Developing a Research Agenda and Research Governance Approaches for Climate Intervention Strategies that Reflect Sunlight to Cool Earth

Committee

Christopher B. Field

Co-Chair

DR. CHRISTOPHER B. FIELD, Chair, (NAS) is the Perry L. McCarty Director of the Stanford Woods Institute for the Environment and Melvin and Joan Lane Professor for Interdisciplinary Environmental Studies. His research focuses on climate change, ranging from work on improving climate models, to prospects for renewable energy systems, to community organizations that can minimize the risk of a tragedy of the commons. Dr. Field was the founding director of the Carnegie Institution's Department of Global Ecology, a position he held from 2002 to 2016. He was co-chair of Working Group II of the Intergovernmental Panel on Climate Change (IPCC) from 2008 to 2015, where he led the effort on the IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (2012) and the Working Group II contribution to the IPCC Fifth Assessment Report (2014) on Impacts, Adaptation, and Vulnerability. His widely cited work has earned many recognitions, including election to the National Academy of Sciences, the Max Planck Research Award, and the Roger Revelle Medal. Dr. Field's A.B. is in biology from Harvard University (1975). His Ph.D. is in biology from Stanford University (1981). For the National Academies, Dr. Field served as a member of the Board on Environmental Studies and Toxicology and he has recently served on the Advisory Board for the Gulf Research Program, the Committee to Review the Draft Climate Science Special Report, and the 2017–2027 Decadal Survey for Earth Science and applications from Space.

William W. Cheung

Member

DR. WILLIAM W. L. CHEUNG is a Professor and Canada Research Chair in Ocean Sustainability and Global Change at the Institute for the Oceans and Fisheries at the University of British Columbia (UBC). His main research areas include understanding the responses and vulnerabilities of marine ecosystems and fisheries to global change, exploring solution options to meet climate challenges in the ocean, and examining trade-offs in managing and conserving living marine resources. His works cut across multiple disciplines, from oceanography to ecology, economics and social sciences, and range from local to global scales. William has published over 150 peer-reviewed publications, including papers in leading international journals. William is actively involved in international and regional initiatives that bridge science and policy. For instance, currently, he is a member of the Core Writing Team for the Synthesis Report in the IPCC's Sixth Assessment and a coordinating lead author for the Intergovernmental Panel on Climate Change (IPCC) Special Report for the Oceans and Cryosphere in the Changing Climate. He was a Coordinating Lead Author of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) and Global Biodiversity Outlook. He serves as associate editor for Global Change Biology and Frontiers in Ecology and the Environment (ESA Journal), and member of the editorial board of Fish and Fisheries, Fisheries Oceanography and Frontier in Marine Sciences, and as scientific advisors in a number of international and local organizations. William obtained his B.Sc. in biology (1998) and M.Phil. (2001) from the University of Hong Kong. He worked for WWF Hong Kong for two years, after which he completed his Ph.D. in resource management and environmental studies at UBC (2007). From 2009 to 2011, he was Lecturer in Marine Ecosystem Services in the School of Environmental Sciences, University of East Anglia.

Lisa Dilling

Member

DR. LISA DILLING is Professor of Environmental Studies, a Fellow of the Cooperative Institute for Research in Environmental Sciences, and a member of the Center for Science and Technology Policy Research at the University of Colorado, Boulder. She is Director of the Western Water Assessment, a National Oceanic and Atmospheric Administration Regional Integrated Sciences and Assessment project that studies and facilitates the use of climate information in decision making in the Intermountain West. Professor Dilling's scholarship focuses on decision making, the use of information and science policies related to climate change, adaptation, carbon management, and geoengineering. Her current projects examine drought in urban water systems, water governance and climate change, municipal adaptation to hazards, decision making in public lands management, and knowledge for adaptation among pastoralists. She has authored numerous articles and is co-editor of the book Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change, from Cambridge University Press. She also spent the 2016–2017 academic year at the Institute for Science, Innovation and Society at the University of Oxford supported by a Leverhulme Trust Visiting Professorship. Professor Dilling received her Ph.D. in biological sciences from the University of California, Santa Barbara in 1997.

Peter C. Frumhoff

Member

DR. PETER C. FRUMHOFF is Director of Science and Policy and Chief Climate Scientist at the Union of Concerned Scientists. A global change ecologist, Dr. Frumhoff has published widely at the nexus of climate science and policy including on the climate responsibilities of fossil fuel companies, the attribution of extreme events to climate change, the ecological impacts of climate change, the role of forests and land use in climate mitigation, and the societal responsibilities of geoengineering researchers. He is a member of the Board on Atmospheric Sciences and Climate at the National Academies of Sciences, Engineering, and Medicine. He was a lead author of the Intergovernmental Panel on Climate Change's (IPCC's) 2007 Fourth Assessment Report and the 2000 IPCC Special Report on Land Use, Land-Use Change, and Forestry, and served as chair of the 2007 Northeast Climate Impacts Assessment. He served on the Advisory Committee on Climate Change and Natural Resource Science at the U.S. Department of the Interior and the board of directors of the American Wind Wildlife Institute. In 2014, Dr. Frumhoff was the Cox Visiting Professor in the School of Earth Sciences at Stanford University. Previously, he taught at Tufts University, Harvard University, and the University of Maryland. He also served as an American Association for the Advancement of Science Science and Diplomacy Fellow at the U.S. Agency for International Development, where he designed and led conservation and rural development programs in Latin America and East Africa. He holds a Ph.D. in ecology and an M.A. in zoology from the University of California, Davis, and a B.A. in psychology from the University of California, San Diego.

Henry T. Greely

Member

MR. HENRY (HANK) T. GREELY is Deane F. and Kate Edelman Johnson Professor of Law and Professor, by courtesy, of Genetics at Stanford University. He specializes in ethical, legal, and social issues arising from advances in the biosciences, particularly from genetics, neuroscience, and human stem cell research. Professor Greely is President of the International Neuroethics Society, directs the Stanford Center for Law and the Biosciences and the Stanford Program on Neuroscience in Society, chairs the California Advisory Committee on Human Stem Cell Research, and serves as co-chair of the Neuroethics Working Group on the National Institutes of Health BRAIN Initiative's Multi-Council Working Group. For the National Academies, he serves on the Committee on Science, Technology, and Law. In May 2016, he published the book The End of Sex and the Future of Human Reproduction. Professor Greely graduated from Stanford University in 1974 with a bachelor's degree in political science and from Yale Law School with a J.D. in 1977. He served as a law clerk for Judge John Minor Wisdom on the U.S. Court of Appeals for the Fifth Circuit and for Justice Potter Stewart of the U.S. Supreme Court. After working during the Carter Administration in the U.S. Departments of Defense and Energy, he entered private law practice in Los Angeles in 1981. He joined the Stanford University faculty in 1985.

Marion E. Hourdequin

Member

DR. MARION HOURDEQUIN is a Professor of Philosophy at Colorado College, where her research focuses on ethics and justice in relation to climate change and climate engineering; the social and ethical dimensions of ecological restoration; and environmental ethics. She has published work in a variety of journals, including Environmental Ethics; Environmental Values; Ethics & the Environment; Ethics, Policy, & Environment; Science, Technology, & Human Values; and Ethical Theory and Moral Practice. She is the author of Environmental Ethics: From Theory to Practice (Bloomsbury, 2015) and editor, with David Havlick, of Restoring Layered Landscapes (Oxford, 2016). Dr. Hourdequin is Vice President of the International Society for Environmental Ethics, and she currently serves as an Associate Editor for the journal Environmental Values and on the Editorial Board of Environmental Ethics. She earned her Ph.D. in philosophy at Duke University (2005) and her undergraduate degree in ecology and evolutionary biology at Princeton University (1995).

James W. Hurrell

Member

DR. JAMES W. HURRELL joined Colorado State University faculty in September 2018 as the Scott Presidential Chair in Environmental Science and Engineering and a professor in the Department of Atmospheric Science. Dr. Hurrell is a former director of the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, where he was a Senior Scientist in the Climate and Global Dynamics Laboratory (CGD). He is also the former Chief Scientist of Community Climate Projects in CGD, which includes the Community Earth System Model, and a former director of CGD and the NCAR Earth System Laboratory. Dr. Hurrell spent 1 year as a visiting scientist at the Hadley Centre for Climate Prediction and Research in the United Kingdom. Dr. Hurrell's research has centered on empirical and modeling studies and diagnostic analyses to better understand climate, climate variability, and climate change. He has authored or co-authored more than 100 peer-reviewed journal articles and book chapters, as well as dozens of other planning documents, workshop papers, and editorials. Dr. Hurrell has been extensively involved in the World Climate Research Programme (WCRP) on Climate Variability and Predictability (CLIVAR), including roles as co-chair of the Scientific Steering Group (SSG) of both U.S. and International CLIVAR, Chair of the Scientific Organizing Committee for the WCRP Open Science Conference (2011), and member of several other CLIVAR panels. He is currently a member and an officer of the Joint Scientific Committee of WCRP. Dr. Hurrell also has served the International Geosphere-Biosphere Programme as a member of the Global Ocean Ecosystem Dynamics SSG and the CLIVAR-PAGES (Past Global Changes) working group. Dr. Hurrell has been involved in assessment activities of the Intergovernmental Panel on Climate Change and the U.S. Climate Change Science Program. He has served on several National Research Council panels, and he has provided briefings and testimonies to both the U.S. Senate and the House of Representatives on climate change science.

Andrew Light

Member

DR. ANDREW LIGHT [until January 20, 2021; see note below] is on leave as University Professor of Philosophy, Public Policy, and Atmospheric Sciences at George Mason University and Distinguished Senior Fellow in the Climate Program at the World Resources Institute in Washington, D.C. He is currently serving as Acting Assistant Secretary and Principal Deputy Assistant Secretary for International Affairs at the U.S. Department of Energy. From 2013 to 2016 he served as Senior Adviser and India Counselor to the Special Envoy on Climate Change and Staff Climate Adviser in the Secretary of State's Office of Policy Planning in the U.S. Department of State. In this capacity, he served on the senior strategy team for the UN climate negotiations, Director of the U.S.-India Joint Working Group for Combating Climate Change, and Chair of the Interagency Climate Working Group on the Sustainable Development Goals, among other duties. In recognition of this work, Dr. Light was awarded the inaugural Alain Locke Award for Public Philosophy from the Society for the Advancement of American Philosophy in March 2016 and, with the larger State Department team working on Paris, a Superior Honor Award from the U.S. Department of State in July 2016 for “contributions to the U.S. effort that made the 21st Conference of the Parties to the UN Framework Convention on Climate Change in Paris, where the landmark Paris Agreement was concluded, a historic success.” In his academic work, Dr. Light is the author of more than 100 articles and book chapters, primarily on the normative dimensions of environmental policy, especially on climate change, restoration ecology, and urban sustainability, and he has authored, co-authored, and edited 19 books, including Environmental Values (2008), Controlling Technology (2005), Moral and Political Reasoning in Environmental Practice (2003), Technology and the Good Life? (2000), and Environmental Pragmatism (1996).

Albert Lin

Member

MR. ALBERT LIN is a Professor of Law at the University of California (UC), Davis School of Law, where he specializes in environmental and natural resources law and also teaches evidence. His research interests include toxic torts and the relationship among emerging technologies, the environment, and law. Prior to joining the UC Davis faculty in 2003, Professor Lin was a trial attorney for the Environment and Natural Resources Division of the U.S. Department of Justice. He is also the author of Prometheus Reimagined: Technology, Environment, and Law in the 21st Century (University of Michigan Press, 2013) and the co-author of a widely used environmental law casebook. He received his J.D. from the University of California, Berkeley School of Law (1996), his M.P.P. from the Harvard Kennedy School (1995), and his B.S. in biology from Emory University (1992).

Douglas MacMartin

Member

DR. DOUGLAS MacMARTIN is a senior research associate in the Sibley School of Mechanical & Aerospace Engineering at Cornell University, and also a Visiting Researcher in Computing + Mathematical Sciences at the California Institute of Technology. Prior to joining Caltech in 2000, he led the active control research and development program at United Technologies Research Center. His primary research focus is on solar climate engineering (geoengineering), working to help develop the knowledge base to support informed future societal decisions. This includes using design principles to assess what outcomes are possible from different strategies, simulating projected climate impacts of those strategies, how to assess and manage uncertainty, as well as supporting ongoing efforts to develop governance. His research is supported by NSF and by the Cornell Atkinson Center for Sustainability (through multiple philanthropic donors). Dr. MacMartin's research interests also include applying engineering dynamics and feedback analysis to study climate dynamics more broadly, as well as control design for the Thirty Meter Telescope project. He joined the steering committee for the Geoengineering Modeling Research Consortium in late 2020, and will be a chair of the 2022 Gordon Research Conference on Climate Engineering. In 2017 he testified in the US Congress at a hearing on geoengineering, and has provided numerous briefings including to the UN Environment Program in 2018. He received his Bachelors' degree in engineering science from the University of Toronto in 1987, and Masters and Ph.D. in Aeronautics and Astronautics from MIT in 1990 and 1992, respectively.

Robert McHenry

Member

MR. ROBERT McHENRY is the Chief Executive Officer of Bright Silicon Technologies, an optical microdevice manufacturing company. He is an expert in advanced technology system engineering and development, particularly with complex policy context. Rob's prior affiliations include the Palo Alto Research Center (PARC) from 2012 to 2020, where he held a number of roles including leading their Energy Technology Program, leading their publicly funded research and development business, and serving as corporate Chief Operating Officer. From 2007 to 2012, Rob served as a Defense Advanced Research Projects Agency (DARPA) program manager, formulating and leading complex maritime and aerospace system demonstration programs that established new technological and policy approaches for highly autonomous platforms. Prior to DARPA Rob ran a defense technology development consultancy, and he started his career as a nuclear submarine officer in the U.S. Navy. Rob holds a M.S. in Nuclear Engineering from the Massachusetts Institute of Technology, and a B.S. in Marine Engineering from the U.S. Naval Academy.

Juan Moreno-Cruz

Member

DR. JUAN MORENO-CRUZ is an Associate Professor at the School of Environment, Enterprise and Development and the Canada Research Chair in Energy Transitions at the University of Waterloo. He is also a CESifo Research Affiliate. He earned his Ph.D. in economics from the University of Calgary in Canada in 2010 and his B.Sc. (2003) and M.Sc. (2004) in electrical engineering from the Universidad de Los Andes in Colombia. Prior to his current position, he was an Associate Professor in the School of Economics at the Georgia Institute of Technology (2011–2017), where he remains an Adjunct Professor. He has been a Visiting Researcher in the Department of Global Ecology of the Carnegie Institution for Science at Stanford University and an Advisor for Carnegie Energy Innovation (since 2017). Dr. Moreno-Cruz's research focuses on the interaction of energy systems, technological change, and climate policy. Dr. Moreno-Cruz has investigated how technologies designed to modify the climate affect the strategic interaction among nations. His work on climate geoengineering economics has been published in top journals in his field and presented at venues across the United States, Canada, and Europe. Dr. Moreno-Cruz's work is at the intersection of applied theory and public policy.

Katharine Ricke

Member

DR. KATHARINE RICKE is an Assistant Professor at the School of Global Policy and Strategy at the University of California, San Diego, and holds a joint appointment with the Scripps Institution of Oceanography. She is a climate change scientist who integrates tools from the physical and social sciences to analyze climate policy problems. Dr. Ricke recently served as a research associate in the Sibley School of Mechanical and Aerospace Engineering at Cornell University and a fellow at the Carnegie Institution for Science. Her publications on solar geoengineering have included physical science on the regional climate effects, economic analysis of the strategic incentives created by geoengineering impacts, and foreign policy analysis of the international relations implications of solar geoengineering. Her research develops methods for accounting for uncertainty and heterogeneity in both the effects of climate change and in preferences for how to address them. She has analyzed uncertainty associated with phenomena including ocean acidification's effects on coral reefs, the warming effect from an emission of carbon dioxide today, the social cost of carbon, and decadal climate variability's influence on international climate agreements. Dr. Ricke received her B.S. in Earth, atmospheric, and planetary science from the Massachusetts Institute of Technology and her Ph.D. in engineering and public policy from Carnegie Mellon University.

Lynn M. Russell

Member

DR. LYNN M. RUSSELL is Professor of Climate, Atmospheric Sciences, and Physical Oceanography at Scripps Institution of Oceanography, University of California, San Diego, where she has led the Climate Sciences Curricular Group since 2009. Her research focuses on the processes that control atmospheric aerosols and their cloud interactions. Dr. Russell's work uses both modeling and measurement studies of atmospheric particles and their chemical composition, and she has studied marine aerosols, flux and entrainment in the marine boundary layer, terrestrial biogenic particles, combustion emissions, and feedbacks between climate and particle sources. She completed undergraduate degrees at Stanford University and received her Ph.D. in chemical engineering from the California Institute of Technology for her studies of marine aerosols. Her postdoctoral work as part of the National Center for Atmospheric Research Advanced Studies Program investigated aerosol and trace gas flux and entrainment in the marine boundary layer. She served on the faculty of Princeton University in the Department of Chemical Engineering before accepting her current position at Scripps in 2003. Dr. Russell has been honored with young investigator awards from the Office of Naval Research, the National Aeronautics and Space Administration, Dreyfus Foundation, the National Science Foundation, and the James S. McDonnell Foundation, and she received the Kenneth T. Whitby Award from the American Association for Aerosol Research (AAAR) (2003) for her contributions on atmospheric aerosol processes. She was elected as a fellow of AAAR in 2014 and of the American Geophysical Union in 2017. Dr. Russell also served as a member of the National Academy of Sciences' Committee on Geoengineering Climate: Technical Evaluation and Discussion of Impacts, which produced two reports including Climate Intervention: Reflecting Sunlight to Cool Earth in 2015.

Ambuj D. Sagar

Member

DR. AMBUJ D. SAGAR is the Vipula and Mahesh Chaturvedi Professor of Policy Studies and the founding Head of the School of Public Policy at the Indian Institute of Technology (IIT) Delhi. Dr. Sagar's interests broadly lie at the intersection of science, technology, and development. His work has focused on innovation policy for meeting sustainability and inclusivity challenges, energy innovation policy and strategies (in areas such as biofuels, clean cookstoves, coal power, automobiles, and institutional mechanisms such as climate innovation centers), climate change policy and politics, capacity development, and higher education policy. He has been an advisor/consultant to various Indian government ministries as well as many multilateral and bilateral agencies. Dr. Sagar did his undergraduate studies in mechanical engineering (1985) at IIT Delhi. He subsequently received an M.S. in aerospace engineering (1986) from the University of Michigan and then an M.S. in materials science (1989), a Ph.D. in polymers (1994), and an M.S. in technology and policy (1994) from the Massachusetts Institute of Technology.

Paul O. Wennberg

Member

DR. PAUL O. WENNBERG (NAS) is R. Stanton Avery Professor of Atmospheric Chemistry and Environmental Science and Engineering and the Director of Ronald and Maxine Linde Center for Global Environmental Science at the California Institute of Technology. His research has improved our understanding of stratosphere and troposphere composition and anthropogenic impacts on climate, ozone depletion, and air quality. His laboratory has developed of state-of-the-art in situ laboratory, airborne, and ground-based instrumentation. These instruments have participated in numerous field campaigns across the world. Dr. Wennberg's laboratory has also been at the center of the development of space- and ground-based measurement of greenhouse gases by remote sensing. He has helped to create the Total Carbon Column Observing Network (TCCON) that is used as the ground-based standard for measurement of greenhouse gas column abundance. Dr. Wennberg earned his B.A. in chemistry from Oberlin College in 1985 and his Ph.D. in physical chemistry from Harvard University in 1994. He was elected into the National Academy of Sciences in 2017 as a member of the geophysics section.