The National Academies of
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A Workshop on Ocean-based CDR Opportunities and Challenges,
Part 1: Setting the Stage
January 19, 2021
12pm - 5pm EST

DRAFT AGENDA

Purpose: This is the first of four workshops designed to explore the most important scientific and technical questions, as well as questions surrounding governance, needed to assess the benefits, risks, and potential scale for the responsible ocean-based carbon dioxide removal and sequestration approaches. This series of workshops is an activity in support of the NASEM Committee on A Research Strategy for Ocean-based Carbon Dioxide Removal (CDR) and Sequestration. Committee members will use this platform as one mechanism to gather information and converse with a diverse set of experts in the field, for the purpose of progressing the consensus study process.

During this workshop, we will examine the opportunities and challenges to ocean-based CDR broadly, including the role of ocean-based CDR in an overall global carbon mitigation strategy; legal and political considerations; social acceptance, ethics, and environmental justice; finance and economics; and finally we will examine parallel efforts from other countries pushing the boundaries on ocean-based CDR approaches. The remaining 3 workshops, to be held on January 27, February 2, and February 25, will focus on specific ocean-based CDR strategies.

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*This public meeting will be recorded and posted on our project website for the duration of the study. All panelists will be provided unique IDs to log in to the Zoom meeting as speakers; a public link will be sent out to registered viewers.

12:00 PM	**Welcome and Workshop Overview** Scott Doney, Committee Chair & University of Virginia
12:05 PM	**Keynote: Global Role for Carbon Removal Strategies** Oliver Geden, German Institute for International and Security Affairs
12:30 PM	**Legal and Political aspects of Ocean-based CDR** *Moderated by: Romany Webb, Committee Member & Columbia University* Panelists: William Burns, American University Anna-Maria Hubert, University of Calgary Lisa Suatoni, Natural Resources Defense Council Oliver Geden, German Institute for International and Security Affairs
1:30 PM	BREAK
1:45 PM	**Social Acceptance and Ethical Considerations to Ocean-based CDR** *Moderated by: Jane Flegal, Committee Member & William and Flora Hewlett Foundation*

Panelists:
David Morrow, American University
Sarah Cooley, Ocean Conservancy
Terre Satterfield, University of British Columbia

2:45 PM **Financial and Economic considerations to Ocean-based CDR**
Moderated by: Kate Moran, Committee Member & University of Victoria
Panelists:
Juan Moreno Cruz, University of Waterloo
Ryan Orbuch, Stripe Climate
Barbara Haya, University of California, Berkeley

3:45 PM BREAK

4:00 PM **Parallel Efforts in Advancement of Ocean-based CDR Strategies**
Moderated by: Andreas Oschlies, Committee Member & GEOMAR and University of Kiel
Panelists**:**
David Keller, GEOMAR, Kiel
Mark Preston, Bellona Foundation, Brussels
Phillip Williamson, University of East Anglia
Filip Meysman, University of Antwerp

5:00 PM **Closing comments and Adjourn**

Speaker Bios

Anna-Maria Hubert is an Assistant Professor in the Faculty of Law at the University of Calgary. She is also an Associate Fellow at the Institute for Science, Innovation, and Society at the University of Oxford. Anna-Maria's research interests lie generally in the area of public international law, focusing on the law of the sea, international environmental law, international human rights law, and international law and policy of science and emerging technologies. She has published extensively on the topic of the regulation and governance of climate engineering, and has provided information and advice to governments, intergovernmental organizations, NGOs, and scientific institutions on this topic, including by serving as an advisor to the International Union for Conservation of Nature (IUCN) and delegate at the meetings of the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter and its 1996 Protocol (known as the London Convention and Protocol).

From 2015 to 2019, she was Principal Investigator of the Geoengineering Research Governance Project (GRGP), a joint initiative of the University of Calgary, Institute for Advanced Sustainability Studies (IASS) in Potsdam and the University of Oxford, a project which sought to enhance understanding about the complex issues posed by proposed geoengineering techniques, and to analyze the changes required in governance and legal frameworks necessary to enable effective oversight in this space in line with accepted principles.

Barbara Haya is a research fellow at both the Goldman School of Public Policy and the California Institute for Energy and Environment at the University of California Berkeley. She leads the Berkeley Carbon Trading Project, which combines research and policy outreach in the study of the effectiveness of carbon offset programs. Barbara is also helping the University of California system develop its strategy for procuring carbon offsets for use towards the system's carbon neutrality goal. Barbara holds a PhD from UC Berkeley's Energy and Resources Group.

David P. Keller completed a Ph.D. in Marine, Estuarine, and Environmental Science from the University of Maryland in 2010 and then joined the Marine Biogeochemical Modelling Department at the GEOMAR Helmholtz Centre for Ocean Research in Kiel, Germany where he is now a senior research scientist. His research expertise and interests are broad and include assessing the potential and feasibility of carbon dioxide removal (negative emissions) approaches for climate change mitigation, understanding feedbacks between biogeochemical cycles and the climate, and investigating interactions between marine ecosystems and biogeochemical cycles. David uses Earth system models to conduct much of his work and enjoys collaborating with scientists from a wide range of other disciplines when working on complex research topics. David currently leads the EU Horizon 2020 project OceanNETs (€7.2M), which investigates ocean-based negative emission technologies, co-leads the Carbon Dioxide Removal Model Intercomparison Project (CDRMIP), and also leads a work package in the EU Horizon 2020 project COMFORT (€8.2M), which investigates tipping points in the climate system. He is a contributing author on the topic of carbon dioxide removal to the forthcoming Intergovernmental Panel on Climate Change Report (Working Group I Sixth Assessment; AR6).

David Morrow is Director of Research at the Institute for Carbon Removal Law and Policy at American University in Washington, DC, as well as a Research Fellow at the Institute for Philosophy and Public

Policy at George Mason University. He studies ethical issues in climate policy, including the ethics and governance of carbon removal.

Filip Meysman is full professor within the Department of Biology at the University of Antwerp. He is coordinator of the new Excellence Centre on Microbial Systems Technology, and active member of the Excellence Centre on the Global Change Ecology. His research focuses on biogeochemical cycling, and the large-scale interactions between biology, chemistry and geology. Ongoing research projects focus on how marine ecosystems can be used to extract CO_2 from the atmosphere via enhanced weathering and he investigates the intriguing and exciting phenomenon of microbial electricity in the ocean floor. As part of scientific outreach activities, he is coordinator of the large citizen science project CurieuzeNeuzen.

Juan Moreno-Cruz is an Associate Professor in the School of Environment, Enterprise and Development and the Canada Research Chair in Energy Transitions at the University of Waterloo. Before joining the University of Waterloo, he was an Assistant Professor and then an Associate Professor at the Georgia Institute of Technology. Dr. Moreno-Cruz has been a Visiting Researcher in the Department of Global Ecology of the Carnegie Institution for Science at Stanford University (since 2015), an Advisor for Carnegie Energy Innovation (since 2017), and a Research Associate of Harvard University's Solar Geoengineering Research Program. Moreno-Cruz obtained my Ph.D. in Economics from the University of Calgary in 2010. Before transitioning to Economics, he earned a M.Sc. and B.Sc. in Electrical Engineering at the Unversidad de Los Andes, in Bogota Colombia. His research focuses on global environmental change and how planetary-level technologies can support and enhance effective climate policy. His most influential work examines how solar and carbon geoengineering technologies affect climate policy. His most recent work provides novel insights into the process of energy transitions by demonstrating how energy access shapes the organization of the economy in cities and how energy consumption in cities in turn pollutes the local and global environment.

Lisa Suatoni has committed her career to applying rigorous science in the crafting of progressive policy in ocean conservation. As Deputy Director for Oceans at NRDC, she focuses on the ocean-climate nexus: how does climate change impact ocean ecosystems, marine life, and the people who depend on it, and how can ocean policy best offset those harms? Lisa is also an expert in sustainable fisheries policy. In addition to her work at NRDC, she is the Timothy B. Atkeson Environmental Lecturer in Law at Yale Law School, where she co-directs the Yale Environmental Protection Clinic. Lisa has a Ph.D. in Ecology and Evolutionary Biology from Yale.

Mark Preston Aragonès is currently a Policy Advisor at Bellona Europa. He works primarily on Carbon Dioxide Removal policy at the EU-level. He is a co-chair of the CDR Working Group of the Zero Emission Platform, the EU's technical advisory group for CCS. He also covers the position of Work Package Leader on European and International Governance for the EU-funded NEGEM project.

Miles Richardson, a prominent Indigenous leader, brings an extensive background in Indigenous and Canadian government relations. After graduating in 1979 from the University of Victoria with a Bachelor of Arts in economics, he served as administrator for the Skidegate Band Council and directed the establishment of the Haida Gwaii Watchmen program. In 1984 Miles was the youngest person to be elected President of the Council of the Haida Nation, a position he held until 1996. During his tenure,

Miles led the drafting of the constitution of the Haida Nation and protected the Gwaii Haanas area of Haida Gwaii with the Gwaii Haanas Agreement, the first modern nation-to-nation agreement between the Haida Nation and Canada. Miles was a member of the former BC Claims Task Force that made recommendations to the Government of Canada, Government of BC and First Nations in BC regarding the framework for negotiations to build new relationships. From 1991-1993, Miles was a delegate of the First Nations Summit Task Group, an executive body that represents First Nations in BC. In 1995, he was nominated by the summit and appointed as commissioner of the BC Treaty Commission, a position he held for two terms. In November 1998, Miles was chosen as Chief Commissioner by agreement of Canada, BC and the First Nations Summit, and remained in the position until 2004. In 2007, Miles was named an Officer of the Order of Canada. From 2010-2013 he was co-chair of the Indigenous Advisory Circle for the Institute on Governance. Currently Miles operates his own strategy and advisory firm, is on the board of directors for Canadians for a New Partnership, the advisory board for the Indigenous Leaders Initiative and the steering committee for the BC Indigenous Clean Energy Initiative.

Ryan Orbuch works on Climate at Stripe. His primary focus is on the company's carbon removal procurement, and ensuring Stripe's approach is accelerative to the field in collaboration with carbon removal founders and scientific experts. Prior to Stripe, Ryan cofounded an educational technology startup. Ryan is based in New York City, and can be reached at orbuch@stripe.com or at twitter.com/orbuch.

Oliver Geden is Senior Fellow at the German Institute for International and Security Affairs (SWP) and a research associate at the University of Oxford's Institute for Science, Innovation and Society. His work focuses on European and global climate policy, including the governance of carbon dioxide removal. Geden has been a visiting scholar at the International Institute for Applied Systems Analysis (IIASA), the Max Planck Institute for Meteorology (MPI-M), the Swiss Federal Institute of Technology (ETH), and the University of California, Berkeley, among others. During his time at SWP, he has been seconded to the policy planning units of both the German Federal Foreign Office and German Federal Ministry for Economic Affairs and Energy. Geden is a lead author for the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (AR6 Working Group 3 on mitigation) as well as a member of the Core Writing Team for the IPCC AR6 Synthesis Report. He holds a PhD in Social Anthropology from Humboldt University Berlin.

Phillip Williamson has mostly worked for the UK Natural Environment Research Council (NERC, now part of UK Research and Innovation), as a program Science Coordinator based at the University of East Anglia, Norwich. He has been involved in the planning and implementation of multi-institute and multidisciplinary research initiatives since the mid-1980s, working for Plymouth Marine Laboratory, the International Geosphere-Biosphere Programme and NERC. Topics have included marine biogeochemistry, ocean-atmosphere interactions and climate geoengineering. Recent activities have included science coordination of the UK Ocean Acidification research programme (co-funded by NERC, Defra and DECC), the Shelf Sea Biogeochemistry programme (co-funded by NERC and Defra), and the UK Greenhouse Gas Removal programme (co-funded by NERC, other Research Councils and BEIS). Williamson has led two reports on climate geoengineering for the UN Convention on Biological Diversity (CBD); has co-authored reports on ocean fertilization for the Intergovernmental Oceanographic Commission (IOC-UNESCO) and on ocean acidification for OSPAR and the CBD; and was a lead author for the 2019 Intergovernmental Panel on Climate Change (IPCC) Special Report on Ocean and Cryosphere in a Changing Climate, also its Glossary and Summary for Policy Makers. Williamson retired from NERC in January 2020 whilst continuing his interests in climate mitigation as an Honorary Reader at UEA.

Sarah Cooley is the Director of Climate Science at Ocean Conservancy, in Washington DC. She has been at Ocean Conservancy since 2014, most recently as the Director of the Ocean Acidification Program. She is currently a Coordinating Lead Author on the Oceans and Coastal Ecosystems chapter in Working Group II of the Intergovernmental Panel on Climate Change's 6th Assessment Report. Dr. Cooley was trained as an ocean carbon cycle scientist and numerical modeler, then moved into interdisciplinary science and policy. At Ocean Conservancy, she works to educate and engage decision-makers and stakeholders from every political perspective about ocean climate change, and to identify ways that different groups can take concrete, stepwise action on the issue. Follow her on Twitter at @CO2ley.

Terre Satterfield is a professor of Culture, Risk and the Environment within the Institute for Resources, Environment and Sustainability (IRES) at The University of British Columbia. An anthropologist by training and an interdisciplinarian by design, Terre's work concerns sustainable development in the context of debates about cultural meanings, environmental values, perceived risk, environmental and ecosystem health. Difficult environmental policy dilemmas and the qualitative and quantitative methods that might resolve these are of particular interest. Locally, her work pertains to First Nations interest in land management, oil and gas development, and regulatory contexts. Globally, her research incorporates biodiversity management and politics, and the perceived risk of new technologies (biotechnology, fracking and nanotechnology). Terre is also a board member or research scientist for several international initiatives that seek to better integrate social science research into policy analysis normally led by the natural and engineering scientists.

Wil Burns holds a PhD in international law from the University of Wales-Cardiff School of Law (now Cardiff University School of Law & Politics). He is a Professor of Research and Co-Director of the Institute for Carbon Removal Law & Policy at American University. He also serves as a Senior Fellow in the International Law Research Program at the Centre for International Governance Innovation (CIGI) in Canada, and as Co-Chair of the International Environmental Law Committee of the American Branch of the International Law Association. He directed the MS in Energy Policy and Climate Program at Johns Hopkins University, from 2012-2014, where he also taught courses in domestic and international climate change law and domestic energy law. He previously served as President of the Association for Environmental Studies and Sciences, and Co-Chair of the International Environmental Law interest group of the American Society of International Law. He has taught at various other academy institutions, including the University of California-Berkeley, Stanford University, Williams College, Colby College, Santa Clara University School of Law and the Monterey Institute of International Studies of Middlebury College. Prior to becoming an academic, he served as Assistant Secretary of State for Public Affairs for the State of Wisconsin and worked in the non-governmental sector for twenty years, including as Executive Director of the Pacific Center for International Studies, a think-tank that focused on implementation of international wildlife treaty regimes, including the Convention on Biological Diversity and International Convention for the Regulation of Whaling. He has published over 80 articles in law, science, and policy journals and has co-edited four books. His current areas of research focus are climate geoengineering and the role of loss and damage in international climate regimes. His edited volume, Climate Change Geoengineering: Philosophical Perspectives, Legal Issues, and Governance Frameworks, is available from Cambridge University Press.

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A RESEARCH STRATEGY FOR OCEAN CARBON DIOXIDE REMOVAL AND SEQUESTRATION

Committee Membership

A. Chair

Scott Doney is the inaugural Joe D. and Helen J. Kington Professor in Environmental Change at the University of Virginia. He was a postdoctoral fellow at the National Center for Atmospheric Research from 1991-1993, and he served as a scientist at the National Center for Atmospheric Research from 1993-2002 and then the Woods Hole Oceanographic Institution from 2002-2017 before moving to the University of Virginia. Dr. Doney's expertise spans oceanography, climate and biogeochemistry, with particular emphasis on the application of numerical models and data analysis to local to global-scale questions. His research focuses on how the global carbon cycle and ocean ecology respond to natural and human-driven climate change and ocean acidification. His previous experience with the National Academies includes membership on a number of committees in association with the Space Studies Board, Board on Atmospheric Sciences and Climate, and Ocean Studies Board. He has also served as an external reviewer for several National Academies reports. Dr. Doney graduated with a BA in chemistry from the University of California, San Diego in 1986 and a PhD in chemical oceanography from the Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography in 1991.

B. Members

Ken Buesseler is a marine radiochemist and member of the Ocean Twilight Zone Project at the Woods Hole Oceanographic Institution (WHOI). He is best known for work using natural and manmade isotopes in the ocean to study processes such as the movement of carbon and iron from the surface to deep ocean, as well as studies of the fate and transport of radioactive contaminants in the ocean. Dr. Buesseler participated in two ocean iron fertilization (OIF) experiments, leading one of three research vessels during the last major US OIF experiment off Antarctica. In 2009 he was elected Fellow of the American Geophysical Union; in 2013 selected as foreign member of the Dutch Academy of Sciences; and in 2018, elected as a Fellow of the American Association for the Advancement of Science. He is author on more than 175 research publications with 10 papers focused on OIF. In 2011 he was noted as the top cited ocean scientist by the Times Higher Education for the decade 2000-2010. Dr. Buesseler received his PhD from Massachusetts Institute of Technology and Woods Hole Oceanographic Institute in 1986.

Jane Flegal is a Program Officer in the Environment program at the William and Flora Hewlett Foundation, where she leads U.S. grant making to combat climate change and support a clean energy transition. She is also a faculty member at the School for the Future of Innovation in Society at Arizona State University and a Research Affiliate at the Institute for Science, Innovation and Society at the University of Oxford. Dr. Flegal is trained as a social scientist whose research has focused on the intersections of science, innovation,

and social outcomes, particularly in the context of climate change. In 2019, she presented to the National Academies' panel on developing a research agenda and research governance approaches for climate intervention strategies that reflect sunlight to cool earth. Dr. Flegal holds a PhD in Environmental Science, Policy, and Management from the University of California at Berkeley, and a BA in Environmental Studies and Politics from Mount Holyoke College.

M. Debora Iglesias-Rodriguez is a professor of biological oceanography at the Department of Ecology, Evolution, and Marine Biology at the University of California, Santa Barbara. Prof. Iglesias-Rodriguez has a B.Sc. in Biology & Biochemistry (University of Santiago de Compostela, Spain) and a PhD in phytoplankton carbon physiology (Swansea University, U.K.). Prof. Iglesias-Rodriguez has worked for twenty years on mechanisms governing microbial diversity and function, focusing on ocean acidification impacts on marine phytoplankton. Her work combines molecular approaches, carbon physiology and biogeochemistry both in the lab and in the field. Her lab is currently investigating ocean alkalinity enhancement as a CDR approach to reduce carbon dioxide in seawater and restore ecosystems that are particularly impacted by ocean acidification.

Kathryn Moran joined the University of Victoria in September 2011 as a Professor in the Faculty of Sciences and as Director of NEPTUNE Canada. In 2012, she was promoted to the position of President & CEO, Ocean Networks Canada. Since then, she has led and grown the organization following the vision of enhancing life on Earth by providing knowledge and leadership that deliver solutions to science, society, and industry. Dr. Moran's interests include topics related to the Arctic, ocean drilling, ocean observing, and climate change including ocean carbon sequestration methods and offshore renewable energy. She previously served on three National Academies committees: the Committee on Emerging Research Questions in the Arctic; the Gulf Research Program Advisory Board; and the Standing Committee on Understanding Gulf Ocean Systems. Dr. Moran holds degrees in marine science and engineering from the University of Pittsburgh, the University of Rhode Island and Dalhousie University.

Andreas Oschlies is Professor of Marine Biogeochemical Modelling at GEOMAR and the University of Kiel, Germany. His research interests include the global carbon, nitrogen and oxygen cycles, their sensitivities to environmental change, and the development and quality assessment of numerical models appropriate to investigate these. He was head of the Collaborative Research Centre "Climate-Biogeochemistry Interactions in the Tropical Ocean" (SFB754) running from 2008 to 2019, is funding member of the Global Ocean Oxygen Network (GO2NE), member of the GESAMP Working Group 41 on Marine Geoengineering, and currently leads the Priority Program "Climate Engineering: Risks, Challenges, Opportunities?" (SPP1689) funded by the German Research Foundation. He has contributed to a number of assessment reports, such as "Large-Scale Intentional Interventions into the Climate System? Assessing the Climate Engineering Debate" for the German Ministry of Education and Research (2011), "The European Transdisciplinary Assessment of Climate Engineering (EuTRACE)" for the European Commission (2015), the GESAMP "High level review of a wide range of proposed marine geoengineering techniques" (2019), and the IPCC Special Report on the Oceans and the Cryosphere (2019). Dr. Oschlies studied Theoretical Physics at Heidelberg and Cambridge (M.Phil., 1990) and received his PhD in Oceanography from the University of Kiel (1994).

Phil Renforth is an Associate Professor for the School of Engineering & Physical Sciences, Institute of Mechanical, Process & Energy Engineering at Heriot-Watt University, Edinburgh,

UK. He is an engineer and geochemist interested in understanding how reacting carbon dioxide with rocks and minerals may be able to help prevent climate change. His research expertise and interests include enhanced weathering, negative emission technologies and alkaline waste and is also interested in understanding geochemical carbon sequestration in the ocean by increasing ocean alkalinity. Dr. Renforth serves on the Scientific Committee for the international conference on negative CO2 emissions, and is the co-chief editor of Frontiers in Climate: Negative Emission Technologies. He is the science coordinator for the UK's Greenhouse Gas Removals programme. He presented to the National Academies Committee on Developing a Research Agenda for Carbon Dioxide Removal and Reliable Sequestration. Dr. Renforth earned his PhD in geo-environmental engineering from the University of Newcastle-upon-Tyne (2011).

Joe Roman is a Fellow in conservation biology and marine ecology at the Gund Institute for Environment, University of Vermont. His research focuses on the ecological functions and services provided by whales and other marine mammals. His team's work shows that great whales, the largest animals ever to have lived, play important ecological roles in the ocean—from enhancing primary productivity to providing habitat for more that 80 endemic species when their carcasses sink to the deep sea. Dr. Roman is dedicated to science policy, scientific diplomacy, teaching, and research. He received his AB from Harvard College in Visual and Environmental Studies (1985), his MS from the University of Florida in Wildlife Ecology and Conservation (1999), and his PhD in Organismic and Evolutionary Biology from Harvard University (2003).

Gaurav N. Sant is a Professor and a Henry Samueli Fellow at the University of California, Los Angeles with appointments in the Departments of Civil and Environmental Engineering and Materials Science and Engineering, and a Member of the California Nanosystems Institute and the Director of the Institute for Carbon Management. Dr. Sant's research interests include interfacial solid-liquid, solid-vapor, and solid-liquid-vapor reactions including dissolution, precipitation, and electrochemical corrosion with applications to (i) cement, concrete, porous media, (ii) hard biological tissues, (iii) metals and alloys, (iv) natural and synthetic minerals, and (v) glasses. In his research, special focus is placed on decarbonizing construction, the development of carbon mitigation technologies and promoting manufacturing disruptions in entrenched heavy-industry sectors. In 2016, Dr. Sant was selected as one of UCLA's Optimists and participated on a National Academies study, "Gaseous Carbon Waste Streams Utilization: Status and Research Needs." Dr. Sant received his Ph.D. in Civil Engineering from Purdue University in 2009.

David A. Siegel is presently a Distinguished Professor in the Department of Geography and Chair of the Interdepartmental Graduate Program in Marine Science at the University of California, Santa Barbara. His research focuses on aquatic ecosystems and their functioning on local to global scales. He has worked extensively in marine bio-optics, satellite ocean color remote sensing and oceanographic observations and numerical modeling for a wide range of problems from assessing marine biodiversity, quantifying the ocean's biological carbon pump, measuring and modeling Giant Kelp spatial population dynamics, and understanding the efficacy of nearshore fisheries management scenarios. Dr. Siegel has served as a member of the National Academies Committee on Assessing Requirements for Sustained Ocean Color Research and Operations (2011), and most recently was a member on the Ecosystems Panel of the National Academies 2018 Committee on the Decadal Survey for Earth Science and Applications from Space. He is a fellow of both the American Geophysical Union and the

American Association for the Advancement of Science. Dr. Siegel received a B.A. in Chemistry and a B.S. in Engineering Sciences from University of California, San Diego (1982) and M.S. and Ph.D. degrees in Geological Sciences from the University of Southern California (1986 & 1988).

Romany Webb is an Associate Research Scholar at Columbia Law School and Senior Fellow at the Sabin Center for Climate Change Law. Her research focuses on climate change mitigation, exploring how legal and policy tools can be used to drive reductions in greenhouse gas emissions, and support efforts to remove greenhouse gas from the atmosphere. Much of Ms. Webb's work centers on legal issues associated with the use of oceans for carbon dioxide removal and storage. She is a member of the Pacific Institute for Climate Solutions' "Solid Carbon" research study, which is assessing the feasibility of removing carbon dioxide from the ambient air using direct air capture facilities located on offshore platforms, and injecting the captured carbon dioxide into sub-seabed basalt rock formations. Ms. Webb received an LL.M., with a certificate of specialization in environmental law, from the University of California, Berkeley in 2013. She also holds an LL.B., awarded with first class honors, from the University of New South Wales (Australia).

Angelicque White is an Associate Professor in the School of Ocean and Earth Science and Technology at the University of Hawaii. Her primary research interests involve understanding how specific organisms acquire the elements necessary for growth and how different nutrient sources impact primary productivity and particle export. She is also working on the development of stochastic, optimization models which can allow for more realistic simulations of the taxonomic and biogeochemical diversity of the phytoplankton community in the upper water column of the North Pacific. Dr. White received her BS and MS in Biology (in 1998 and 2001 respectively) from the University of Alabama in Huntsville and her PhD in Biological Oceanography form Oregon State University (2006).