

P R O C E E D I N G S



Coping with Climate Change

N A T I O N A L S U M M I T

M UNIVERSITY OF MICHIGAN

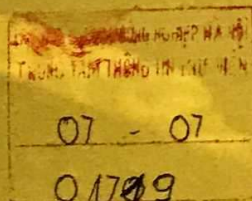
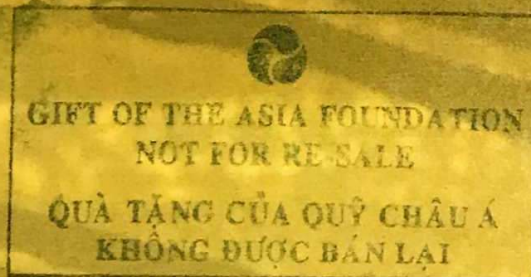
May 8–10, 2007
Ann Arbor, MI

P R O C E E D I N G S



Coping with Climate Change

N A T I O N A L S U M M I T



EDITED BY

Rosina M. Bierbaum
Daniel G. Brown
Jan L. McAlpine

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

**School of Natural Resources
and Environment**
Dana Building
440 Church Street
Ann Arbor, MI 48109-1041

© 2008 by The Regents of the University of Michigan

ISBN 13: 978-1-159726-556-0
ISBN 10: 159726556-X

Design & Layout
Linda A. Alvira
Michigan Marketing & Design

Project Managers
Sarah H. Kennedy
Michigan Marketing & Design

Kevin Merrill
School of Natural Resources and Environment

Copy Editor
Joel Seguire

Logo Design
Q Ltd., Ann Arbor, Michigan
and San Francisco, California

Cover Photo
Alfred Gescheidt/Getty Images

Photographs
U-M Photo Services

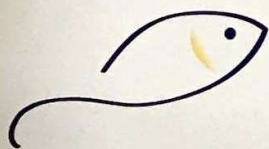
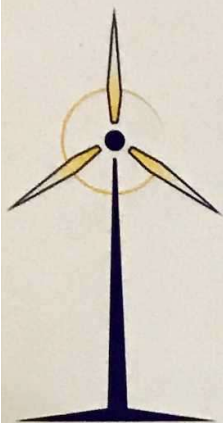
MM&D 080023



This publication was printed with vegetable-based inks on 100% post-consumer waste paper stock, and is certified to Forest Stewardship Council (FSC) standards.

The cover and logo for the *Coping with Climate Change: National Summit Proceedings* was designed from a 1967 photograph of ice skaters in Central Park, New York City, by Alfred Gescheidt, which was obtained from Getty Images. The cool to warm colors in the logo represent the temperature trends associated with climate change. In the photograph, the sun is shining and the skaters' shadows cast the observer both toward the past and the future of the planet. The ice is a metaphor for vulnerability to heat and cold and the uncertainty of how humans will "keep skating" when the ice melts. Since this photograph was taken, there have been observable changes in climate and the world has finally taken note.

CONTENTS



EXECUTIVE SUMMARY

Rosina M. Bierbaum.....	2
-------------------------	---

OPENING PLENARY

Provost's Opening Remarks	
Teresa Sullivan.....	28
Dean's Introductory Remarks	
Rosina M. Bierbaum.....	29
Introduction	
Howard Frumkin.....	32
Climate Update	
Thomas R. Karl.....	36
Adaptation and the Energy Sector	
Susan F. Tierney.....	44
Climate Change and Human Health: Issues and Priorities for Adaptive Strategies and for Public Health Functions	
Anthony (AJ) McMichael.....	54
Opportunities to Anticipate and Adapt to the Effects of Climate Change on Water Quality	
Joel D. Scheraga.....	62
Coping with Climate Change? A Look at Marine Fisheries	
Edward L. Miles.....	75

INTERIM PLENARY

Sector Breakout Reports: Introduction and Discussion	
Rosina M. Bierbaum and Jan L. McAlpine	
Gary Was-Energy	
Randall Freed-Water Quality	
Daniel Hayes-Fisheries	
Howard Hu and Kristie Ebi-Public Health.....	84
Making Climate Change Research Matter: Balance and Scale	
Thomas Dietz.....	100
Governments, Responsibilities, Barriers, and Actors in Adaptation Action for Climate Change	
W. Neil Adger.....	108
Adaptation Strategies: Climate and Insurance	
Franklin W. Nutter.....	117

Sector Syntheses

Energy Sector.....	124
Water Quality Sector.....	132
Fisheries Sector.....	141
Public Health Sector.....	153

Scenario Summaries

1. Coastal Community Rapidly Losing Shoreline	164
2. Drought in the Southwest	167
3. Failure of the Power Grid	170
4. Rapidly Declining Snowpack in the Northwest	174
5. Great Lakes Levels Fall	177



CLOSING PLENARY

Overview of Closing Plenary

Rosina M. Bierbaum	182
--------------------------	-----

Adapting in Ann Arbor

John Hieftje	183
--------------------	-----

Closing Panel

Responding to Climate Change: A Few Thoughts on Moving Ahead

Peter Backlund	190
----------------------	-----

Adapting to a Changing Health Burden

Kristie Ebi	194
-------------------	-----

Tipping Points, Adaptation, and the Need for Leadership

Anthony Janetos	197
-----------------------	-----

Elements of a National Adaptation Strategy

Peter Schultz	200
---------------------	-----

A World We Have Not Known Before

Robert Corell	205
---------------------	-----

Closing Remarks

Rosina M. Bierbaum	210
--------------------------	-----

SPEAKER BIOGRAPHIES	212
----------------------------------	-----

PARTICIPANT BIOGRAPHIES	216
--------------------------------------	-----

APPENDIX

Summit Program

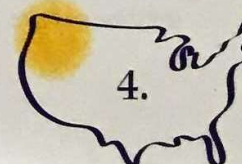
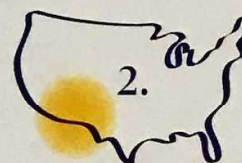
Welcome and Purpose

Rosina M. Bierbaum	236
--------------------------	-----

Schedule of Events	238
---------------------------------	-----

List of Selected Organizational and Scientific Acronyms	242
--	-----

CD Index	244
-----------------------	-----



THIS PUBLICATION IS ACCOMPANIED BY A CD THAT INCLUDES THE MAJORITY OF POWERPOINT SLIDES PRESENTED DURING THE SUMMIT.

MANY OF THE PAPERS INCLUDED IN THIS VOLUME ARE ALSO AVAILABLE AT: WWW.SNRE.UMICH.EDU/CLIMATE_CHANGE.

EXECUTIVE SUMMARY



Rosina M. Bierbaum

Dean and Professor, School of Natural Resources and Environment,
University of Michigan

This past year, the focus on the climate change issue has finally shifted from the question "Is it changing?" to the important questions of "So what?" and "Can society manage the unavoidable changes?"

The release of the Intergovernmental Panel on Climate Change reports (IPCC),¹ the awarding of the Nobel Peace Prize for both climate science and climate communication efforts,² and the adoption of the "Bali Roadmap" at the 13th Conference of Parties Meeting in Indonesia³ underscored the recognition that humans are changing the climate rapidly and that the world must act collectively to dampen the unsustainable trajectory of greenhouse gas emissions.

"Adaptation" is no longer a forbidden word. For too long, talking about adaptation or "coping with climate change" implied that no serious mitigation or emissions reductions were being contemplated. However, the accumulation of scientific evidence in the last few years makes it abundantly clear that climate changes are underway, impacts are already being felt, and humanity faces more changes in the future. Thus, we need to respond to ongoing changes now and prepare for those yet to come. Both mitigation and adaptation are needed. A sensible strategy to minimize the damages from anthropogenic climate change must work in parallel to both mitigate the pace and ultimate magnitude of the changes that occur and to adapt to the changes that cannot be avoided.

A "mitigation only" strategy won't work because it's already too late to avoid substantial climate change. An "adaptation only" strategy won't work either because most adaptation measures become more costly and less effective as the magnitude of the changes to which we are trying to adapt gets larger.

The study of adaptation is nascent compared to the many analyses of costs and technologies to reduce emissions. In order to begin a national conversation on adaptation, we convened a National Summit on Coping with Climate Change at the University of Michigan on May 8–10, 2007. Two hundred participants representing industry, academia, environmental groups, and policy makers from city, state, regional, national, and international levels met and discussed the problems climate change would pose. In addition, we discussed options to enhance resilience and the robustness of our social and ecological systems to withstand the current and future changes. This will require fundamental changes in planning, management, institutional arrangements, technologies, and research and development strategies. The Summit focused principally on the United States, but international examples were used to illustrate key points. Figure 2 outlines the summit process (see page 6).

Some conclusions of the discussions include:

1. **Past is not prologue:** Infrastructure and natural resource management and planning based on the last 100 years of climate will be wrong. The design features of infrastructure and tolerances of species will be exceeded as climate change proceeds. Society needs to prepare for the climate of the future, not that of the past.
2. **Degrees of warming matter:** Both the rate and magnitude of climate change pose problems for ecological and social systems. Aggressive mitigation can lessen the impacts of climate change and increase the time to develop solutions.
3. **"Average" change may not be most important:** There will also be changes in extreme events such as droughts, floods, maximum temperatures, and hurricane intensities, which can result in tremendous human suffering and economic loss. Society is ill-prepared to cope with an increase in frequency of these costly events.

***Society is ill-prepared
to cope with an increase
in extreme events.***

4. **A portfolio approach is needed:** Both mitigation and adaptation measures need to be developed and implemented in concert. There are inter-relationships between options that can reduce emissions and those that enhance adaptive capacity.

5. **Adaptive management will be required:** "Best practices" to cope with climate change may need to be refined and evaluated regularly since the detailed impacts superimposed on other environmental stresses are not yet fully understood. Different regions may have different needs.

6. **Investment is not commensurate with the urgency of the problem:** The research, development, demonstration, and deployment funding for both mitigation and adaptation research is inadequate. More integrative science assessments should be conducted with a focus on understanding regional impacts and multiple stresses, resulting in a strategic prioritization of research needed by policy makers.

Global climate has already changed noticeably, with more than half of the increase in temperature from pre-industrial levels occurring since 1970.

CURRENT STATE OF UNDERSTANDING ABOUT CLIMATE CHANGE

Human activities have changed the climate of the Earth, with significant impacts on ecosystems and human society, and the pace of change is increasing. The global-average surface temperature is now about 0.8°C above its level in 1750, with most of the increase having occurred in the twentieth century and the most rapid rise occurring since 1970. Temperature changes over the continents have been greater than the global average and the changes over the continents at high latitudes have been greater still. The pattern of the observed changes matches closely what climate science predicts from the buildup in the atmospheric concentrations of carbon dioxide (CO₂), methane (CH₄), and other greenhouse gases (GHGs), taking into account other known influences on the temperature. The largest change of all of the human and natural influences on climate over the past 250 years has been the



Figure 1. Participants gather for Dean Bierbaum's remarks during the Opening Plenary, May 8, 2007.