America’s Climate Choices, Maryland’s Climate Choices

Department of Atmospheric and Oceanic Science
University of Maryland, College Park

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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
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
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 (CACC), 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

www.globalchange.gov/
Projected Changes in Precipitation

by 2080-90s

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”.

America’s Climate Choices
(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

- Global mean temperature change
- Projecting Future Greenhouse 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

1. Identify the problem and objectives (e.g., risk of climate change, reduce risks by reducing emissions and adapting to impacts)

2. Establish decision-making criteria (e.g., minimize costs and risks, maximize reliability, ensure equity, protect ecosystems)

3. Assess risk (e.g., model potential climate impacts or emission scenarios, analyze vulnerability or life cycle emissions)

4. Identify options (e.g., alter infrastructure or manufacturing processes, pass regulations, increase insurance)

5. Appraise options (e.g., assess costs and benefits, consult public)

6. Make decision
    - Is problem defined correctly?
    - Have the criteria been met?

7. Implement decision (e.g., coordinate and integrate into management)

8. Monitor and reassess (e.g., measure GHG, hazard impacts, costs)
(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**
- Reduce GHG emissions
- Adapt
- Support R & D
- Build Information systems
- Public engagement
- International engagement

**State-local Level**
- Reduce GHG emissions
- Adapt
- Support R & D
- Build Information systems
- Public engagement
- Intl engagement
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

www.mde.state.md.us/air/climatechange/
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.)

www.mde.state.md.us/air/climatechange/
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

<table>
<thead>
<tr>
<th>Affected Sectors</th>
<th>Climate Stressor</th>
<th>Climate Vulnerability</th>
<th>Adaptation Strategies</th>
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<tbody>
<tr>
<td>Water Resources</td>
<td>Changes in precip.</td>
<td>Decreased water supply</td>
<td>Create water markets</td>
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<td></td>
<td>• Extreme events</td>
<td>• Increased flooding</td>
<td>Improve flood control</td>
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<tr>
<td>Bay/Aquatic Ecosystems</td>
<td>Sea level rise</td>
<td>Increased salinity</td>
<td>Install “living shorelines”</td>
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<td></td>
<td>• Increased water temp</td>
<td>• Habitat loss</td>
<td>Protect critical habitat</td>
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<tr>
<td>Human Health</td>
<td>Increased air temp.</td>
<td>Vector-borne illness</td>
<td>Designate “cooling centers”</td>
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<tr>
<td></td>
<td>• Extreme events</td>
<td>• Heat-related health effects</td>
<td>Vector-borne surveillance</td>
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<tr>
<td>Agriculture</td>
<td>Changes in precip.</td>
<td>Drought</td>
<td>Plant salt tolerant crops</td>
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<td>• Sea level rise</td>
<td>• Salt-water intrusion</td>
<td>Drought management</td>
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<tr>
<td>Forest/Terrestrial Ecosystems</td>
<td>Changes in precip.</td>
<td>Disease, Fire</td>
<td>Fire mgmt. and control</td>
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<td></td>
<td>• Increased air temp.</td>
<td>• Species shifts</td>
<td>Invasive species mgmt</td>
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<tr>
<td>Growth &amp; Infrastructure</td>
<td>Changes in precip.</td>
<td>Increased population growth</td>
<td>“Smart” site and building design</td>
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<tr>
<td></td>
<td>• Sea level rise</td>
<td>• Increased flooding</td>
<td>Retrofit storm water mgmt.</td>
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<tr>
<td>Coastal Zone</td>
<td>Sea level rise</td>
<td>Submergence of low-lying lands</td>
<td>Protect coastal infrastructure</td>
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<td></td>
<td>• Extreme events</td>
<td>• Increased coastal flooding</td>
<td>Increase natural vegetative buffers</td>
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### Scientific Assessment

- Adaptation: Phase I
- Adaptation: Phase II
Climate Change Education

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

www.madeclear.org/
Questions?

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www.umces.edu/people/president