Forecasting Environmental Changes

5th National Conference on Science, Policy and the Environment
February 3-4, 2005

Agenda

Ronald Reagan Building and International Trade Center
1300 Pennsylvania Avenue, NW, Washington, DC

Thursday, February 3, 2005

8:00 am **Registration & Continental Breakfast**
Amphitheater Foyer

9:00 am **Welcome**
Amphitheater
Craig Schiffries, Conference Chair, National Council for Science and the Environment
Amb. Richard Benedick, President, National Council for Science and the Environment

9:15 am-10:00 am **Keynote Address**
Amphitheater
James Gustave Speth, Dean, Yale School of Forestry & Environmental Studies; Former Chair, White House Council on Environmental Quality; Recipient, Blue Planet Prize

10:00 am-11:00 am **Plenary Roundtable –Lessons Learned from Successful Environmental Forecasting Approaches**
Amphitheater
Moderator:
Mohamed El-Ashry, Former President and CEO, Global Environment Facility
Speakers:
D. James Baker, President and CEO, Academy of Natural Sciences; Former Administrator, NOAA
Charles Kennel, Director, Scripps Institution of Oceanography; Former Associate Administrator, Mission to Planet Earth, NASA
Charles Groat, Director, U.S. Geological Survey
Margaret Leinen, Assistant Director, Geosciences, National Science Foundation

11:00 am-12:15 pm **Plenary Roundtable - Designing Ecological Forecasting Systems**
Amphitheater
Moderator:
Ronald Pulliam, Regents Professor, University of Georgia; Former Director, National Biological Survey; Former President, Ecological Society of America
Speakers:
Ann Bartuska, Deputy Chief for Research and Development, U.S. Forest Service; Former President, Ecological Society of America
Gary Foley, Director, National Exposure Laboratory, U.S. EPA
Bruce Hayden, Professor, University of Virginia; Lead Investigator, National Ecological Observatory Network (NEON) Design Consortium
Thomas Lovejoy, President, The H. John Heinz III Center for Science, Economics, and the Environment; Former President, American Institute of Biological Sciences
Steven Stanley, Professor of Paleobiology, Johns Hopkins University; Former President, American Geological Institute

12:15 pm-1:30 pm **Lunch** (on your own)

1:30 pm-
5:00 pm

Breakout Sessions – 19 concurrent sessions

Meeting Rooms	Sessions on Linking Systems and Users
Hemisphere B	1. Connecting Forecasts with Policymakers
Meridian B	2. Improving the Usefulness of Environmental Information for Personal Decisionmaking: EPA's Public Report on the Environment, the Earth Portal, and More
Oceanic A	3. Sharing Forecasting Information with Users
Horizon A	4. Improving Academic Programs to Prepare the Next Generation of Forecasters
Classroom C/D	5. Providing Real Time Forecasts – How to Assess and Meet User Needs
	Sessions on Connecting Institutions
Polaris B	6. Integrating U.S. Efforts with International Initiatives
Continental B	7. Linking Levels of Government: Federal-State-Local
Amphitheater Stage	8. Cross-Sectoral Connections: Engaging the Private Sector as a Partner with the Government
Meridian C	Sessions on Scientific and Technological Connections
	9. Linking Ocean, Atmospheric and Terrestrial Observation and Forecasting Systems
Hemisphere A	
Horizon B	10. Integrating Economic, Social and Environmental Forecasting
Polaris A	11. Working Across Spatial Scales – From Molecular to Global
Polaris C	12. Forecasting Environmental Change of the Landscape at a Regional Scale
	13. Working Across Temporal Scales – Integrating Short-term and Long-term Approaches
Continental C	
	14. Facilitating the Development of Environmental Sensors and Sensor Networks
Oceanic B	
	15. Fusion and Integration of Satellite Remote-Sensing and Ground-Based Observations and Presentation for Environmental Policy
Continental A	
	16. Examining the Role of Eco-Informatics in Environmental Decisionmaking
Meridian D	17. Cyberinfrastructure for All: Connectivity, Content, and Collaboration
Meridian E	18. Linking Environmental Indicators with Forecasting
Classroom A/B	19. Moving From Observation to Forecasting Systems: Linking Characterization, Process Research, Modeling, Prediction and Delivery

5:30 pm **Reception and Poster Session**
Atrium

7:00 pm **5th John H. Chafee Memorial Lecture on Science and the Environment**
Amphitheater

Opening Remarks
Stephen Hubbell, Chairman, National Council for Science and the Environment

Introduction
Jeffrey Leonard, President and CEO, Global Environment Fund

Choosing Our Common Future: Democracy's True Test
William D. Ruckelshaus, First and Fifth Administrator, U.S. Environmental Protection Agency; Chairman Emeritus, World Resources Institute; Chairman, Meridian Institute

Friday, February 4, 2005

8:00 am **Continental Breakfast**
Amphitheater Foyer

9:00 am-10:00 am **Plenary Address**
Amphitheater
Introduction
Randy Johnson, Chair, Board of Commissioners, Hennepin County, Minnesota
Plenary Lecture
Jack Dangermond, Founder and President, ESRI

10:00 am-noon **Concurrent Symposia** – 4 concurrent sessions

Creating a Global Earth Observation System of Systems (GEOSS): Benefits for Environmental Forecasting
Amphitheater
Charles Groat, Chair, Director U.S. Geological Survey; U.S. GEO Alternate Representative
Roberta Balstad, President, Center for International Earth Science Information Network
Rosalind Helz, Associate Program Coordinator, Volcano Hazard Program, USGS
K. Bruce Jones, Senior Scientist, U.S. EPA
Greg Withee, Assistant Administrator for Satellite and Information Services, NOAA; Co-Chair of the Interagency Working Group on Earth Observations

Creating a National Ecological Observatory Network (NEON): Developing the Capacity for Ecological Forecasting
Horizon Ballroom
Bruce Hayden, Chair, University of Virginia, Co-Director NEON Project Office
Jeff Goldman, NEON Project Manager
Pauline Luther, Education Director, Environmental Distance Learning
William Michener, Co-Director, NEON Project Office
Ron Pulliam, University of Georgia

Environmental Change: An Interactive Discussion About the Future
Polaris Suite
Michael Brody, Co-Chair, Office of the Chief Financial Officer, U.S. EPA
Robert Olson, Co-Chair, Institute of Alternative Futures
Skip Laitner, Office of Air and Radiation, US Environmental Protection Agency
David Rejeski, Foresight and Governance Program, Woodrow Wilson International Center for Scholars
Terry Welch, Director, Environmental Technology Center, Dow Chemical

Engaging Users in Environmental Forecasting
Hemisphere Suite A
Nathalie Valette-Silver, Chair, NOAA National Ocean Service, Coordinator, the National Centers for Coastal Ocean Science Ecological Forecasting Activities
Otto Doering, Purdue University; on sabbatical at USDA Natural Resources Conservation Service
Ann Fisher, Department of Agricultural Economics & Rural Sociology, Pennsylvania State University
Gregory Hernandez, NOAA Public Affairs, previously a journalist with NBC News
Robert Lempert, Senior Physical Scientist, RAND Pardee Center
Gary C. Matlock, NOAA, Director of the National Centers for Coastal Ocean Science

Noon-
1:30 pm **Buffet Lunch**
Atrium

1:30 pm-
2:00 pm **Plenary Address**
Amphitheater
Introduction
James C. Renick, Chancellor, North Carolina A&T State University
Plenary Lecture
Arden Bement Jr., Director, National Science Foundation

2:00 pm-
2:15 pm **Signing Ceremony**
Amphitheater
NOAA – USGS Joint Memorandum of Understanding
Charles Groat, Director, U.S. Geological Survey
Adm. Conrad Lautenbacher, Administrator, NOAA

2:15 pm-
3:30 pm **Plenary Roundtable - Applying Environmental Forecasting to Environmental Decisionmaking**
Amphitheater
Moderator:
Dave Jones, President and CEO, StormCenter Communications, Inc.
Speakers:
Ray Anderson, Founder and Chairman, Interface, Inc.; Former Co-chair, President's Council on Sustainable Development
Rita Colwell, Distinguished University Professor, University of Maryland and the Johns Hopkins University Bloomberg School of Public Health; Chairman; Canon U.S. Live Sciences, Inc.; Director Emeritus, National Science Foundation
Adm. Conrad Lautenbacher, Administrator, NOAA
Walter Reid, Director, Millennium Ecosystem Assessment

3:30 pm **Adjourn**

Breakout Sessions – Thursday, February 3, from 1:30 pm – 5:00 pm

Sessions on Linking Systems and Users

1. **Connecting Forecasts with Policymakers**
   Room: Hemisphere B

   Session Chair: ***Robert Lempert***, Senior Scientist, RAND Frederick S. Pardee Center for Longer Range Global Policy and the Future Human Condition
   Discussants: ***Mark Schaefer***, President and CEO, NatureServe; ***Nancy J. Wheatley***, Water Resources Strategies

   Environmental forecasts can help policymakers and the public understand the implications of current trends and the potential implications of alternative policy choices. But the information needs of different policymakers often vary widely. How can scientists provide forecasts that policymakers find useful, timely, and credible? How can information from forecasts best be incorporated into environmental law and policy? How best to characterize the uncertainty inherent in many forecasts? How can decision support systems and other tools be used and configured to more effectively provide information to policymakers?

2. **Improving the Usefulness of Environmental Information for Personal Decisionmaking: EPA's Public Report on the Environment, the *Earth Portal*, and More**
   Room: Meridian B

   Session Chair and Discussant: ***Jim Lester***, Environment Group Director, Houston Advanced Research Center and Chair of NCSE Earth Portal Stewardship committee
   Discussants: ***Bruce Stein***, Vice President for Programs, NatureServe; *Representative*, Office of Environmental Information, U.S. Environmental Protection Agency

   This session will explore why the public seeks information on the condition and trends of the environment as well as the topics and formats they find useful. The session will develop recommendations that EPA, the *Earth Portal* and other information providers can use to better communicate environmental information to the public.

3. **Sharing Forecasting Information with Users**
   Room: Oceanic A

   Session Chair: ***Elaine Hoagland***, National Council for Science and the Environment
   Discussants: ***Kevin Coyle***, President, National Environment Education and Training Foundation; ***Dave Jones***, President and CEO, StormCenter Communications, Inc.; ***Leigh Welling***, Director, Crown of the Continent Research Learning Center, Glacier National Park

   This session will develop recommendations for developing an environmental forecasting network that can help the general public assess their needs, discover information, and use it to address environmental risks and change. We need a society in which people think ahead and know what issues to watch out for. How can both long- and short-term forecasts contribute to public understanding and action? What are the needs for public understanding of environmental change and forecasting in the view of scientists and educators, and does this match actual public perceptions? How can we help the public develop a sense of what they need to know about environmental change?

4. **Improving Academic Programs to Prepare the Next Generation of Forecasters**
   Room: Horizon A

   Session Chair: ***Will Focht***, Director, Environmental Institute, Oklahoma State University; Co-Chair, Council of Environmental Deans and Directors (CEDD) Curriculum Committee

Discussants: ***Sandra Henderson***, GLOBE Chief Educator, University Corporation for Atmospheric Research; ***Sonia Ortega***, Education and Human Resources Directorate, National Science Foundation; ***Ronald Baird***, Director, SeaGrant Program

What skill sets do professionals need to participate in integrated observation, forecasting and monitoring systems? How should academic programs be improved to provide them? Although individuals may specialize in a single area, they should have some understanding of the overall process of forecasting environmental changes, including the creation and use of technologies for data collection, to transformation of data into useful information and communicating the results to the public and decisionmakers. What skills should forecasters of various types have? What preparation is useful at the pre-college, university, and post-graduate levels?

NCSE's Council of Environmental Deans and Directors is exploring curricula for undergraduate and graduate environmental programs. Although perspectives vary within the group, there is a shared view that environmental programs should strive toward interdisciplinarity and focus on the human-nature interface.

5. **Providing Real Time Forecasts – How to Assess and Meet User Needs**
   Room: Classroom C/D

   Session Chair: ***Denice Shaw***, Office of Research and Development, U.S. EPA
   Discussants: ***John Whit***, U.S. EPA; ***Chris Owen***, Apprise Technology; ***Pauline Luther***, Director, Environmental Distance Learning

   Real time forecasts are a special case where short-term needs of users must be met. What can be learned from successful real-time forecasting programs? How can these lessons be applied in other situations?

Sessions on Connecting Institutions

6. **Integrating U.S. Efforts with International Initiatives**
   Room: Polaris B

   Session Chair: ***Nancy Colleton***, President, Institute for Global Environmental Strategies; Co-Founder, The Alliance for Earth Observations.
   Discussants: ***Eliot Christian***, US Geological Survey; ***D. Brent Smith***, Chief, International and Interagency Affairs, NOAA; ***Fernando R. Echavarria***, Bureau of Oceans, International Environmental and Science Affairs, U.S. State Department; ***Teresa Kennedy***, Director of International and U.S. Partnerships, GLOBE Program

   The United States has an extensive experience and track record in integrating environmental science efforts with international initiatives. US representatives will discuss how to create global systems that are transparent with maximum sharing of data in an age of security. What are the major challenges to integrating US effort with international initiatives? What are our best success stories? What have we learned form efforts that have failed? How has technology helped or hindered advancement in this area? What do you see as the greatest challenges to implementing a global Earth observation system? How does one ensure utility and equal partnership of the developing world?

7. **Linking Levels of Government: Federal-State-Local**
   Room: Continental B

   Session Chair: ***Randy Johnson***, Chair, Hennepin County (MN) Board of Commissioners
   Discussant: ***Molly O'Neill***, State Director, Network Steering Board, Environmental Council of the States

   Successful forecasting requires strong collaboration across and among federal, state and local governments. Issues such as invasive species, water pollution, and air pollution readily cross political boundaries. This session will explore successful efforts at intergovernmental collaboration and discuss how to expand these successful

efforts to develop useful forecasting tools that benefit all governments. How can forecasting systems be responsive to federal, state, and local needs? What unique aspects of urban and rural needs should be considered when developing forecasting systems?

8. **Cross-Sectoral Connections: Engaging the Private Sector as a Partner with the Government**
Room: Amphitheater Stage

Session Chair: ***Mary G. Altalo***, Corporate Vice President, Science Applications International Corp.

How can the private sector be an equal partner with the government in creating forecasting systems? What are successful examples within the U.S.? What lessons can be learned from them? How should they be applied in other situations?

Sessions on Scientific and Technological Connections

9. **Linking Ocean, Atmospheric and Terrestrial Observation and Forecasting Systems**
Room: Meridian C

Session Chair: ***Anthony Janetos***, Vice President, H. John Heinz III Center for Science, Economics and the Environment
Discussants: ***John Orcutt***, Deputy Director, Scripps Institution of Oceanography; President, American Geophysical Union; ***Ron Birk***, Program Director, Applied Sciences Program, NASA

Many systems exist - how can the infrastructure be more compatible? What efficiencies and economies of scale exist? What cyberinfrastructure components can be shared and what aspects require customization or unique solutions? Can IWGEO get the data they need by coordinating existing environmental observatories and long-term data streams (e.g., from USGS, USDA, NOAA, etc.) or do they need the new platforms that could be developed through NEON or the ocean observing platforms that are under development? What other systems are needed? Can global observation systems be built by accretion and be made more than the sums of their parts?

10. **Integrating Economic, Social and Environmental Forecasting**
Room: Hemisphere A

Session Chair: ***Caitlin Simpson***, Office of Global Programs, NOAA
Discussants: ***William Karesh***, Director, Field Veterinary Program, Wildlife Conservation Society; ***Dan Osgood***, Economist, International Research Institute for Climate Prediction, Columbia University

One of the biggest challenges in the environmental field is how to productively engage social scientists in a field that has traditionally been dominated by natural scientists. A first step is to recognize that economic and social forecasting systems exist and that the ability to forecast the conditions of humanity and the planet will be improved when these forecasting systems are integrated with forecasts of the biophysical environment. Where has this been done effectively? What are the barriers and how can they be overcome?

11. **Working Across Spatial Scales – From Molecular to Global**
Room: Horizon B

Session Co-Chairs: ***Jeff Amthor***, Program Manager, U.S. Department of Energy Office of Science, Climate Change Research Division; ***Woody Turner***, Program Scientist, Office of Earth Science, NASA
Discussants: ***Gary Jacobs*** and ***Stan Wullschleger***, Oak Ridge National Laboratory; ***John Paul***, Professor of Marine Science, the University of South Florida

An amazing variety of new molecular techniques have become available recently and more will be available soon. These techniques provide opportunities to connect researchers working at the molecular level and the plot level, along with others who are bringing together plot level and landscape/regional level work. How can we overcome challenges that cross spatial scales?

12. Forecasting Environmental Change of the Landscape at a Regional Scale
Room: Polaris A

Session Chair: ***Sarah Shafer***, Earth Surface Processes Team, U.S. Geological Survey
Discussants: *John Wiens*, Chief Scientist, The Nature Conservancy

Modeling climate, environmental, and landscape change at the regional scale promises to be far more relevant to users than forecasts derived from global climate models, which typically lack sufficient resolution and detail. A wealth of regional data on vegetation, wildlife, surface and ground water hydrology, human activities, and other natural resources exists in government, state, and university managed databases. Integration of these diverse databases within regional climate change models can provide a powerful forecasting tool for communities, businesses, and state and federal government planners and policy makers. What are the common challenges and how can they be overcome; what are the likely benefits and who are the potential users for forecasts of regional landscape change?

13. Working Across Temporal Scales: Integrating Short-term and Long-term Approaches
Room: Polaris C

Session Chair: ***Sue Haseltine***, Associate Director for Biology, U.S. Geological Survey
Discussants: ***Ann Bartuska***, Deputy Chief for Research and Development, USDA Forest Service; ***Jim Nichols***, Patuxent Wildlife Research Center, U.S. Geological Survey

The users of forecasts vary with the time and space scale of the conclusions. Community planners and businesses are interested primarily in forecasts at the local scale and of several seasons to several years into the future. Government policy makers may be interested in forecasts over a broad range of scales of time and space. How can the needs of various users efficiently be met? How can measurements of short-term or local change be incorporated into long-term, large-scale observation and forecasting systems? How can long-term data sets and time-series analyses provide information for short-term needs.

14. Facilitating the Development of Environmental Sensors and Sensor Networks
Room: Continental C

Session Chair and Discussant: ***Elizabeth Blood***, Program Officer, Division of Biological Infrastructure, National Science Foundation (NSF)
Presentation: ***Peter Arzberger,*** University of California, San Diego- "Sensors for Environmental Observing: Highlights and Key Observations from an NSF Funded Workshop"
Discussants: ***Pat Brezonik***, ***Henry Gholz***, ***Alex Isern***, ***Doug James*** and ***Steve Meacham*** (all NSF)

To reliably forecast environmental change, models must become dynamically linked to real-time and robust sensing of environmental dynamics. Environmental science necessary to capture these dynamics is at a crossroads. To move environmental forecasting initiatives forward, progress must be made in developing environmental sensors that measure biological and chemical parameters, to maintain a sustained in situ presence in potentially harsh environments.

Participants in this session will provide input on research frontiers in environmental sensing, sensor needs for environmental forecasting, strategies for facilitating the development of sensors for environmental forecasting, the challenges associated with integrating sensor data with predictive models, and the use of models.

15. **Fusion and Integration of Satellite Remote-Sensing and Ground-Based Observations and Presentation for Environmental Policy**
Room: Oceanic B

Session Chair: ***Jill Engel-Cox***, Senior Research Scientist, Battelle Memorial Institute
Discussants: ***Ashbindu Singh***, Regional Coordinator, Division of Early Warning & Assessment- North America, United Nations Environment Programme; ***Lawrence Friedl***, Program Manager, National Applications, Sun-Earth Systems Division, NASA; ***Alan Rush***, Policy Analyst, Office of Air Quality Standards, U.S. EPA

Satellite remote sensing represents a tremendous resource for monitoring and forecasting environmental change, but these complex datasets often need to be integrated with ground-based data that have direct relevance to policy, the environment and human health. Data from satellite sensors often exist in formats that are difficult for scientists from other fields and the public to use and understand, even though their application has been demonstrated for problems as diverse as air and water pollution, desertification, habitat destruction, ocean dead zones, and climate change, among many others. How can these "eyes in the sky" best contribute to environmental monitoring, model, and policy to solve the most challenging environmental problems?

16. **Examining the Role of Eco-Informatics in Environmental Decision Making**
Room: Continental A

Session Co-Chairs: ***Mike Frame*** and ***Tyrone Wilson***, National Biological Information Infrastructure, U.S. Geological Survey
Discussant: ***John Schnase***, Lead, Information Sciences & Technology Research, NASA Goddard Space Flight Center

Ecology and Environmental decision makers (i.e. customers) at all levels of government (local, state, national and international) seek to integrate ecological and environmental information into resource management, oversight, and policy decisions. While decision makers may explore a wide variety of information sources through information providers and data managers, they are faced (often indirectly) with many information technology issues, including data gaps, data integration, data presentation, and how to use or create appropriate indicators.

17. **Cyberinfrastructure for All: Connectivity, Content, and Collaboration**
Room: Meridian D

Session Chair: ***Ann Zimmerman***, Research Fellow, University of Michigan
Discussants: ***Jim Gosz***, Professor, University of New Mexico; Director for the New Mexico Experimental Program to Stimulate Competitive Research; ***Arnold Kee***, Director of Programs, Institute for Higher Education Policy; ***Lori Perine***, Executive Director, Agenda 2020 Technology Alliance, American Forest and Paper Association

The emerging cyberinfrastructure (CI) will be an integrated system of computation, communication, and information elements that supports a range of applications such as data sharing, remote operation of scientific instruments, and high-performance computing. CI will make e-science possible by tying together researchers, educators, and students from around the globe. In order to achieve the CI vision, we must overcome barriers in resources or knowledge that might hinder the development or use of CI in some settings. The purpose of this breakout session is to identify these challenges, to consider the opportunities that CI presents to enable broader participation in cutting edge education and research activities, and to develop recommendations on how to address the impediments and take advantage of the many possibilities.

18. Linking Environmental Indicators with Forecasting
Room: Meridian E

Session Chair: ***Brenda Groskinsky***, ORD Science Liaison for Region 7, U.S. EPA
Presentations: ***Rick Linthurst***, Office of the Inspector General, U.S. EPA; ***Chase Huntley***, Senior Analyst, National Resources and Environment Department, U.S. General Accounting Office
Discussants: ***Jamison Ervin***, Ecoregional Measures Manager, The Nature Conservancy; ***H. Theordore Heintz, Jr.***, White House Council for Environmental Quality; ***Bruce Jones***, Office of Research and Development, U.S. EPA; ***Douglas M. Muchoney***, Program Coordinator, Geographic Analysis and Monitoring, U.S. Geological Survey

There are an enormous number of environmental indicators. Many of these are indicators of process rather than indicators of outcome. What are the opportunities for environmental indicators to measure the effects of models in providing accurate forecasts? How can indicators be presented in usable forms for the public?

19. Moving From Observation to Forecasting Systems: Linking Characterization, Process, Research, Modeling, Prediction and Delivery
Room: Classroom A/B

Session Chair: ***Gary Foley***, Director, National Exposure Laboratory, Office of R&D, U.S. EPA
Discussants: ***Michele Aston***, National Exposure Research Laboratory, U.S. EPA; ***Mathew Sobel***, Professor, Weatherhead School of Management Case Western Reserve University; ***Dorsey Worthy***, National Exposure Research Laboratory, U.S. EPA

There are often major disconnections among the different elements necessary for forecasting, For example, the types of data needed to develop models may differ from the types data needed to provide a forecast. Earth observatory platforms designed by basic researchers may not incorporate environmental forecasting tools that are appropriate to the needs of policymakers. Some platforms should be set up to answer specific research questions and others gather "baseline" data that are usable by many communities. There is much important research to be done using long-term data sets of all types. Long-term data sets can be used to address more complex research questions through modern integration and synthesis of data. There are examples of successful approaches that address all the needs for useful forecasting. How can we learn from the successes and move to a more unified approach?

Biographies of Plenary Speakers

Ray Anderson is Founder and Chairman of Interface, Inc., one of the world's largest interior furnishings companies. After founding Interface in 1973, he and his company revolutionized the commercial floorcovering industry by producing America's first free-lay carpet tiles. Now, Mr. Anderson has embarked on a mission to make Interface a sustainable corporation by leading a worldwide effort to pioneer the processes of sustainable development.

Mr. Anderson learned the carpet and textile businesses through 14-plus years in various positions at Deering-Milliken and Callaway Mills, and in 1973, set about founding a company to adapt European technology to produce free-lay carpet tiles in America. He developed a partnership with Britain's Carpets International Plc. that year and set up operations in LaGrange, Georgia. Ten years later, Interface took over Carpets International.

Mr. Anderson was named co-chairman of the President's Council on Sustainable Development in 1997, and received the inaugural Millennium Award from Global Green, presented by Mikhail Gorbachev in September 1996. He was also recognized in 1996 as the Ernst & Young Entrepreneur of the Year for the Southeast Region, and as the Georgia Conservancy's Conservationist of the Year in 1997. In January, 2001, Mr. Anderson was selected by the National Academy of Sciences to receive the George and Cynthia Mitchell International Prize for Sustainable Development, the first corporate CEO to be so honored.

D. James Baker is the 27th President and CEO of the Academy of Natural Sciences, based in Philadelphia and St. Leonard, Maryland. Since his inauguration in 2002, Dr. Baker has worked to increase the Academy's funding and strengthen its stature as a national and international leader in environmental science and education.

From 1993-2001, Dr. Baker served as Under Secretary of Commerce for Oceans & Atmosphere and Administrator of the National Oceanic and Atmospheric Administration (NOAA). He supervised a staff of 12,500 that was responsible for the nation's weather and climate forecasting, monitoring and archiving of atmospheric data, management of marine fisheries and mammals, mapping and charting of all U.S. waters, coastal zone management, and research and development in all these areas. During his tenure as Administrator, funding for NOAA increased 80 percent.

Before joining NOAA, Dr. Baker served as President of Joint Oceanographic Institutions, Inc., a non-profit group of universities that manages national and international earth-science programs. During this period he also held the position of Distinguished Visiting Scientist at the Jet Propulsion Laboratory, California Institute of Technology. There he worked with NASA and university colleagues to develop new plans for oceanic and atmospheric instruments and satellite programs.

Dr. Baker received his B.S. from Stanford University and holds a Ph.D. in experimental physics from Cornell University. He has held faculty positions at numerous prestigious research universities and is the founding President of the Oceanography Society. Author *of Planet Earth: The View from Space*, Dr. Baker has written more than 100 articles on climate, oceanography, space technology, natural resource management and sustainable development.

Ann Bartuska is Deputy Chief for Research and Development at USDA Forest Service. Prior to her appointment to this position in January of 2003, she spent three years as the Executive Director of the Nature Conservancy's Invasive Species Initiative.

Before joining the Nature Conservancy, Dr. Bartuska spent fourteen years working for the Forest Service. During this time she became the first woman, and first ecologist, to be named Director of Forest Management, and also held such various positions as Forest Service Liaison to the National Biological Survey and Director of Ecosystem Management for the National Forest System.

A former President of the Ecological Society of America, Dr. Bartuska currently serves on the board of the Council of Scientific Society Presidents. She also serves on the advisory board for the National Ecological Observation Network (NEON). Dr. Bartuska is an ecosystems biologist with a master's degree in Botany from Ohio University and a Ph.D. in Biology from West Virginia University.

Arden L. Bement Jr. is the Director of the National Science Foundation (NSF). Confirmed by the U.S. Senate in November of 2004, he had served as Acting Director of NSF for ten months.

Previously, Dr. Bement served as Director of the National Institute of Standards and Technology (NIST), a position he held from December, 2001 until his confirmation as NSF Director. Prior to his appointment as NIST director, Dr. Bement was the David A. Ross Distinguished Professor of Nuclear Engineering and head of the School of Nuclear Engineering at Purdue University. For six years Dr. Bement was a member of the National Science Board, which is the governing body of NSF.

Dr. Bement holds an engineer of metallurgy degree from the Colorado School of Mines, a master's degree in metallurgical engineering from the University of Idaho, and a Ph.D. in metallurgical engineering from the University of Michigan. In addition, he has been awarded an honorary degree in engineering from Cleveland State University and an honorary doctorate degree in science from Case Western Reserve University. He is a member of the U.S. National Academy of Engineering.

Ambassador Richard E. Benedick has played a major role in global environmental affairs as chief U.S. negotiator and a principal architect of the historic Montreal Protocol on protecting the ozone layer. He also served as Special Advisor to Secretaries-General of the 1992 UN Conference on Environment and Development (Rio de Janeiro) and the 1994 Conference on Population and Development (Cairo). He has been President of the National Council for Science and the Environment since 1994, while concurrently holding senior posts at the Joint Global Change Research Institute of the Pacific Northwest National Laboratory and at Wissenschaftszentrum Berlin. His acclaimed book *Ozone Diplomacy* was selected by McGraw-Hill for an anthology of twentieth-century environmental classics.

A career diplomat, Dr. Benedick served at embassies abroad, was Deputy Assistant Secretary of State for Environment and Health, and headed divisions responsible for population affairs and for economic assistance and multilateral finance. He has led many international delegations, testified before Congress and foreign parliaments, and presided over international conferences and negotiations on environment, development, population, and science policy.

Dr. Benedick was elected in 1991 to the World Academy of Art and Science, and in 2002 to the American Academy of Diplomacy, an association of 100 former cabinet secretaries, ambassadors, and statesmen "who have made notable contributions to American foreign policy." Among other honors, he received a D.Sc. honoris causa by North Carolina State University and the two highest Presidential career public service awards. Benedick graduated summa cum laude and Phi Beta Kappa from Columbia, holds an M.A. (honors) from Yale and a doctorate from Harvard, and was Evans Fellow at Oxford University in metaphysical poetry.

Rita R. Colwell served as the 11th Director of the National Science Foundation from August 1998 to February 2004. Under Dr. Colwell's leadership, the National Science Foundation budget grew by over 68 percent, surpassing $5 billion for the first time in 2003, and the agency was recognized for excellence in both science and management.

Dr. Colwell is Distinguished University Professor at the University of Maryland and The Johns Hopkins Bloomberg School of Public Health. She also serves as Chairman of Canon U.S. Life Sciences, Inc., a newly created Washington-based subsidiary of Canon U.S.A. whose goal is to identify and develop life-science solutions with potential applications in diagnostics and medical instrumentation. Dr. Colwell is also a member of AAAS, the American Philosophical Society and the National Academy of Sciences.

Before coming to NSF, Dr. Colwell was President of the University of Maryland Biotechnology Institute, 1991-1998, and Professor of Microbiology and Biotechnology at the University Maryland. She was also a member of the National Science Board from 1984 to 1990.

Dr. Colwell has held many advisory positions in U.S. Government, non-profit science policy organizations, and private foundations, as well as in the international scientific research community. She is a nationally respected scientist and educator, and has authored or co-authored 16 books and more than 600 scientific publications. She is the recipient of numerous honors and awards as well as 35 honorary degrees from institutions of higher education.

Dr. Colwell holds a B.S. in Bacteriology and a M.S. in Genetics from Purdue University, and a Ph.D. in Oceanography from the University of Washington.

Jack Dangermond is the Founder and President of ESRI, the world's fourth largest privately held software company. Founded in 1969 and headquartered in Redlands, California, ESRI is widely recognized as the technical and market leader in geographic information system (GIS) software, pioneering innovative solutions for working with spatial data on the desktop, across the enterprise, in the field, and on the Web. ESRI has the largest GIS software install base in the world with more than one million users in more than 100,000 organizations representing government, NGOs, academia, and industries such as utilities, health care, transportation, telecommunications, homeland security, retail, and agriculture

Mr. Dangermond is recognized not only as a pioneer in spatial analysis methods, but also as one of the most influential people in GIS. Over the last 30 years, Mr. Dangermond has delivered keynote addresses at many international conferences, published hundreds of papers on GIS, and given thousands of presentations on GIS around the world.

He is the recipient of numerous awards, honorary degrees, lectureships, and medals. He is a member of many professional organizations and has served on advisory committees for U.S. agencies including NASA's Science and Technology Advisory Committee, the U.S. EPA, the National Academy of Sciences, the National Science Foundation, and the National Center for Geographic Information and Analysis.

Mr. Dangermond earned a B.S. in environmental science from California State Polytechnic University. He holds a M.S. in urban planning from the Institute of Technology at the University of Minnesota as well as a M.S. degree in landscape architecture from the Graduate School of Design at Harvard University. Dangermond holds honorary doctorates from The City University of London, University of Redlands, and Ferris State University.

Mohamed El-Ashry is the former Chairman and CEO of the Global Environmental Facility, which he led from 1991 to 2002. Under his leadership, GEF grew from a pilot program with less than 30 members to the largest single source of funding for the global environment with 173 member countries. During his tenure, the Global Environmental Facility allocated $4 billion in grants and leveraged $12 billion in additional financing for the

environment, growing to include more than 1,000 projects in over 140 countries. In 2002, James Wolfensohn, President of the World Bank, said: "The GEF, as we know it today, is the product of Mohamed El-Ashry's vision, leadership, dedication, and hard work. He has made a significant contribution to the global environment and sustainable development."

Mr. El-Ashry came to the GEF from the World Bank, where he was the Chief Environmental Advisor to the President and Director of the Environment Department. Prior to joining the World Bank, he served as Senior Vice President of the World Resources Institute (WRI) and as Director of Environmental Quality with the Tennessee Valley Authority.

Mr. El-Ashry earned his B.S. degree with honors in 1959 from Cairo University and Ph.D. degree in geology in 1966 from the University of Illinois. He has received numerous international awards and honors and is the author of three books and more than 200 papers.

Gary J. Foley is the Director of the U.S. Environmental Protection Agency's National Exposure Research Laboratory, a position he has held since 1995. Before joining the NERL, Dr. Foley served as the Acting Assistant Administrator of EPA's Office of Research and Development. He has held other senior positions at EPA in the Atmospheric Research and Exposure Assessment Laboratory, Environmental Monitoring Systems Laboratory, the Acid Deposition Research Program, and the Energy and Air Division of the Office of Environmental Processes and Effects Research.

Currently, Dr. Foley chairs the EPA Committee on Regulatory Environmental Modeling and the EPA High Performance Computing Executive Council. Internationally, he is the US Co-chair of the Air Board of the International Joint Commission and has been active in persistent toxic substances work with the North American Commission for Environmental Cooperation and the United Nations.

Dr. Foley is the recipient of the Meritorious Executive Presidential Rank Award, four EPA Bronze Medals, and six Special Achievement Awards. He received a Ph.D. and M.S. in chemical engineering from the University of Wisconsin and his B.S. degree from Manhattan College in New York.

Charles Groat has served as the 13th Director of the U.S. Geological Survey since 1998. Now serving under his second presidential administration, Dr. Groat oversees the Survey's 10,000 employees and annual budget of nearly a billion dollars. He has worked to strengthen the USGS mission of providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

With more than 25 years experience in geological studies, Dr. Groat has been directly involved in energy and minerals resource assessment, groundwater occurrence and protection, geomorphic processes and landform evolution in desert areas, and coastal studies. Before coming to the Survey, Dr. Groat held leadership positions at the University of Texas at El Paso and at Louisiana State University. Dr. Groat has also served as Executive Director of the American Geological Institute.

Dr. Groat received a B.A. from the University of Rochester, a M.S. from the University of Massachusetts, and a Ph.D. in geology from the University of Texas at Austin. He has authored and contributed to numerous publications and articles on major issues involving earth resources and the environment, and has served on over a dozen earth science boards and committees.

Bruce Hayden is a professor at the University of Virginia. Since joining the UVA department of Environmental Sciences in 1970, Dr. Hayden has pursued his interests in the historical climatology of weather systems and the connections between the structure of the Earth's climates and the related biogeography of terrestrial and marine biomes. He also helped to found and run the Virginia Coast Reserve Long-Term Ecological Research (LTER) site on the Eastern Shore. Established in 1987, this project works to understand the dynamics and changes of the ecosystems along Virginia's coastline.

Currently, Dr. Hayden is the lead investigator for the National Ecological Observatory Network (NEON) Design Consortium. This National Science Foundation initiative is intended to create a continental scale research instrument consisting of geographically distributed infrastructure.

Dr. Hayden attended Penn State where he earned both a Bachelor of Arts degree in zoology and a Master of Science degree in botany. He received his Ph.D. in Biometeorology from the University of Chicago in 1968.

Stephen P. Hubbell is a professor of Botany at the University of Georgia. Previously, Dr. Hubbell was a Butler Fellow and professor of ecology and evolutionary biology at Princeton University. Prior to joining the faculty at Princeton in 1988, he was a faculty member at the University of Michigan and University of Iowa, and a staff scientist at the Smithsonian Tropical Research Institute. In 1992 he was on leave from Princeton as a senior research fellow of the Smithsonian Institution.

Dr. Hubbell was awarded a Guggenheim Fellowship in 1984 and was a Pew Scholar in Conservation and the Environment from 1990-1992. In 1992 he received the Distinguished National Service Award from the Society for Conservation Biology. He is a member of Phi Beta Kappa, Sigma Xi, and is a Fellow of the American Association for the Advancement of Science.

Dr. Hubbell's principal research concerns the ecology and management of tropical rain forests. His work focuses on long-term dynamics of tropical rain forests in the new and old world tropics, as well as the implications of global change for the conservation and management of forests.

He received a Ph.D. in Zoology from the University of California at Berkeley in 1969, and a B.A. magna cum laude in Biology from Carleton College in 1963.

Randy Johnson has served as the Chair of the Hennepin County Board of Commissioners since 1978 and has run unopposed in the last three elections. He served as president of the National Association of Counties (NACo) in 1997 and 1998. NACo represents the nation's 3,100 counties.

His leadership on environmental issues in Hennepin County, Minnesota, has made Commissioner Johnson a national authority on the subject. He has helped the county establish a comprehensive recycling and integrated solid waste management program that is consistently cited as one of the best in the nation. He has addressed international conferences at the U.N. and elsewhere on such issues as alternative fuels, climate change, and new technology implementation.

Commissioner Johnson currently serves on many advisory boards and committees, including the Federal Geographic Data Committee, Housing and Urban Development's Community Builder's Advisory Board, as well as the Board of the National Council for Science and the Environment.

Commissioner Johnson earned his B.A. in Political Science from Macalester College and his J.D. degree cum laude from the University of Minnesota Law School in 1974.

Dave Jones is the CEO, President and Founder of StormCenter Communications, Inc. He has worked in the weather industry for 20 years and combines his experience in meteorology, broadcasting and remote sensing with a vision for the future in leading the way to transform the television weathercast into an Envirocast. Mr. Jones has been described by NASA as an "Applications Futurist" due to his ability to identify future earth science applications that can address national and local priorities.

From 1990-2000 Mr. Jones was employed by NBC in Washington, DC as the number two on-air meteorologist with primary duties on weekend evenings. While working for NBC, Mr. Jones conceived of and produced three winning proposals to NASA that focused on commercialization of earth science data from NASA. This led to the first local TV weather web site in 1995. Earlier in his career he co-founded a weather forecasting company in the Pacific Northwest that was first to offer customized weather forecasts to the windsurfing industry.

Mr. Jones is co-founder and past President of the Federation of Earth Science Information Partners. Mr. Jones holds the AMS Seal of Approval for television meteorologists and is currently a member of the AMS Board of Continuing Education and the AMS Societal Impacts Committee. He recieved a B.S. in Physical Sciences with an emphasis on Math and Computer Science from the University of Maryland in 1986.

Charles Kennel is the Director of the Scripps Institution of Oceanography at the University of California, San Diego, where he also serves as Vice Chancellor and Dean of Marine Sciences. Dr. Kennel is currently the Chairman of the National Academy of Science/National Research Council Committee on Global Change Research. He is also a member of the Pew Oceans Commission and the Chairman of the NASA Advisory Council.

Prior to assuming his current position at Scripps, Dr. Kennel served as associate administrator for NASA, directing Mission to Planet Earth, the world's largest earth science program, from 1994 to1996

He has chaired and served on numerous advisory boards and committees at the National Academies, the National Science Foundation, the Department of Energy, Princeton University, the Geophysical Institute, the University of Alaska, and the University Corporation for Atmospheric Research. He has received numerous honors, awards and fellowships and is the author or co-author of over 250 publications in plasma physics, space plasma physics, planetary science, astrophysics, and nonlinear science.

Dr. Kennel received an A.B. from Harvard College and a Ph.D in astrophysical sciences from Princeton University.

Vice Admiral Conrad C. Lautenbacher, Jr., U.S. Navy (Ret.) was appointed Undersecretary of Commerce for Oceans and Atmosphere and the 8th Administrator of the National Oceanic and Atmospheric Administration (NOAA) in 2001. Lautenbacher oversees the everyday functions of NOAA and works to develop its strategic and operational future. The agency includes the National Environmental Satellite, Data and Information Services; National Marine Fisheries Service; National Ocean Service; National Weather Services; Oceanic and Atmospheric Research; Marine and Aviation Operations; and the NOAA Corps, the nation's 7th uniformed service.

As NOAA's Administrator, Lautenbacher directed an internal review and reorganization of the agency's corporate structure to meet the environmental challenges of the 21st century. In July 2003, he spearheaded the first-ever Earth Observation Summit, which hosted ministerial-level representation from several dozen nations in Washington, DC. The effort culminated at the Second

Earth Observing Summit held in Tokyo in April 2004 where 47 nations formalized the plans for international cooperation on the construction and maintenance of a Global Earth Observing System.

Before joining NOAA, Lautenbacher was president and CEO of the Consortium for Oceanographic Research and Education (CORE). This non-profit organization has a membership of 76 institutions of higher learning and a mission to increase basic knowledge and public support across the spectrum of ocean sciences.

Admiral Lautenbacher is a graduate of the U.S. Naval Academy (Class of '64) and has had a celebrated career in operational, command and staff positions both ashore and afloat. Vice Admiral Lautenbacher went on to receive his Masters and Doctorate in applied mathematics from Harvard University.

Margaret Leinen is the Assistant Director for Geosciences at the National Science Foundation and coordinator across NSF of all environmental research and education programs. During Dr. Leinen's five years at NSF she has overseen the development of a new interdisciplinary portfolio in environmental research and education.

Prior to joining NSF, Dr. Leinen served as Dean of the Graduate School of Oceanography, Vice Provost for Marine and Environmental Programs and Interim Dean of the College of the Environment and Life Sciences at the University of Rhode Island. During her tenure, she spearheaded the University's efforts to build a cohesive interdisciplinary marine and environmental focus.

She is past President of The Oceanography Society and has served on the Board of Governors of the Joint Oceanographic Institutions, Inc. and the Ocean Research Advisory Council. Dr. Leinen also served as the Vice Chair of the International Geosphere-Biosphere Programme and on the Board on Global Change of the National Research Council of the National Academy of Sciences.

Dr. Leinen received her B.S. in geology from the University of Illinois; her M.S. in geological oceanography from Oregon State University; and her Ph.D. in oceanography from the University of Rhode Island.

Jeffrey Leonard is President, Chief Executive Officer and founding partner of the Global Environment Fund, an international investment management firm established in 1989 to invest in, and provide management support to, companies that make positive contributions to environmental quality, human health and the sustainable management of natural resources.

In his current role at the Global Environment Fund, Dr. Leonard oversees technology investments in the fields of energy, environmental infrastructure, intelligent systems engineering, biotechnolgy, and health care.

Prior to founding GEF, Dr. Leonard was involved with international finance agencies, governments and non-governmental organizations throughout Latin America, Asia, and Africa addressing matters pertaining to economic development and environmental infrastructure. He has previously served as an advisor or consultant to the World Bank, U.S. Agency for International Development, World Resources Institute, U.S. Environmental Protection Agency, and the U.S. Office of Technology. Dr. Leonard has been on the Board of NCSE since 1991.

Dr. Leonard earned a BA magna cum laude at Harvard College, a MSc at the London School of Economics, and a Ph.D. at Princeton University.

Thomas E. Lovejoy is President of the H. John Heinz III Center for Science, Economics and the Environment. Before assuming this role, Dr. Lovejoy was the World Bank's Chief Biodiversity Advisor, Lead Specialist for Environment for Latin America and the Carribean, and Senior Advisor to the President of the United Nations Foundation. He has held science advisory positions at the Smithsonian Institution, the Department of the Interior, and the United Nations Environment Programme, and was Executive Vice President of the World Wildlife Fund-US.

Dr. Lovejoy originated the concept of debt-for-nature swaps. Over one billion dollars in conservation funds has already been made available through this mechanism. He also founded the public television series *Nature*, and served as principal advisor to the series for many years. This program is the most popular long-term series on public television. He has also served on science and environmental councils and committees under the Reagan, Bush and Clinton Administrations.

In 2001 Dr. Lovejoy received the Tyler Prize for Environmental Achievement. He received a B.S. and a Ph.D. in biology from Yale University.

H. Ronald Pulliam has led a distinguished academic career and has used his expertise in ecology and biological science in many different capacities. Dr. Pulliam is currently a professor at the University of Georgia's Institute of Ecology where he was Director from 1987 to 1994. He has been a visiting scientist at Sussex University in Brighton, England, and a research biologist at the H.S. Colton Research Center, Museum of Arizona. In 1994 he was selected to be the Director of the National Biological Service Department of the Interior in Washington, D.C., and then became the Science Adviser to the Secretary of the Interior in 1996.

Outside the academic world, Dr. Pulliam has served as Vice-President and President of the Ecological Society of America and was also chosen to serve on the National Scientific Advisory Board of the Nature Conservancy. In 1993, he became the Co-Chair of the Committee on Environment and Natural Resources in the U.S. Office of Science and Technology. Dr. Pulliam has been on the Board of NCSE since 1997.

Dr. Pulliam earned a B.S. in Zoology from the University of Georgia and a Ph.D. in Zoology from Duke University.

Walter Reid is the Director of the Millennium Ecosystem Assessment (MA). Between 1998 and 2000, Dr. Reid led the process to establish the Millennium Ecosystem Assessment, an international work program designed to meet the needs of decision-makers for scientific information on the links between ecosystem change and human well-being. During this period Dr. Reid also coordinated the Puget Sound Salmon Collaboration. This group of Washington State environmental and business leaders was chaired by William Ruckelshaus and recommended actions to help recover threatened salmon species.

From 1992 to 1998, Dr. Reid was Vice President of the World Resources Institute in Washington D.C. Prior to that, he was a Gilbert White Fellow at Resources for the Future and he has also worked for the California Department of Fish and Game and the U.S. Forest Service. He is a member of the Board of Editors of *Ecological Applications*, *Ecosystems*, and *PLOS-Biology*, a member of the International Advisory Board of Frontiers in Ecology and Environment, and a past member of the Board of the Society for Conservation Biology.

Dr. Reid earned his Ph.D. in Zoology (Ecology and Evolutionary Biology) from the University of Washington in 1987 and his B.A. in Zoology from the University of California at Berkeley in 1978.

James C. Renick is Chancellor and Professor of Political Science at North Carolina Agricultural and Technical State University. Dr. Renick came to North Carolina A&T from the University of Michigan-Dearborn, where he served as Chancellor and Professor of Public Administration and Education. Dr. Renick previously served as Vice Provost for Academic Initiatives and External Affairs at George Mason University. Dr. Renick serves on numerous national boards and foundations including the Presidential Board of Advisors on Historically Black Colleges and Universities, the North Carolina Board of Science and Technology, and the Parren J. Mitchell Foundation.

Throughout his career, Chancellor Renick's work has focused on building partnerships between higher education and the community-at-large, especially in the area of corporate-university relations. His achievements have brought him numerous awards including the American Association for Higher Education Black Caucus'

Exemplary Award for Public Service, the University of Michigan President's Medallion, Who's Who in Black America, and Faculty of the Year.

A native of Rockford, Illinois, Renick earned a B.A. from Central State University in Ohio, a Master of Social Work degree from Kansas University and a Ph.D. in Public Administration from Florida State University.

William D. Ruckelshaus served as the first Administrator of the United States Environmental Protection Agency from its inception in December of 1970 to April of 1973. A decade later he was asked by President Ronald Reagan to return to the agency's helm, where he served as the fifth Administrator until 1985. While the challenges of administering the EPA evolved as the agency matured, Mr. Ruckelshaus consistently sought balanced, durable and broadly-supported approaches to environmental and conservation issues.

From 1983 to 1987 Mr. Ruckelshaus was the U.S. Representative to the United Nations World Commission on Environment and Development (commonly known as the Brundtland Commission). The Commission's 1987 report on sustainable development, *Our Common Future*, led to the 1992 Earth Summit held in Rio de Janeiro, which was one of the largest gatherings of world leaders in history.

Mr. Ruckelshaus was appointed by President George W. Bush to serve on the U.S. Commission on Ocean Policy. The Commission recently issued its congressionally mandated final report, making recommendations to the President and Congress for a coordinated and comprehensive national ocean policy. Previously, Mr. Ruckelshaus was appointed by President Clinton to serve as the U.S. envoy addressing issues relating to the Pacific Salmon Treaty. He has served as chairman of the Washington State Salmon Recovery Funding Board since 1999, and has been instrumental in efforts to recover endangered salmon species in the region.

Mr. Ruckelshaus is the immediate past Chairman of the World Resource Institute Board. He is also Chairman Emeritus of the University of Wyoming Ruckelshaus Institute for Environment and Natural Resources, Chairman of the Meridian Institute and serves on the board of several other nonprofit organizations.

Currently, Mr. Ruckelshaus is a Strategic Director in the Madrona Venture Fund and a principal in the Madrona Investment Group, L.L.C., a Seattle based investment company. He is the director of several corporations, including Cummins Engine Company, Pharmacia Corporation, Solutia, Inc., Coinstar, Inc., Nordstrom, Inc. and Weyerhaeuser Company.

Born in Indianapolis, Indiana in 1932, Mr. Ruckelshaus graduated cum laude from Princeton University in 1957 and obtained his law degree from Harvard University in 1960. He was a member of the Indiana House of Representatives and its majority leader from 1967 to 1969. Mr. Ruckelshaus has held other leadership positions in the federal government including Acting Director of the Federal Bureau of Investigation and Deputy Attorney General of the United States.

Craig M. Schiffries is Chairman of the 5th National Conference on Science, Policy and the Environment and Director of Science Policy at the National Council for Science and the Environment. He has previously served as a Congressional Science Fellow on the staff of the United States Senate Judiciary Committee; Director of Government Affairs at the American Geological Institute; Director of the Board on Earth Sciences and Resources of the National Academy of Sciences / National Research Council; a visiting faculty member at Yale University; and a consultant with Monitor Company.

Dr. Schiffries is Co-Chairman of the USGS Coalition, an alliance of 69 organizations united by a commitment to the continued vitality of the unique combination of biological, geological, hydrological and mapping programs of the U.S. Geological Survey. He serves on the British Ambassador's Advisory Council for Marshall Scholarships and is Chairman of the Selection Committee in Washington, DC.

Dr. Schiffries simultaneously earned his B.S. and M.S. degrees from Yale University, where was he was elected to *Phi Beta Kappa*, graduated *summa cum laude,* and double-majored in Geology and Geophysics and in Economics and Political Science. He was a Marshall Scholar at Oxford University, where he earned an honors B.A. in Philosophy,

Politics, and Economics. He received a Ph.D. in Geology from Harvard University, where he held a fellowship from the Hertz Foundation.

James Gustave Speth currently serves as dean and professor in the practice of environmental policy and sustainable development at Yale University's School of Forestry & Environmental Studies. He is a visionary leader and scholar, with an extensive understanding of the interrelationship between environmental, economic and developmental concerns. His publications include two books, *Red Sky at Morning* and *Worlds Apart*, as well as over 100 journal articles. Speth's critically acclaimed *Red Sky at Morning* has enlivened the international environmental community, providing an in depth, insightful analysis of the status the Earth's ecological systems and ways that major issues can be addressed on all levels - international, national, local, and individual.

Before joining the faculty at Yale, Speth served as administrator of the United Nations Development Programme and chair of the UN Development Group. Prior to his service at the UN, he was founder and president of the World Resources Institute; professor of law at Georgetown University; chairman of President Carter's Council on Environmental Quality; and senior attorney and cofounder of the Natural Resources Defense Council.

Among Mr. Speth's many awards are the National Wildlife Federation's Resources Defense Award, the Natural Resources Council of America's Barbara Swain Award of Honor, the Keystone Center's National Leadership Award, and most recently, the Blue Planet Prize.

An alumnus of Yale University, Speth then attended Oxford University as a Rhodes Scholar, earning a M. Litt in Economics. In 1969 he completed a J. D. at Yale Law School, and he recently received an honorary Doctor of Laws degree from Clark University.

Steven M. Stanley is a professor of Paleobiology and program chair for the Advanced Academic Program in Environmental Sciences and Policy at The Johns Hopkins University. Dr. Stanley is widely recognized for his work on the evolution of life and the history of ecosystems in the context of past environmental change.

Dr. Stanley recently introduced a new explanation for the modern ice age, based on the strengthening of the modern oceanic conveyor belt, and has related the evolution of the human genus in Africa to the onset of this ice age. In work still in progress with Lawrence Hardie, he has shown how changes in seawater chemistry during the past half billion years, driven by changes in rates of seafloor spreading, have dictated what kinds of marine organisms have served as dominant reef-builders and limestone producers.
Dr. Stanley is a member of the National Academy of Sciences and has served on the Commission on Geosciences, Environment and Resources of the National Research Council. He was the chair of the National Science Foundation's Geobiology of Critical Intervals initiative, which studied critical segments of the stratigraphic record or of geological time that offer special opportunities for elucidating the fundamental nature and long-term history of the coupled earth-life system. Dr. Stanley is also past-President of the American Geological Institute and of the Paleontological Society.

Dr. Stanley received his undergraduate degree from Princeton University in 1963 and his doctorate from Yale University in 1968.

Poster Session Abstract Titles & Authors

1. DIANE DEBINSKI. Iowa State University. **Using Remotely Sensed Habitat Classification and Species Distribution Patterns to Define Ecological Indicators of Climate Change.**

2. BILLETT, CLARE[1] and ROBERT CHEETHAM.[2] [1]Natural Lands Trust; [2]Avencia, Inc. **SmartConservation: Prioritization Program.**

3. IERARDI, MICHAEL and TONI M. JOHNSON. U.S. Geological Survey. **The National Water Quality Monitoring Council.**

4. CLAGETT, PETER[1]; REILLY, JAMES[2]; JANTZ, CLAIRE[3] and SCOTT GOETZ.[3] [1]USGS; [2]Maryland Department of Planning; [3]Woods Hole Research Center. **Urban Growth Modeling in the Chesapeake Bay Watershed.**

5. D. RICK VAN SCHOIK. Southwest Consortium for Environmental Research and Policy. **Eventualities in the US-Mexican Border Region: Harbinger for the Nation?**

6. ASHBY, STEVEN; BARKO, JOHN and DAVE RICHARDS. U.S. Army Corps of Engineers. **Environmental Forecasting and Decision Making in Comprehensive Water Resource Manage-ment.**

7. JENICEK, ELISABETH[1]; GORAN, WILLIAM[1]; FOURNIER, DONALD[2] and NATALIE DOWNS.[3] [1]U.S. Army, Engineering Research Development Center; [2]University of Illinois; [3]PERTAN Associates. **Strategic Sustainability Assessment Regional Evaluation.**

8. GRAY, STEPHEN T. and JULIO L. BETANCOURT. U.S. Geological Survey – Desert Laboratory. **Assessing the Importance of Decadal-to-Multidecadal (D2M) Climate Variability in Forecasting Ecological and Hydrologic Change Across the Interior West.**

9. VALETTE-SILVER, NATHALIE J. and GARY C. MATLOCK. National Oceanic and Atmospheric Administration. **The Integration of Science and Management.**

10. GROSS, THOMAS[1]; BROWN, CHRISTOPHER[2]; HOOD, RALEIGH[3]; RAMERS, DOUGLAS[4]; TANGO, PETER[5]; MICHAEL, BRUCE[5] and ALEXEY VOINOV.[6] [1]Chesapeake Research Consortium; [2]National Oceanic and Atmospheric Administration; [3]University of Maryland Center for Environmental Science, Horn Point Laboratory; [4]University of North Carolina, Charlotte; [5]Maryland Department of Natural Resources; [6]University of Vermont. **Integrating Environmental Models to Predict Spatial Distribution of Harmful Algal Bloom Occurrence.**

11. WAGGETT, CARYL E.[1]; WAGGETT, JAMES A. [2]; WILMORE, SETH B.[1] and ROBERT S. LANE.[3] [1]Allegheny College; [2]IEEE; [3]University of California, Berkeley. **Assessing Risk of Lyme Disease using Satellite Imagery in Northern California: Efficacy of Predicting Disease Risk in an Era of Land Use Changes.**

12. NEMANI, RAMAKRISHNA[1]; GOLDEN, KEITH [1]; VOTAVA, PETR[2]; MICHAELIS, ANDY [2]; WHITE, MICHAEL[3]; MELTON, FORREST[2]; GLYMOUR, CLARK[4]; RUNNING, STEVE[5]; MYNENI, Ranga[6] and JOSEPH COUGHLAN.[1] [1]NASA Ames Research Center; [2]CSU Monterey Bay; [3]Utah State University; [4]Carnegie Mellon University; [5]University of Montana; [6]Boston University. **Biospheric Monitoring and Forecasting Using Ecosystem Modeling and Satellite Data.**

13. FISHER, ANN and RACHAEL DEMPSEY. Penn State University. **Improve Local and Regional Decisions with Projections and Tools About Climate and Land Use: The Consortium for Atlantic Regional Assessment (CARA)**

14. BELL, J. BRUCE; and STUART L. PIMM. Duke University. **Predicting Tropical Deforestation from Road Proximity and Land Cover History in the Amazon Basin.**

15. WELLING, LEIGH[1]; THOMAS, JULIE[2]; FAGRE, DAN[3] and KAREN SCOTT.[4] [1]National Park Service, Glacier National Park; [2]Air Resources Liaison; [3]USGS, Rocky Mountain Research Station, Glacier Field Station; [4]Environmental Protection Agency - Office of Air & Radiation, Climate Change Division. **Climate Change in National Parks: Moving from Knowledge to Action.**

16. MCMANUS, JOHN W.; GAYANILO, FELIMON; HAZRA, AMIT; KOOL, JOHNATHAN; LANGDON, CHRIS; YÑIGUEZ, ALETTA; BRANDT, MARILYN; and WADE COOPER. University of Miami – National Center for Caribbean Coral Reef Research (NCORE). **The Challenge of Building Forecasting into the New Online Data Navigator for South Florida.**

17. RABINOWITZ, PETER[1]; F JOSHUA DEIN[2]; ZIMRA GORDON[1] and LYNDA ODOFIN.[1] [1]Yale University School of Medicine; [2]USGS National Wildlife Health Center. **Animals as Sentinels of Human Environmental Health Hazards.**

18. HEYCK-WILLIAMS, SHANNON and JACOB SCHERR. Natural Resources Defense Council. **Connecting Policy Makers with Environmental Knowledge: The Earth Legacy Commission on U.S. Leadership in the Global Environment.**

19. HAROLD STONE. East Carolina University. **A Graphic Model to Aid Sustainable Decision Making in Environmental Policy.**

20. EFROYMSON, REBECCA[1]; VIRGINIA H. DALE[1]; LATHA M. BASKARAN[1]; LATHA M. BASKARAN[1]; MATTHEW ALDRIDGE[2]; MICHAEL BERRY[2]; MICHAEL CHANG[3]; CATHERINE STEWART[4] and ROBERT A. WASHINGTON-ALLEN.[1] [1]Oak Ridge National Laboratory; [2] University of Tennessee; [3]Georgia Institute of Technology; [4]Aberdeen Proving Ground. **RSim: A Simulation Model to Explore Impacts of Resource Use and Constraints on Military Installations and in Surrounding Regions.**

21. KUBY, LAUREN; REDMAN, CHARLES, L.; BUIZER, JAMES and BRENDA SHEARS. Arizona State University. **Arizona State University's International Institute for Sustainability: Research with a Purpose.**

22. MUBENGA, KAMONAYI[1]; JORDAN, NIKISA[1]; ENGEL-COX, JILL[2]; RAYMOND HOFF[1]; KEVIN MCCANN[1] and RAY ROGERS.[1] [1]University of Maryland Baltimore County; [2]UMBC – Battelle Memorial Institute. **Blogging Smog: The U.S. Air Quality Weblog.**

23. TAKLE, EUGENE S.; KING, CATHERINE L.; CRUSE, RICK; ARRITT, RAYMOND W.; GASSMAN, PHIL; GUTOWSKI, JR., WILLIAM J.; ASBJORNSEN, HEIDI; DEBINSKI, DIANE; JHA, MANOJ; and MAHESH SAHU. Iowa State University. Basing Policy on Sound Science: **Using Human Behavior Models Coupled with Physically Based Models.**

24. DIERAUF, LESLIE A.; METEYER, CAROL U.; SLOTA, PAUL and F. JOSHUA DEIN. USGS, Biological Resources Discipline - National Wildlife Health Center. **Thirty Years of Data Demonstrating Changes in Wildlife Health - U.S. Geological Survey's (USGS) National Wildlife Health Center, Madison, WI.**

25. LUCY BENNISON LAFFITTE. North Carolina State University. **What Does Environmental Sustainability Have in Common with Homeland Security? Deep Pockets of Social Capital.**

26. KAVANAGH, KATHLEEN[1]; LINK, TIM [1]; MARSHALL, JOHN D.[1]; BRAATNE, JEFF[1]; HAN, HAN-SAP[1]; CUNDY, TERRY [2]; DALEY-LAURSEN, STEVEN [1] and WOODAM CHUNG.[3] [1]University of Idaho; [2]Potlatch Corporation; [3]University of Montana. **Collaborative Watershed Studies of Ecosystem Responses to Current Forest Harvest Practices in the Rocky Mountains, USA.**

27. SMITH, RICHARD; ALEXANDER, RICHARD B.; SCHWARZ, GREGORY E. and MICHAEL C. IERARDI. U.S. Geological Survey. **Effects of Structural Changes in U.S. Animal Agriculture on Fecal Coliform Contamination of Streams.**

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