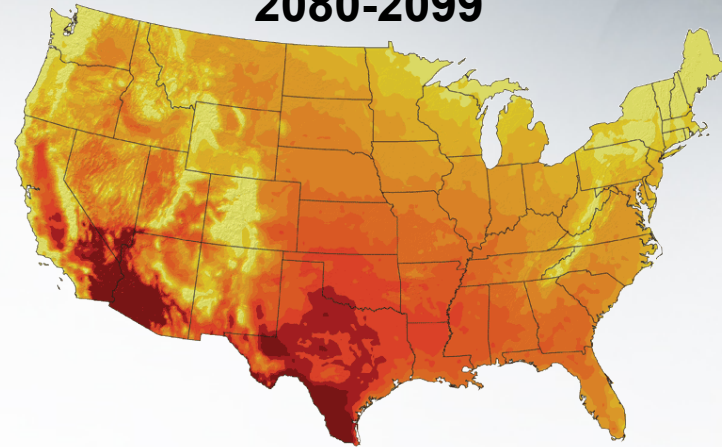


Number of Days Over 100°F

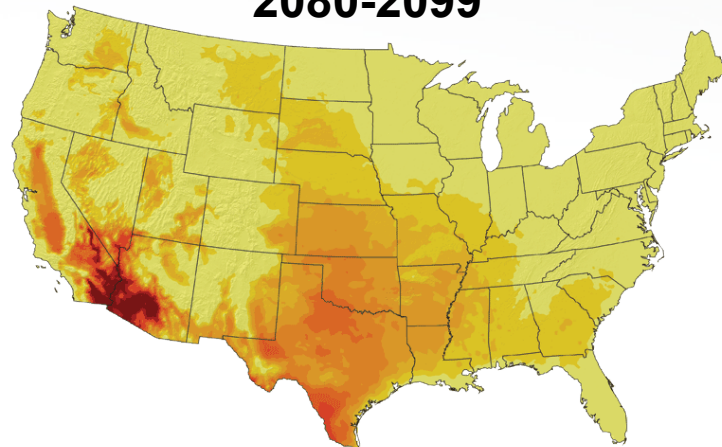
Recent Past, 1961-1979



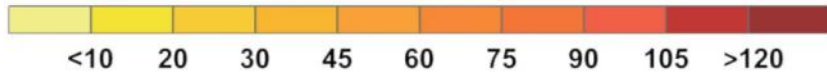
Higher Emissions Scenario
2080-2099



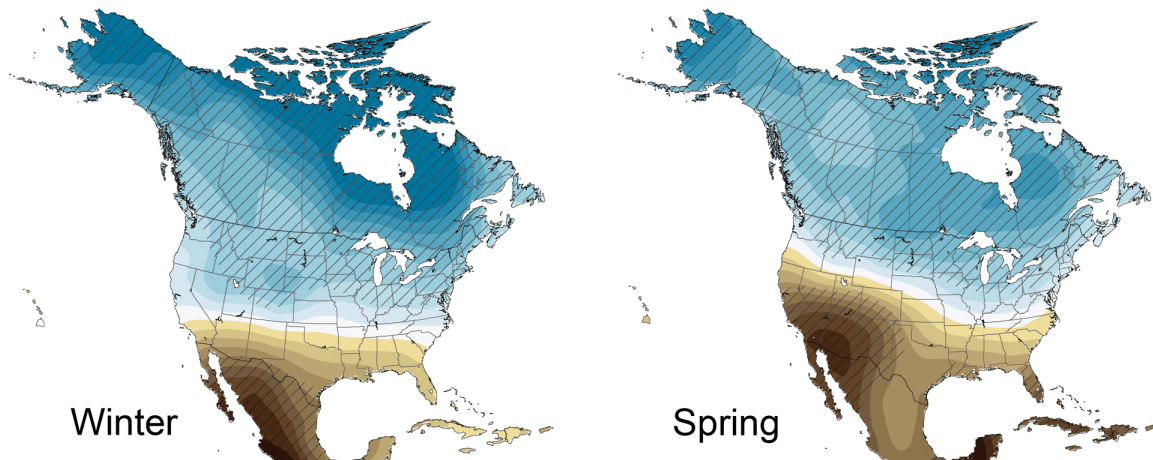
Lower Emissions Scenario,
2080-2099



Number of Days



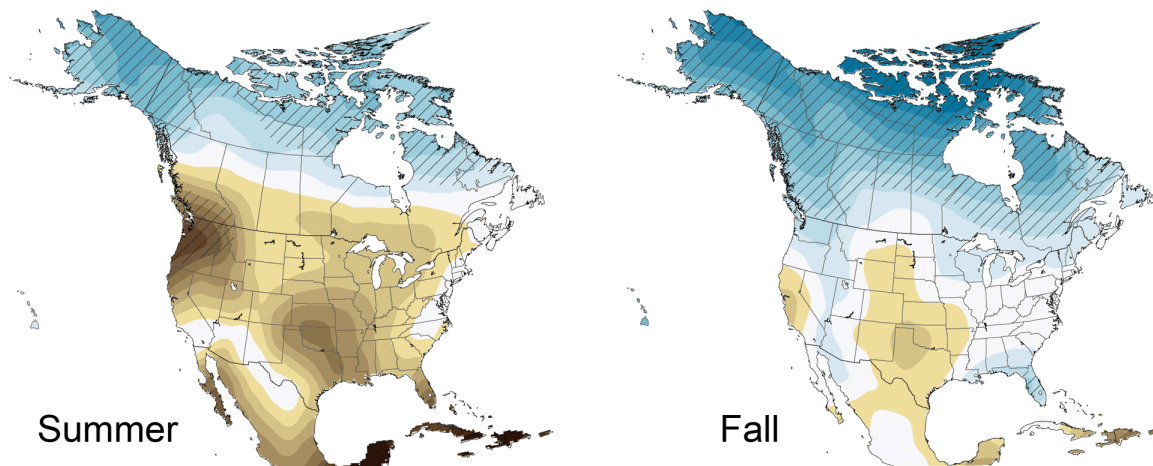
Projected Changes in Precipitation



Winter

Spring

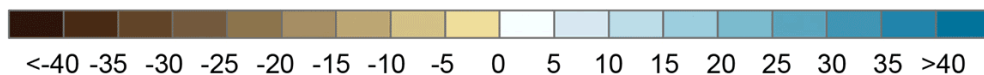
by 2080-90s



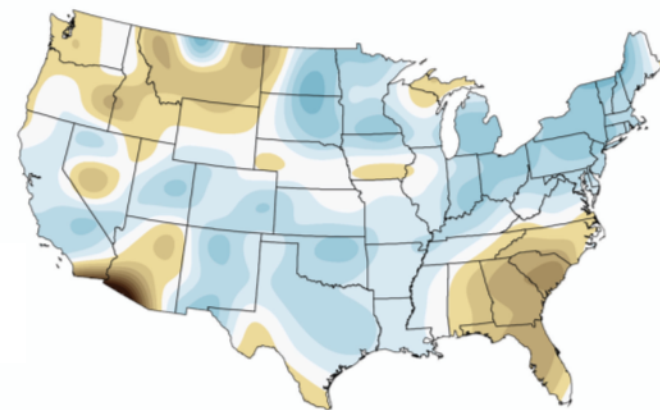
Summer

Fall

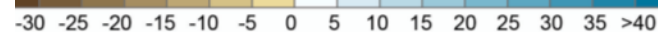
Percent Change



**Observed annual change
1950-2008**



Percent Change



www.globalchange.gov/



Key Motivations for Action



- ✿ The faster that emissions are reduced, the lower the risks, and the less pressure to make steeper and potentially more expensive reductions later.
- ✿ Current energy infrastructure investments could lock in emissions for decades to come. Enacting relevant policies now will provide crucial guidance for investment decisions today.
- ✿ Policy changes can potentially be reversed or scaled back if needed.
- ✿ But adverse changes in the climate system may be difficult or impossible to “undo”.



More Take-home Messages



- (iii) We will always be facing uncertainties about climate risks, but uncertainty is not a reason for inaction; to the contrary, it can be an important reason *for* action.

- (iv) It argues for using iterative risk management, which emphasizes taking action to reduce risk while continuously incorporating new information and adjusting efforts accordingly.

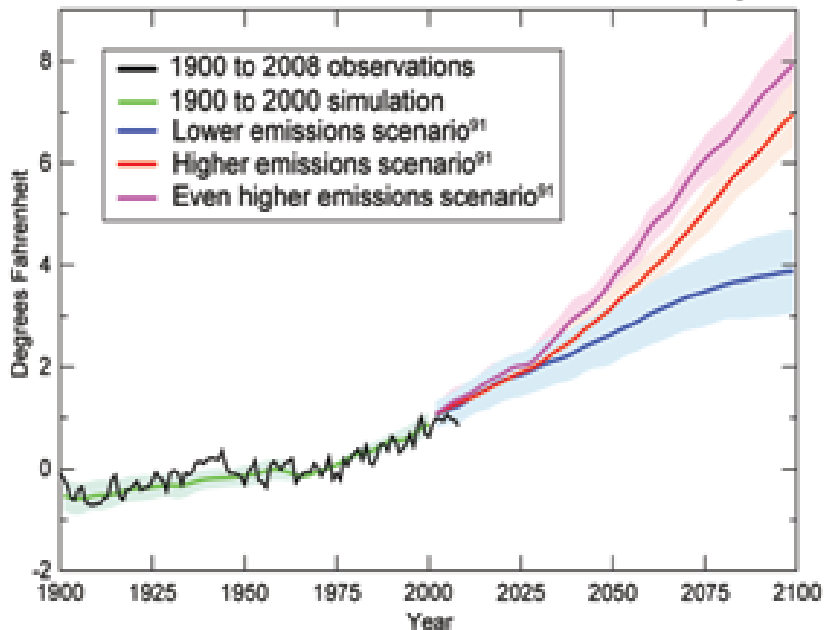


Key Sources of Uncertainty

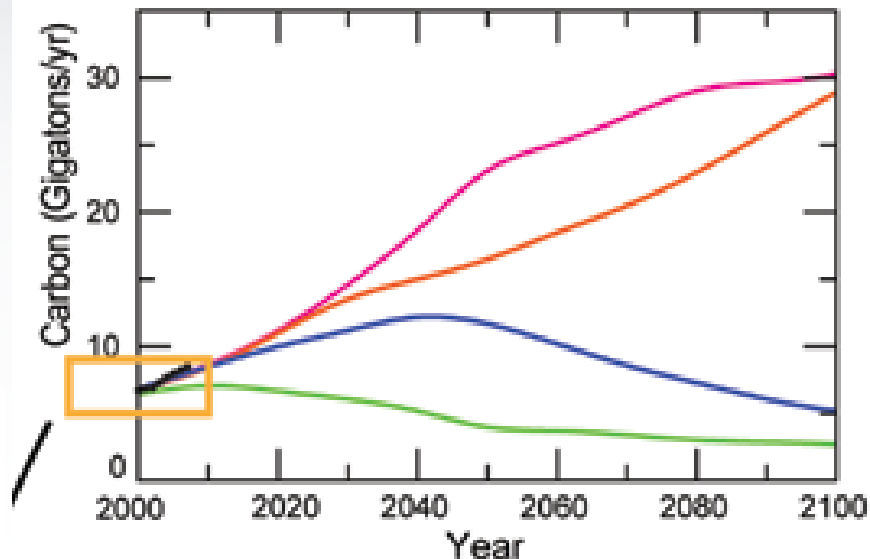


Projecting Future Greenhouse Emissions

Global mean temperature change



Carbon from Fossil Fuel CO₂ Emissions



Sensitivity of Climate System to Greenhouse Gases



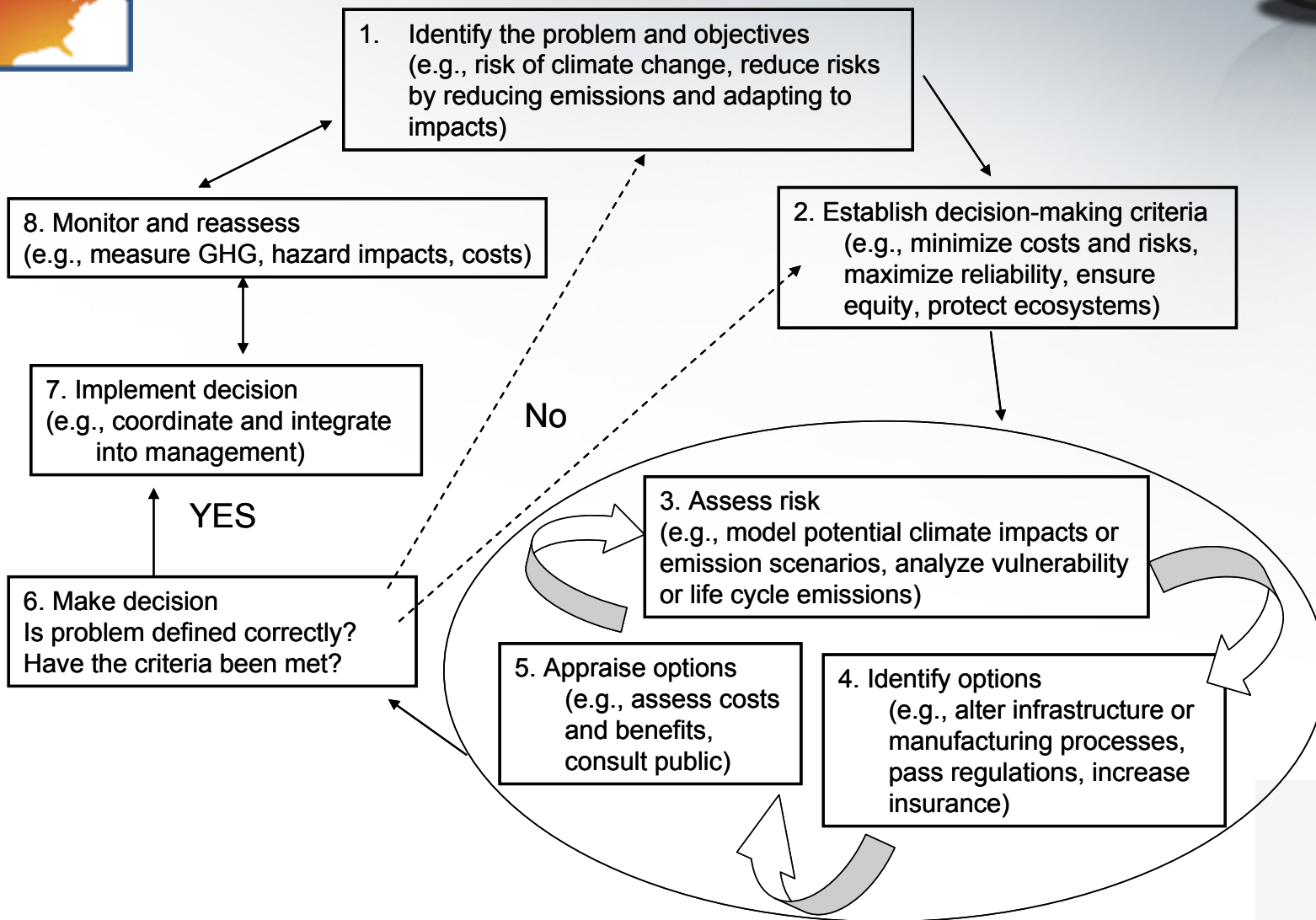
Why Climate Change is a Difficult Challenge



- ✿ complex linkages among emissions, climate changes, impacts
- ✿ time lags in the climate system and in human responses
- ✿ risks, vulnerabilities, and values vary widely
- ✿ relevant decisions are made at all levels of society
- ✿ limiting climate change requires global-scale efforts
- ✿ climate change is one of multiple interconnected challenges
- ✿ costs / benefits are hard to quantify
- ✿ many factors impede public understanding



Iterative Risk Management





Another Take-home Message



(iv) Current climate change response efforts (of local and state governments, NGOs, private sector) are significant but not likely to yield progress comparable to what could be achieved with strong national policies and leadership.



Diverse Portfolio of Actions Required



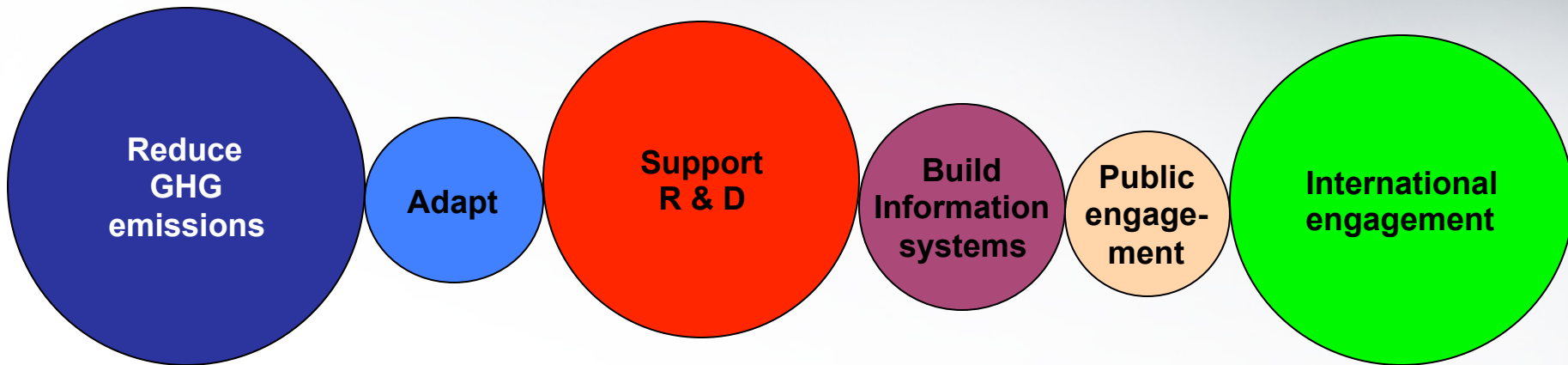
1. Substantially reduce greenhouse gas emissions (ideally, through a national carbon pricing system and strategic complementary policies)
2. Begin mobilizing for adaptation at all levels
3. Invest in research and development, both to advance basic understanding and to improve/expand response options
4. Develop effective systems to inform and evaluate climate choices
5. Link scientific analysis with public deliberation
6. Actively engage in international response efforts
7. Coordinate the many components of the nation's response efforts



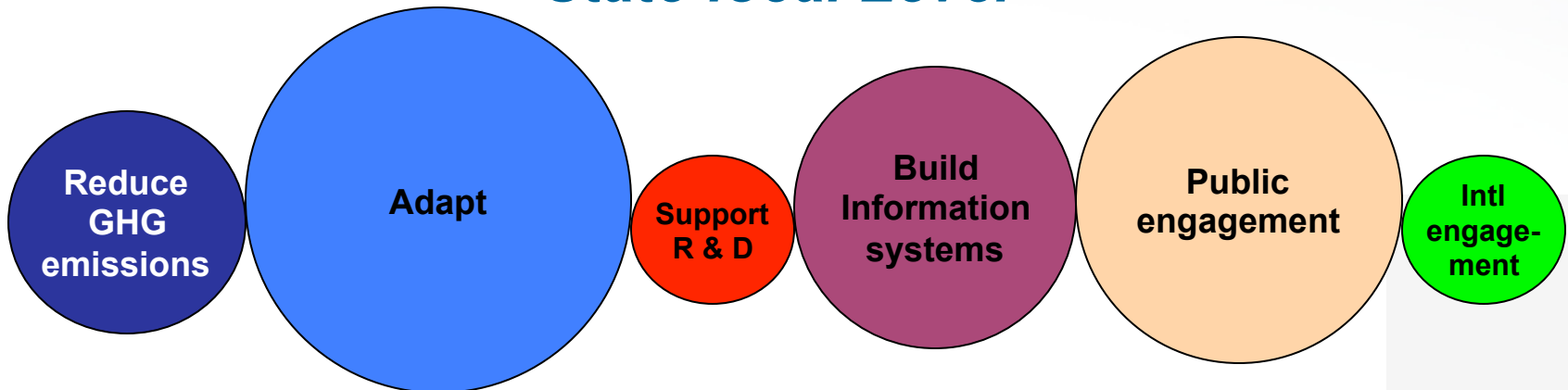
Emphasis Depends on Level



Federal Level



State-local Level

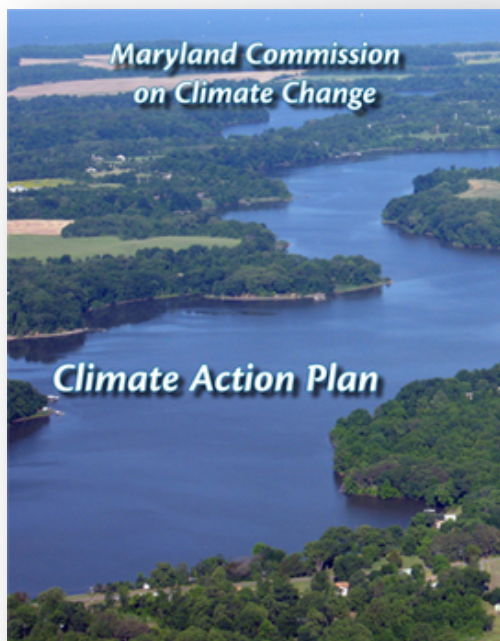


Commission on Climate Change

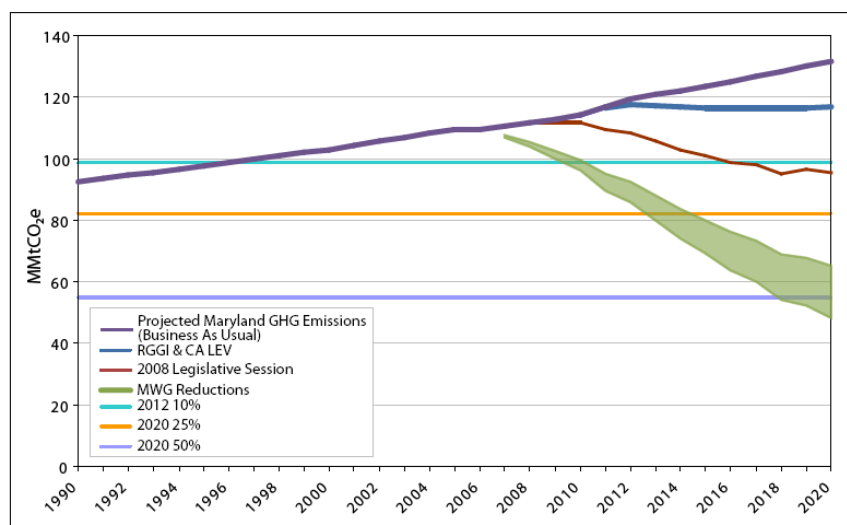


- ❁ Comprehensive Climate Change Impact Assessment
- ❁ Comprehensive Greenhouse Gas and Carbon Footprint Reduction Strategy
- ❁ Comprehensive Strategy for Reducing Maryland's Climate Change Vulnerability

Maryland's Climate Action Plan



- ✦ State goals for reducing GHG emissions
- ✦ 42 policy options for achieving goals binned by effectiveness and feasibility
- ✦ Steps toward adaptation (integrated planning, vulnerable infrastructure, building codes, insurance, etc.)
- ✦ Greenhouse Gas Reduction Act of 2009 (25% reduction by 2020)



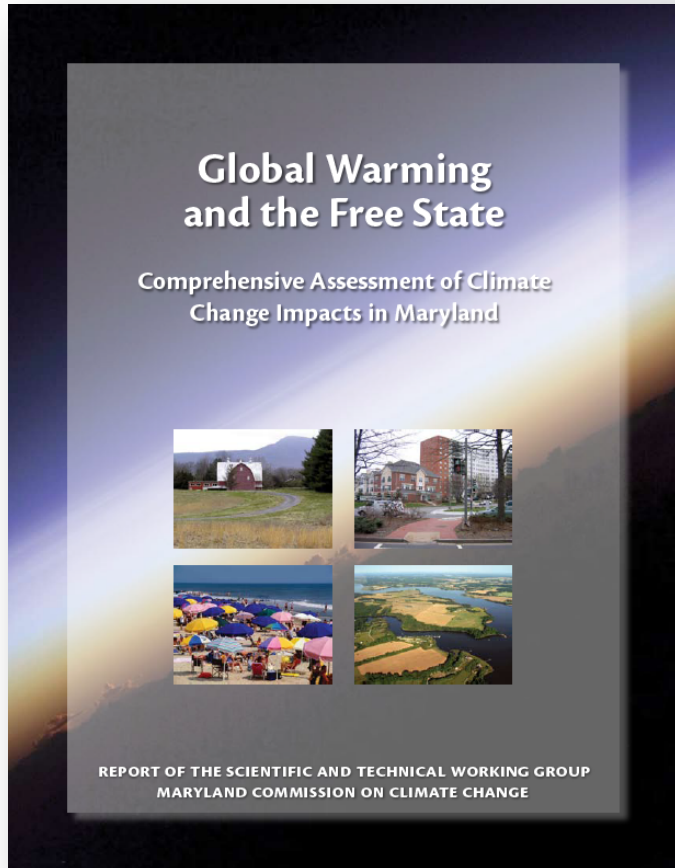
Climate Change Impacts in Maryland



- ❁ Scientific and Technical Working Group of Maryland Commission on Climate Change
- ❁ Considered likely impacts under higher and lower emissions scenarios
- ❁ Used best global models to project temperature, precipitation, sea level
- ❁ Assessed water resources, agriculture, forests, the Bay, human health, etc.



Global Warming and the Free State



- ✿ Global warming **is already here**.
- ✿ Maryland's climate will be much warmer later in the century.
- ✿ Precipitation will very **likely increase during the winter and spring** but hotter temperatures are likely to create **drier conditions during the summer**.
- ✿ Sea level is likely to rise at least **twice as fast** as it did during the 20th century.
- ✿ Chesapeake Bay restoration will be made **more challenging** by climate change.
- ✿ Substantially reducing greenhouse gas emissions **is required to avoid** the most severe impacts in Maryland.
www.umces.edu/climateimpacts/

Sector Based Adaptation



Affected Sectors	Climate Stressor	Climate Vulnerability	Adaptation Strategies
Water Resources	<ul style="list-style-type: none"> • Changes in precip. • Extreme events 	<ul style="list-style-type: none"> • Decreased water supply • Increased flooding 	<ul style="list-style-type: none"> • Create water markets • Improve flood control
Bay/Aquatic Ecosystems	<ul style="list-style-type: none"> • Sea level rise • Increased water temp 	<ul style="list-style-type: none"> • Increased salinity • Habitat loss 	<ul style="list-style-type: none"> • Install “living shorelines” • Protect critical habitat
Human Health	<ul style="list-style-type: none"> • Increased air temp. • Extreme events 	<ul style="list-style-type: none"> • Vector-borne illness • Heat-related health effects 	<ul style="list-style-type: none"> • Designate “cooling centers” • Vector-borne surveillance
Agriculture	<ul style="list-style-type: none"> • Changes in precip. • Sea level rise 	<ul style="list-style-type: none"> • Drought • Salt-water intrusion 	<ul style="list-style-type: none"> • Plant salt tolerant crops • Drought management
Forest/Terrestrial Ecosystems	<ul style="list-style-type: none"> • Changes in precip. • Increased air temp. 	<ul style="list-style-type: none"> • Disease, Fire • Species shifts 	<ul style="list-style-type: none"> • Fire mgmt. and control • Invasive species mgmt
Growth & Infrastructure	<ul style="list-style-type: none"> • Changes in precip. • Sea level rise 	<ul style="list-style-type: none"> • Increased population growth • Increased flooding 	<ul style="list-style-type: none"> • “Smart” site and building design • Retrofit storm water mgmt.
Coastal Zone	<ul style="list-style-type: none"> • Sea level rise • Extreme events 	<ul style="list-style-type: none"> • Submergence of low-lying lands • Increased coastal flooding 	<ul style="list-style-type: none"> • Protect coastal infrastructure • Increase natural vegetative buffers

Scientific Assessment

Adaptation: Phase I

Adaptation: Phase II



**Maryland and Delaware Climate Change
Education Assessment and Research**

- ☀ K-12 Education (must be integrated with NCLB, STEM, RTTT)
- ☀ Higher Education (sustainability literacy, pipeline)
- ☀ Informal Education (museums, aquaria, outdoor centers, media)

Questions?



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✿ www.umces.edu/people/president