

America's Climate Choices: Panel on Advancing the Science of Climate Change

Committee

Pamela A. Matson

Chair

Pamela Matson (Chair) (NAS) is the Chester Naramore Dean of Stanford University's School of Earth Sciences. She is also the Richard and Rhoda Goldman Professor of Environmental Studies, a senior fellow of the Woods Institute for Environment, and co-leader of Stanford's Initiative on Environment and Sustainability. Her research focuses on biogeochemical cycling and land/water interactions in tropical forests and agricultural systems, and on sustainability science. Together with hydrologists, atmospheric scientists, economists and agronomists, she analyzes the economic drivers and environmental consequences of land use and resource use decisions in agricultural systems, with the objective of identifying practices that are economically and environmentally sustainable. She and her research team also evaluate the vulnerability of human-environment systems to climate and other global changes. Pamela joined the Stanford faculty in 1997, following positions as professor at UC Berkeley and research scientist at NASA. She earned her B.S. at the University of Wisconsin – Eau Claire, M.S. at Indiana University, and Ph.D. at Oregon State University. She was the founding chair of the National Academies Roundtable on Science and Technology for Sustainability, is a past President of the Ecological Society of America, and served on the science committee for the International Geosphere-Biosphere Program. She currently serves on the board of trustees of the World Wildlife Fund. She was elected to the American Academy of Arts and Sciences in 1992 and to the National Academy of Sciences in 1994. In 1995, Dr. Matson was selected as a MacArthur Fellow, and in 1997 was elected a Fellow of the American Association for the Advancement of Science. In 2002 she was named the Burton and Deedee McMurtry University Fellow in Undergraduate Education at Stanford.

Thomas Dietz

Vice Chair

Thomas Dietz (vice chair) is Assistant Vice President for Environmental Research, Director of the Environmental Science and Policy Program, and Professor of Sociology and Crop and Soil Sciences at Michigan State University. His current research examines the human driving forces of environmental change, environmental values and the interplay between science and democracy in environmental issues. His publications include 11 books and over 100 research papers and book chapters, including co-authorship of the framework and synthesis documents of the Millennium Ecosystem Assessment. He is a National Associate of the National Academy of Sciences, a Fellow of the American Association for the Advancement of Science and has been awarded the Sustainability Science Award of the Ecological Society of America, the Distinguished Contribution Award of the American Sociological Association Section on Environment, Technology and Society, and the Outstanding Publication Award, also from the American Sociological Association Section on Environment, Technology and Society. Dietz has served on numerous National Academies panels and chaired the Committee on the Human Dimensions of Global Change and the Panel on Public Participation in Environmental Assessment and Decision Making. He holds a Bachelor of General Studies degree from Kent State and a PhD in Ecology from the University of California at Davis.

Waleed Abdalati

Member

Waleed Abdalati is the director of the Center for the Study of Earth from Space in CIRES at the University of Colorado, where he is also an associate professor of Geography. He conducts research on high-latitude glaciers and ice sheets using satellite and airborne instruments. From 2004-2008 he was head of NASA Goddard Space Flight Center's Cryospheric Sciences Branch, supervising a group of scientists that work with satellite and aircraft instruments to understand the Earth's changing ice cover. From 2000 to the 2006, he managed NASA's Cryospheric Sciences Program, overseeing NASA-funded research efforts on glaciers, ice sheets, sea ice, and polar climate. During that time, he also served as Program Scientist for NASA's Ice Cloud and land Elevation Satellite (ICESat), which has as its primary objective understanding changes in the Earth's ice cover. From 1996 through 2000, Dr. Abdalati was a research scientist at NASA's Goddard Space Flight Center, and from 1986-1990 he worked as a mechanical engineer in the aerospace industry. He received his Ph.D. from the University of Colorado's Program in Atmospheric and Ocean Sciences in 1996, an M.S. degree in Aerospace Engineering Sciences from the University of Colorado in 1991, and a B.S. in Mechanical Engineering from Syracuse University in 1986. Dr. Abdalati has led or participated in 9 field expeditions to remote regions of the Greenland ice sheet and the ice caps in the Canadian Arctic. He has received numerous awards for his research and service to NASA, including the Presidential Early Career Award for Scientists and Engineers from the White House in 1999 and the NASA Exceptional Service Medal in 2004.

Antonio J. Busalacchi, Jr.

Member

Antonio J. Busalacchi, Jr. is Director of the Earth System Science Interdisciplinary Center (ESSIC) and Professor in the Department of Atmospheric and Oceanic Science at the University of Maryland, College Park. His research interests include tropical ocean circulation and its role in the coupled climate system, and climate variability and predictability. Dr. Busalacchi has been involved in the activities of the World Climate Research Program for many years and currently is Chair, of The Joint Scientific Committee (JSC) that oversees the WCRP and previously was co-chair of the scientific steering group for its subprogram on Climate Variability and Predictability (CLIVAR). Dr. Busalacchi has extensive NRC experience as a CHAIR of the Climate Research Committee and Committee on a Strategy to Mitigate the Impact of Sensor Descent and Demanifests on the NPOESS and GOES-R Spacecraft, and member of the Committee on Earth Studies, the Panel on the Tropical Ocean Global Atmosphere (TOGA) Program, and the Panel on Ocean Atmosphere Observations Supporting Short-Term Climate Predictions. He holds a Ph.D. in oceanography from Florida State University.

Ken Caldeira

Member

Ken Caldeira is a scientist at the Carnegie Institution for Science's Department of Global Ecology. His lab investigates ongoing changes to earth's climate and carbon cycle, climate and carbon-cycle changes in the ancient past, ocean carbon cycle and biogeochemistry, ocean acidification, land cover and climate change, carbon-neutral energy for economic growth and environmental preservation, and geoengineering. Dr. Caldeira previously worked as an Environmental Scientist and Physicist at Lawrence Livermore National Laboratory, where he researched long-term evolution of climate and geochemical cycles; ocean carbon sequestration; numerical simulation of climate, carbon, and biogeochemistry; marine biogeochemical cycles; and approaches to supplying energy services with diminished environmental footprint. Dr. Caldeira received his M.S. and Ph.D. degrees in Atmospheric Sciences from the New York University Department of Applied Science.

Robert W. Corell

Member

Robert W. Corell is the Global Change Director at the H. John Heinz III Center for Science, Economics, and the Environment at the American Meteorological Society. Prior to this he worked as a Senior Policy Fellow at the Policy Program of the American Meteorological Society and an Affiliate of the Washington Advisory Group. He recently completed an appointment as a Senior Research Fellow in the Belfer Center for Science and International Affairs at Harvard University's Kennedy School of Government. He is actively engaged in research concerned with the sciences of global change and the connection between science and public policy, particularly research activities that are focused on global and regional climate change, related environmental issues, and science to promote understanding of vulnerability and sustainable development. He was recently honored with a National Conservation Award for Science, in recognition of his more than four decades of environmental science work. In addition to his work with the American Meteorological Society, he co-chairs an international strategic planning group that is developing a strategy designed to harness science, technology, and innovation for sustainable development, serves as the Chair of the Arctic Climate Impact Assessment, counsels as Senior Science Advisor to ManyOne.Net, and is Chair of the Board of the Digital Universe Foundation. He was Assistant Director for Geosciences at the National Science Foundation where he had oversight for the Atmospheric, Earth, and Ocean Sciences and the global change programs of the National Science Foundation (NSF). He also led the United States Global Change Research Program from 1987-2000. He was formerly a professor and academic administrator at the University of New Hampshire. He is an oceanographer and engineer by background and training. He received his Ph.D., M.S., and B.S. degrees from the Massachusetts Institute of Technology (MIT).

Ruth S. DeFries

Member

Ruth DeFries (NAS) is Denning Professor of Sustainable Development in Columbia University's Department of Ecology, Evolution and Environmental Biology. Her research investigates the relationships between human activities, the land surface, and the biophysical and biogeochemical processes that regulate the Earth's habitability. She is interested in observing land cover and land use change at regional and global scales with remotely sensed data and exploring the implications for ecological services such as climate regulation, the carbon cycle, and biodiversity. Dr. DeFries obtained a Ph.D. in 1980 from the Department of Geography and Environmental Engineering at Johns Hopkins University and a Bachelor's degree in 1976 from Washington University with a major in earth science. Previously, Dr. DeFries worked at the National Research Council with the Committee on Global Change and taught at the Indian Institute of Technology in Bombay. She is a fellow of the Aldo Leopold Leadership Program.

Inez Y. Fung

Member

Inez Y. Fung is a professor of atmospheric sciences and founding Co-director of the Berkeley Institute of the Environment at the University of California, Berkeley. She studies the interactions between climate change and biogeochemical cycles, particularly the processes that maintain and alter the composition of the atmosphere. Her research emphasis is on using atmospheric transport models and a coupled carbon-climate model to examine how CO₂ sources and sinks are changing. She is also a member of the science team for NASA's Orbiting Carbon Observatory. Dr. Fung is a recipient of the American Geophysical Union's Roger Revelle Medal, and appears in a new NAS biography series for middle-school readers, Women's Adventure in Science. She is a fellow of the American Meteorological Society and the American Geophysical Union, and a member of the National Academy of Sciences. She received her B.S. in applied mathematics and her Ph.D. in meteorology from MIT.

Steven Gaines

Member

Steven Gaines is Director of the Marine Science Institute and Professor of Ecology, Evolution, and Marine Biology at the University of California at Santa Barbara. He is a marine ecologist who studies marine conservation, the design of marine reserves, the impact of climate change on oceans, and sustainable fisheries. Steve is a lead investigator of several groups: 1) PISCO (Partnership for Interdisciplinary Studies of Coastal Oceans), a consortium studying marine ecosystems of the west coast of the US, 2) the Santa Barbara Coastal LTER (Long Term Ecological Research) that studies connections between coastal watersheds and the ecology of kelp forests, 3) the Sustainable Fisheries Group, which uses market based approaches to enhance the sustainability of fisheries, and 4) Flow, Fish and Fishing, a biocomplexity project examining connections between ocean physics, fish, and fishing. Steve was awarded a Pew Fellowship in 2003 to extend the conceptual framework for networks of marine reserves and uses the findings of this work to aid the ongoing efforts of the Marine Life Protection Act to establish a state-wide network of marine protected areas. Steve received his Ph.D. in zoology in 1983 from Oregon State University and was a postdoctoral fellow and research scientist at Stanford University for four years. In 1987, he joined the faculty of Brown University and then the faculty at UC Santa Barbara in 1994. Dr. Gaines became Director of the Marine Science Institute at UCSB in 1997 and has served as Acting Vice Chancellor for Research at UCSB, and Acting Dean of Science.

George M. Hornberger

Member

George M. Hornberger (NAE) is a Distinguished University Professor in the Department of Civil and Environmental Engineering and the Department of Earth and Environmental Sciences at Vanderbilt University. His research interests are catchment hydrology and hydrochemistry, as well as the transport of colloids in geological media. His work centers on the coupling of field observations with mathematical modelling, with a focus on understanding how water is routed physically through soils and rocks to streams and how hydrological processes and geochemical processes combine to produce observed stream dynamics. This modelling work allows the extension of work on individual catchments to regional scales and to the investigation of the impact of meteorological driving variables on catchment hydrology. Dr. Hornberger is a member of the American Geophysical Union, the Geological Society of America, the Society of Sigma Xi, and the American Women in Science. He has served on numerous NRC studies and is currently a member of the Report Review Committee. He also chairs the Board on Earth Sciences and Resources. Dr. Hornberger received his Ph.D. in hydrology from Stanford University.

Maria C. Lemos

Member

Maria Carmen Lemos is an associate professor of natural resources and environment at the University of Michigan and a Senior Policy Analyst at the Udall Center for Studies of Public Policy at the University of Arizona. She holds a Ph.D. in political science from the Massachusetts Institute of Technology. Her research interests focus on the use of technical and scientific knowledge in environmental policy making, especially in less developed countries, the impact of technocratic decision making on democracy and equity, public participation in policy making, and the human dimensions of global change. A small part of her work is funded by CCSP programs in NOAA. Dr. Lemos has contributed to a number of national and international efforts related to climate change, including the Intergovernmental Panel on Climate Change fourth assessment (chapter on industry, settlement, and society), and CCSP decision support systems on seasonal to interannual forecasts and the carbon cycle.

Susanne C. Moser

Member

Susanne C. Moser is Director and Principal Researcher of Susanne Moser Research and Consulting and Associate Researcher at the University of California-Santa Cruz' Institute of Marine Sciences. Previously, she was a Research Scientist at the Institute for the Study of Society and Environment at the National Center for Atmospheric Research and served as staff scientist at the Union of Concerned Scientists, a visiting assistant professor at Clark University, and a fellow in the Global Environmental Assessment Project at Harvard University. Her research interests include the impacts of global environmental change, especially in the coastal, public health, and forest sectors, societal responses to environmental hazards in the face of uncertainty, the use of science to support policy- and decision-making, and the effective communication of climate change to facilitate social change. Current work focuses on developing adaptation strategies to climate change at local and state levels, identifying ways to promote community resilience, and building decision support systems. She is a fellow of the Aldo Leopold and Donella Meadows Leadership Programs and received a diploma in Applied Physical Geography from the University of Trier and M.A. and Ph.D. degrees in Geography from Clark University.

Richard H. Moss

Member

Richard H. Moss is Vice President and Managing Director for Climate Change at the World Wildlife Fund (WWF). Dr. Moss is at the forefront of WWF's efforts to develop conservation plans that account for changing climate and contribute to rapid reductions in greenhouse gas emissions. He ensures that the best science and information is used in WWF's planning, and that solutions to climate change are a global priority. As a science-driven, global thinker, Dr. Moss is shaping WWF's leadership role to focus on adapting to climate changes that can no longer be avoided and reducing reductions. Among his many accomplishments in the climate field, Dr. Moss has played an influential role as a member of the 2007 Nobel Prize-winning Intergovernmental Panel on Climate Change (IPCC) team. He served as head of the technical staff of the impacts-adaptation-mitigation working group from 1993-1999 and edited or co-authored a number of IPCC reports including the Panel's first examination of The Regional Impacts of Climate Change (1998). He also co-authored IPCC's first methodology on consistently evaluating and communicating scientific uncertainty in assessments, used by authors of the IPCC's Third Assessment Report.. He presently serves as co-chair of the IPCC Task Group on Data and Scenario Support for Impact and Climate Analysis. From 2000 to 2006, he served as director of the coordination office for the United States Climate Change Science Program, where he led preparation of the program's ten-year Strategic Plan (2003) focusing on development and application of research to support decision making. Dr. Moss earned his Ph.D. from Princeton University's Woodrow Wilson School of Public and International Affairs, his MPA from Princeton University, and his B.A. from Carleton College.

Edward A. Parson

Member

Edward A. Parson is Professor of Law and Professor of Natural Resources & Environment at the University of Michigan. His research examines international environmental policy, the role of science and technology in public policy, and the political economy of regulation. Parson's recent articles have appeared in *Science*, *Climatic Change*, *Issues in Science and Technology*, the *Journal of Economic Literature*, and the *Annual Review of Energy and the Environment*. His most recent books are *The Science and Politics of Global Climate Change* (Cambridge, 2006, with Andrew Dessler), and *Protecting the Ozone Layer: Science and Strategy* (Oxford, 2003), which won the 2004 Harold and Margaret Sprout Award of the International Studies Association. Parson has chaired and served on several senior advisory committees for the National Academy of Sciences and the U.S. Government Global Change Research Program, including the Synthesis Team for the US National Assessment of Climate Impacts. In 2005, he was appointed to the National Advisory Board of the Union of Concerned Scientists. He has worked and consulted for the International Institute for Applied

Systems Analysis, the United Nations Environment Program, the Office of Technology Assessment of the U.S. Congress, the Privy Council Office of the Government of Canada, and the White House Office of Science and Technology Policy, and spent twelve years on the faculty of Harvard's Kennedy School of Government. He holds degrees in Physics from the University of Toronto and in Management Science from the University of British Columbia, and a Ph.D. in Public Policy from Harvard.

A. R. Ravishankara

Member

Akkihebbal "Ravi" Ravishankara (NAS) is an atmospheric chemist at the U.S. Commerce Department's National Oceanic and Atmospheric Administration in Boulder, Colorado. He is Director of the Chemical Sciences Division of the NOAA Earth System Research Laboratory. Ravishankara's research has contributed fundamental studies of the gas-phase and surface chemistry of Earth's atmosphere. His investigations have advanced the understanding of basic chemical processes and reaction rates related to several major environmental issues, including ozone-layer depletion, climate change, and air pollution. For example, his results have led to a better understanding of the chemistry that causes the Antarctic ozone hole, identified new processes that affect ozone pollution in the lower atmosphere, and elucidated the role of aerosols and clouds in climate. In addition, he has led the evaluation of the "ozone-friendliness" and "climate friendliness" of many substances that have been proposed for use in commercial and industrial applications. Ravishankara has played leading roles in national and international reports assessing the state-of-the-science understanding of ozone-layer depletion and other issues. He is a Cochair of the Scientific Assessment Panel of the U.N. Montreal Protocol that protects the stratospheric ozone layer. He is currently co-leading an effort within NOAA to establish an integrated program linking climate change and air quality. A research scientist with NOAA since 1984, Ravishankara has also been an Adjunct Professor of Chemistry at the University of Colorado in Boulder since 1989. He is a member of the U.S. National Academy of Sciences. Awards include his election as a Fellow of the American Geophysical Union, Fellow of the American Association for the Advancement of Science, Fellow of the United Kingdom Royal Society of Chemistry, recipient of the Polanyi Medal and Centenary lectureship of the Royal Society of Chemistry, the U.S. Environmental Protection Agency's Stratospheric Ozone Protection Award, the Department of Commerce Silver Medal, and the U.S. Presidential Rank Award. Ravishankara received his doctorate in physical chemistry from the University of Florida in 1975. He has authored or coauthored over 300 scientific publications.

Raymond W. Schmitt

Member

Raymond W. Schmitt is a Senior Scientist at the Woods Hole Oceanographic Institution where he has spent most of his career. His research interests include oceanic mixing and microstructure, double-diffusive convection, the thermohaline circulation, oceanic freshwater budgets, the salinity distribution and its measurement, the use of acoustics for imaging fine structure, and the development of instrumentation. He is also interested in the intergenerational problem of sustaining long-term observations for climate. Dr. Schmitt has served on ocean sciences and polar program panels with the National Science Foundation, the Ocean Observing System Development Panel, the CLIVAR Science Steering Group, and the Ocean Studies Board. He was named a J.S. Guggenheim fellow in 1997 and has authored or co-authored over 75 publications. Dr. Schmitt earned his Ph.D. in physical oceanography from the University of Rhode Island and his B.S. in physics from Carnegie Mellon University.

B. L. Turner, II

Member

B. L. (Billie Lee) Turner II (NAS) is Gilbert F. White Professor of Environment and Society in Arizona State University's School of Geographical Sciences. For most of his career (1980-2008) he taught at Clark University in Worcester, Massachusetts, where he served as the Alice C. Higgins and Milton P. Professor of Environment and Society, and Director of the Graduate School of Geography. He received his BA and MA degrees from the University of Texas at Austin in 1968 and 1969, respectively and his PhD at the University of Wisconsin, Madison in 1974. Turner's research interests center on human-environment relationships, specifically dealing with land change science, sustainability, tropical forests, and the ancient Maya. He is currently engaged in a long-term study on deforestation and sustainability in the southern Yucatán. Dr. Turner is associated with the development of Land Use/Cover Change studies exemplified in the international programs sponsored by the IGBP and IHDP. He has also promoted the emerging field of 'Sustainability Science', a major focus at Arizona State University. He is a former Guggenheim Fellow and Fellow of the Center for Advanced Studies in the Behavioral Sciences, recipient of research honors from various geographical associations. He was elected to the National Academy of Sciences in 1995, and the American Academy of Arts and Sciences in 1998.

Warren M. Washington

Member

Warren M. Washington (NAE) is a senior scientist and head of the Climate Change Research Section in the Climate and Global Dynamics Division at the National Center for Atmospheric Research (NCAR). After completing his doctorate in meteorology at Pennsylvania State University, he joined NCAR in 1963 as a research scientist. Dr. Washington's areas of expertise are atmospheric science and climate research, and he specializes in computer modeling of the Earth's climate. He serves as a consultant and advisor to a number of government officials and committees on climate-system modeling. From 1978 to 1984, he served on the President's National Advisory Committee on Oceans and Atmosphere. In 1998, he was appointed to NOAA's Science Advisory Board. In 2002, he was appointed to the Science Advisory Panel of the U.S. Commission on Ocean Policy and the National Academies' Coordinating Committee on Global Change. Dr. Washington's NRC service is extensive and includes membership on the Board on Sustainable Development, the Commission on Geosciences, Environment, and Resources, the Board on Atmospheric Sciences and Climate, and the Panel on Earth and Atmospheric Sciences (chair). He is past chair of the National Science Board.

John P. Weyant

Member

John P. Weyant is Professor of Management Science and Engineering, Director of the Energy Modeling Forum (EMF) and Deputy Director of the Precourt Institute for Energy Efficiency at Stanford University. He is also a Senior Fellow of the Freeman Spogli Institute for International Studies and the Woods Institute for the Environment at Stanford. Prof. Weyant earned a B.S./M.S. in Aeronautical Engineering and Astronautics, M.S. degrees in Engineering Management and in Operations Research and Statistics all from Rensselaer Polytechnic Institute, and a Ph.D. in Management Science with minors in Economics, Operations Research, and Organization Theory from University of California at Berkeley. He also was also a National Science Foundation Post-Doctoral Fellow at Harvard's Kennedy School of Government. His current research focuses on analysis of global climate change policy options, energy efficiency analysis, energy technology assessment, and models for strategic planning. Weyant has been a convening lead author or lead author for the Intergovernmental Panel on Climate Change for chapters on integrated assessment, greenhouse gas mitigation, integrated climate impacts, and sustainable development, and most recently served as a review editor for the climate change mitigation working group of the IPCC's forth assessment report. He has been active in the U.S. debate on climate change policy through the Department of State, the Department of Energy and the Environmental Protection Agency. In California, he is a member of the California Air Resources Board's Economic and Technology Advancement Advisory Committee (ETAAC) which is charged with making recommendations for technology policies to help implement AB 32, The Global Warming Solutions Act of 2006. Weyant was awarded the US Association for Energy Economics' 2008 Adelman-Frankel award for unique and enduring contributions to the field of energy economics. Weyant was honored in 2007 as a major contributor to the Nobel Peace prize awarded to the Intergovernmental Panel on Climate Change and in 2008 by Chairman Mary Nichols for contributions to the to the California Air Resources Board's Economic and Technology Advancement Advisory Committee on AB 32.

David A. Whelan

Member

David A. Whelan (NAE) is Vice President and Deputy General Manager of Boeing's Advanced Systems and Chief Scientist, Integrated Defense Systems. Prior to joining Boeing in 2001, Dr. Whelan was Director of the Tactical Technology Office at the Defense Advanced Research Projects Agency (DARPA), where he led the development of enabling technologies, such as unmanned vehicles and space-based radar systems. Prior to his position with DARPA, Dr. Whelan held several positions of increasing responsibility with Hughes Aircraft in the development and application of Radar Systems. His high-technology development experience also includes positions as research physicist for Lawrence Livermore National Laboratory, as well as one of four lead engineers assigned for the design and development of the B-2 Stealth Bomber Program at Northrop Grumman. Dr. Whelan is Vice Chairman of the NRC Naval Studies Board and a member of the NRC USSOCOM Standing Committee. He is a Director of the HRL (former Hughes Research Laboratory) and serves on the LLNL Directors Review Committee for the Physics Department. Dr. Whelan is the recipient of Secretary of Defense Medal for Meritorious Civilian Service (2001), Secretary of Defense Medal for Outstanding Public Service (1998) and the US Air Force Medal for Meritorious Civilian Service (2008).