NATIONAL ACADEMIES *Sciences Engineering Medicine*

The Dynamics of Climate and the Macroeconomy: A Workshop

November 1–2, 2023

Contents

Meeting Logistics

The National Academies are hosting the Roundtable on Macroeconomics and Climate-related Risks and Opportunities executive meeting in a hybrid format. In-person participants will convene at the AC Hotel by Marriott Capitol Hill Navy Yard in Washington, DC. Remote participants will convene on a ZoomGov platform. Please review the meeting details provided below.

DATES & TIMES

- Wednesday, November 1st, 2023: 10:00 am–4:30 pm ET
- Thursday, November 2nd, 2023: 10:15 am–4:15 pm ET

MEETING CONTACTS

- Bridget McGovern (BAMcGovern@nas.edu, (614) 886-2767)
- Lindsay Moller (LMoller@nas.edu, (912) 675-2414)

IN-PERSON LOCATION

- The AC Hotel by Marriott Capitol Hill Navy Yard is located at 867 New Jersey Ave SE, Washington, DC 20003, less than a 10-minute walk from two Metro Stations (Instructions are included below).

ZOOM CONNECTION

- Please see page 9 for ZoomGov links for each day.
- **In-person participants should bring a laptop to the meeting**, since we will be using personal cameras to push each person's video out (see hybrid meeting guidance on next page).

FOOD NOTES

- Light breakfast, lunch, and a tea/coffee service with snacks will be served in the building. Vegetarian/vegan and gluten free options will be available. If federal participants are responsible for covering the costs of their meals, please contact Lindsay Moller with questions.

NATIONAL ACADEMIES Sciences Engineering Medicine

BOARD ON ATMOSPHERIC SCIENCES AND CLIMATE | BOARD ON ENVIRONMENTAL CHANGE AND SOCIETY | BOARD ON SCIENCE, TECHNOLOGY, AND ECONOMIC POLICY

The Dynamics of Climate and the Macroeconomy

A Workshop

CLICK HERE TO JOIN

Meeting ID
161 749 0850
Passcode
746257

Phone Only
Find your local number here.

AC Hotel by Marriott Washington DC Capitol Hill Navy Yard
867 New Jersey Ave SE,
Washington, DC 20003

Purpose

The first day of the workshop will compare perspectives on nonlinear, cascading and compounding risk to inform how climate science and macroeconomics may collectively better understand climate risk. It will focus on how the different disciplines assess and model cascading and compounding impacts. In a collaborative spirit the aim will be to establish what the community can learn from each other's approaches to studying cascading risk, and to start a workshop dialogue on what research gaps need to be filled. The second day of the workshop will explore examples and lessons learned from past nonlinear, cascading and compounding risk. The workshop will culminate in interactive breakouts to identify needs and priorities from the lens of developing a research agenda to advance research on systemic risk assessment.

WEDNESDAY, NOVEMBER 1, 2023 | 10:00 AM–4:30 PM | BLUE GRANITE ROOM

9:00–10:00 **Coffee and Light Breakfast Available**

10:00–10:30 **Opening Remarks**

Opening remarks from co-chairs

10:30–12:00 **Session 1: Nonlinear, Cascading, and Compounding Risks in the Climate**

~15 min overview keynote followed by a series of ~5-min flash talks and a panel discussion

This panel will first consider the characteristics of weather/climate changes and variability, including temporal and spatial manifestations. We will then hear from experts who are translating climate risks into impacts, adaptation, and vulnerability of coupled human-natural systems.

Moderators: ***Tim Lenton*** *(workshop co-chair) and* ***Brad Colman*** *(workshop planning committee)*

Overview: **David Armstrong McKay,** Research Impact Fellow, University of Exeter & Global Systems Institute

Panelists:

- **Matt Huber,** Professor, Department of Earth, Atmospheric, and Planetary Sciences, Purdue University
- **Kristie Ebi,** Professor in the Center for Health and the Global Environment, University of Washington
- **Elisabeth Gilmore,** Associate Professor in Environmental Engineering, Carleton University
- **Mikhail Chester,** Professor, School of Sustainable Engineering and the Built Environment, Arizona State University

12:00–1:00 **LUNCH**

1:00–2:30 **Session 2: Nonlinear, Cascading, and Compounding Risks in the Economy**

~15 min overview keynote followed by a series of ~5-min flash talks and a panel discussion

The second session will delve deeper into the propagation mechanisms of systemic risk across sectors, regions, and time. This panel will open with experts who consider micro-behavioral responses to risks cascading through the economy followed by macroeconomists who think about risks cascading through the macroeconomy and how climate might factor into risk cascades. The panel will bridge the micro and macro levels and attempt to find linkages between the two.

Moderators: Wendy Edelberg *(Roundtable co-chair and workshop planning committee) and* ***Lori Hunter*** *(workshop planning committee)*

Overview: **Karen Fisher-Vanden,** Distinguished Professor of Environmental and Resource Economics and Public Policy, Pennsylvania State University

Panelists:

- **Catherine Hausman,** Associate Professor of Public Policy, University of Michigan
- **Etienne Espagne,** Senior Climate Economist, World Bank
- **Stephie Fried,** Senior Economist, Federal Reserve Bank of San Francisco
- **Yongyang Cai,** Professor, Department of Agricultural, Environmental, and Developmental Economics, The Ohio State University
- **Matthew Kahn,** Provost Professor of Economics, University of Southern California

2:30–3:00 **BREAK**

3:00–4:00 **Interactive Breakouts: Capacity Building and Collaboration**

Self-selected breakout groups have a 1-hour discussion to articulate their approach to research and challenges that arise related to their group's topic to build capacity for collaboration.

Moderators: Sanya Carley *(University of Pennsylvania),* ***Tim Garrett*** *(University of Utah),* ***Sarah Kapnick*** *(National Oceanic and Atmospheric Administration),* ***Jeremy Martinich*** *(Environmental Protection Agency),* ***Yongyang Cai*** *(Ohio State University),* ***Frances Moore*** *(University of California, Davis),* ***James Neumann*** *(Industrial Economics),* ***Peter Wilcoxen*** *(Syracuse University)*

4:00–4:30 **Report Back**

Rapporteurs will have ~3 minutes to summarize key takeaways from their breakout discussion.

END OF DAY 1

THURSDAY, NOVEMBER 2, 2023 | 10:15 AM–4:15 PM | BLUE GRANITE ROOM

9:00–10:15 **Coffee and Light Breakfast Available**

10:15–10:30 **Opening Remarks + Recap Day 1**

Co-Chairs convene meeting

10:30–12:00 **Session 3: Past and Contemporary Lessons in Macroeconomic Shocks and Risks**

~10-min presentations + ~40 min Q&A

The third session will probe the sources of nonlinear, cascading, and compounding macroeconomic risk through a series of recent historical examples. The aim will be to draw out specific lessons about the nature and mechanisms of macroeconomic risk that are potentially relevant to climate-related risk (interpreted as both physical and transition risks).

Moderators: Sathya Gopalakrishnan *(workshop planning committee)*

Panelists:

- **Markus Brunnermeier,** Edwards S. Sanford Professor in Economics, Princeton University
- **Laurence Ball,** Professor of Economics, John Hopkins University
- **Vellore Arthi,** Assistant Professor in Economics, University of California, Irvine
- **Joseph Tainter,** Professor, Environment & Society, Utah State University

12:00–1:15 **LUNCH**

1:15–2:00 **Session 4: Perspectives on Future Directions**

Panel discussion

This fourth session will consider how to advance research on systemic risk assessment related to climate and macroeconomic dynamics. It will start with a panel offering different sectoral and institutional perspectives on this challenge—both academic and practical perspectives—before workshop participants identify priorities for a research agenda in structured breakouts.

Moderators: Eric Kemp-Benedict *(workshop co-chair) and* ***Paulina Jaramillo*** *(workshop planning committee)*

Panelists:

- **Ruth Richardson,** Executive Director, Accelerator for Systemic Risk Assessment
- **Katharine Mach,** Professor at the Rosenstiel School of Marine, Atmospheric, & Earth Science, University of Miami
- **Esteban Rossi-Hansberg,** Glen A. Lloyd Distinguished Service Professor, Kenneth C. Griffin Department of Economics, University of Chicago
- **Brian O'Neill,** Earth Scientist and Laboratory Fellow, Pacific Northwest National Laboratory
- **Tony Smith,** Professor of Economics Chair, Yale University

2:00–2:10 **Instructions for Breakouts**

2:10–3:30 **World Café Breakouts: Research Agenda Development**

Four 20-minute rounds. Workshop participants will rotate through each of the themed groups. At the beginning of each round, the moderator will summarize the previous discussion so each round builds on the previous ones.

***Moderators: Tim Garrett** (University of Utah), **Robert Kopp** (Rutgers University), **Adele Morris** (Federal Reserve Board), **Brian O'Neill** (Pacific Northwest National Laboratory), **Jeremy Martinich** (Environmental Protection Agency), **Kyle Meng** (Council of Economic Advisers), **James Neumann** (Industrial Economics), **Jisung Park** (University of Pennsylvania)*

3:30–3:45 **BREAK**

Virtual and in-person rapporteurs debrief to identify key takeaways for their breakout topic.

3:40–4:10 **Report Back + Discussion**

One rapporteur from each topic will have ~5 minutes to summarize the key takeaways from the in-person and virtual breakout discussions.

4:10–4:15 **Wrap Up**

MEETING ADJOURNS

Location, Transportation, and Accessibility

The Workshop will take place in the Blue Granite Room on the second floor of the AC Hotel.

LOCATION & PARKING

- The AC Hotel by Marriott Capitol Hill Navy Yard is located at 867 New Jersey Ave SE, Washington, DC 20003.
- Valet parking is available at the hotel for $57/day.
- Alternative, there is extremely street parking (2-hour maximum) and a Whole Foods across the street with a parking garage.

BY METRO

- **6-min walk from Navy Yard Station:** Take the Green Line to Navy Yard-Ballpark Station. Exit station and head north on New Jersey Ave SE toward L St SE. Hotel will be on your left.
- **8-min walk from Capitol South Station:** Take the Orange, Blue, or Silver Line to Capitol South Metro stop. Exit station and head south on First Street SE. Turn right onto F St SE. Turn left onto New Jersey Ave SE. Hotel will be on your right.

ACCESSIBILITY

- Main entrance, conference room, and on-site restaurants are all wheelchair accessible.
- On-site Business Center and Fitness Center have accessible entrances.
- Rooms and suits accessible through the interior corridor.
- Property has elevators and service animals are welcome.
- Valet parking for vehicles outfitted for drivers in wheelchairs.
- **For more information** about the physical features of the hotel's accessible rooms, common areas, or special services related to a specific disability, **please call 202-488-3600**.

ZoomGov Links

Wednesday, November 1, 2023 (10:00 am–4:30 pm EST)
Thursday, November 2, 2023 (10:15 am–4:15 pm EST)

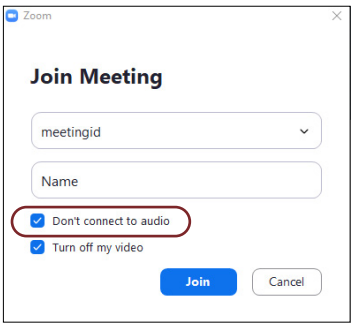
Enter ZoomGov Meeting
Meeting ID: 161 749 0850
Password: 746257

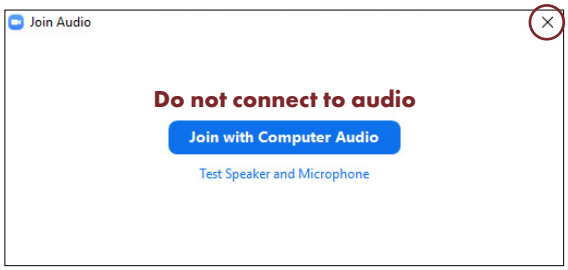
Local Numbers to Join by Phone

Thank you for participating in our event! For the best meeting experience, please follow this guide when setting up your laptop or tablet for in-room participation.

CONNECTING TO ZOOM

All participants in the room will be connected to Zoom. This will help us keep our virtual participants engaged by allowing them to see who is raising their hand and who is speaking in the room.





Before connecting to the Zoom meeting, please **mute your speakers**. When you connect to Zoom, please **do not connect to the audio**. This will cause loud feedback in the room. You will be connected to the Zoom audio automatically in the room via the table microphones.

USE OF WEBCAMS

The use of your webcam is very important for our remote participants. This allows them to better see who is speaking in the room and make it easier to engage with everyone. During today's event your webcam may be spotlighted when you speak. Remember, do not connect to the audio—even if you are prompted to.

If you do not have a device or webcam available, please let the staff know so they can make alternative arrangements.

PARTICIPATING IN THE MEETING

We will be using Zoom's raise hand feature for both remote participants and for those in the room. Please **use your raise hand feature** when giving a comment or asking a question. This will help the moderator know the order in which hands were raised.

Summary

- Connect to Zoom using the information provided by the Academies staff.
- Do NOT connect to Zoom Audio. Muting your speakers is also preferred.
- Use the raise hand feature in Zoom for comments/questions.

NATIONAL ACADEMIES Sciences Engineering Medicine

Contributing Meaningfully in a Virtual Setting

INTRODUCTION

Occasionally, some National Academies meetings will be held virtually. Virtual meeting technology allows us to continue our important work of providing independent, objective advice to inform policy, spark progress and innovation, and confront challenging issues for the benefit of society, even when in-person meetings are not possible. The skills and practices that help you successfully contribute to an in-person meeting are just as important in a virtual setting, but some additional adaptations can help improve the virtual meeting experience.

BEFORE THE MEETING

Make time before your meeting for the following essential types of preparation:

- **Intellectual Preparation:**
  - Review the agenda, the Statement of Task, and any other provided materials.
  - Develop a list of questions you have or points you want to discuss.
  - If possible, familiarize yourself with the list of meeting participants and their expertise.
- **Technology Preparation:**
  - Ensure you have a reliable high-speed internet connection.
  - Install the latest version of the virtual meeting platform installed (Zoom, Microsoft Teams, etc.).
  - Gain familiarity with the basic features of the platform. Check out our *Training on Systems and Tools* PDF for more information on the specific platform you'll be using.
  - If possible, close all other computer programs and turn off notifications to minimize distractions and interruptions.
- **Location and Logistics Preparation:**
  - Choose a private location to ensure the confidentiality of the meeting.
  - Minimize potential disruptions and background noise.
  - Clean up the space behind you or use a virtual background.
  - Dress appropriately for the formality of the meeting.
  - To make a great impression, ensure your face is clearly lit.
  - Login a few minutes early to check your audio, headphones, camera, and microphone. Arriving early helps the meeting organizers begin on time and minimizes distractions for other participants.

DURING THE MEETING

The success of the virtual meeting is up to you and the other participants. Each volunteer at the meeting was chosen because they have valuable expertise and insight to contribute. To make the most of this unique opportunity to share your expertise and learn from other volunteers, try to:

- Be deliberate and assertive in sharing your own insights and questions – no one else can do this for you.
- Take a lead in encouraging discussion. If you notice someone hasn't spoken up yet, ask their opinion.
- Avoid interrupting others – in a virtual setting, this is especially disruptive to the flow of a meeting. If you want to build on or respond to a comment, write down your ideas and share them when the other speaker has finished, or share your insights via chat.
- Remember that the chat transcript can become an important record of the meeting, and use it to share information, ideas, and responses to comments. As much as possible, post in complete sentences and clearly note which comments you are replying to, to make the transcript clearer.
- When possible, leave your camera on to create an inclusive, consistent experience for all.
- Ensure your name is displayed to others.
- Consider adding your pronouns to your name display.
- Be aware of your mute button. Muting your audio improves the audio experience for others, but make sure to unmute yourself as you speak up.
- When screen sharing, ensure you do not have distracting, unnecessary, or unprofessional tabs and programs open.
- Don't multitask. Treat this meeting as you would an in-person meeting and devote your attention fully to the discussion.
- Avoid personal grooming while on camera.
- Acknowledge and deal with any personal interruptions, such as from children or pets.

Following this guidance will enable you to make meaningful contributions to the meeting, which will lead to a more impactful final product.

Guidance for Asking Questions via Slido

How to join the conversation

Access the link directly:
https://app.sli.do/event/bWTaJobtHn1UED235TJvaP

OR

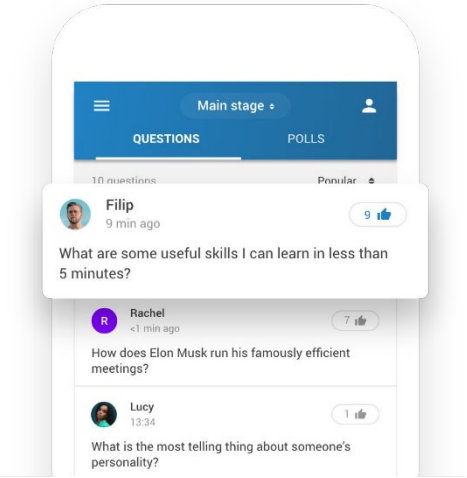
Go to slido.com and enter the event code:
#ClimateMacroDynamics

Open browser

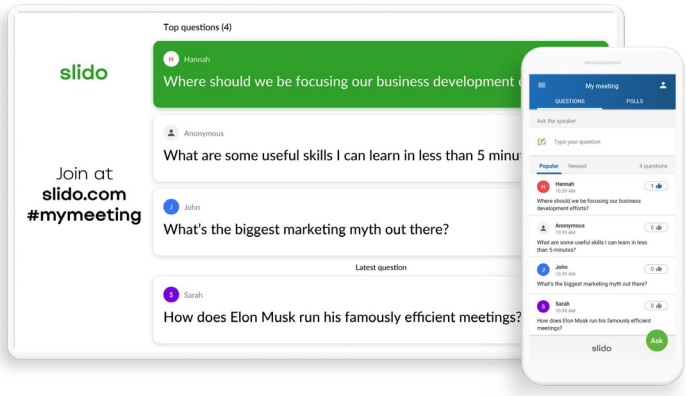
Go to slido.com

Enter event code:
ClimateMacroDynamics

Upvote comments you like



Comments, replies, and votes will appear in real-time on an interactive wall



For more information: https://community.sli.do/

World Café Method

The World Cafe is a method which makes use of an informal cafe setting for participants to explore an issue by discussing it in small table groups.

Discussion is held in multiple rounds of 20-30 minutes, with the cafe ambiance intended to allow for more relaxed and open conversations to take place.

DESCRIPTION

The World Cafe is an engagement process designed to take place in a cafe setting (or a room set up to resemble one as much as possible) so that participants are seated around small tables with tablecloths and tea, coffee and other beverages. The idea behind this is to create a space that supports 'good conversation', where anybody is able to talk about things that matter to them.

The method is based on the assumption that people already have within them the wisdom and creativity to confront even the most difficult challenges and rests on two key principles:

1. humans want to talk together about things that matter to them
2. and if they do, they can create collective power.

The process is distinguished by a number of core design principles. These include making sure that the space is hospitable space, everyone's contribution counts and that participants take responsibility for listening and exploring insights together.

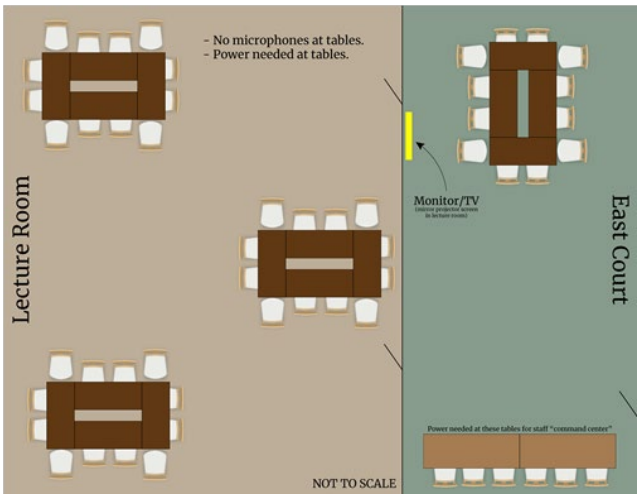
THE PROCESS

- Each round is initiated with a specific question related to the overall purpose of the event. The same questions can be used for more than one round or they can build upon one another.
- During the event participants discuss the questions at their table, before moving on to a new table/group for each new round. Often participants are provided with pens and are encouraged to draw and record their conversations on the paper tablecloths to capture free flowing ideas as they emerge.
- One participant (the table host) remains and summarises the previous conversation to the newly arrived participants. By moving participants around the room the conversations at each table are cross-fertilised with ideas from other tables, resulting in a collective intelligence. At the end of the process the main ideas are summarised in a plenary session and follow-up possibilities are discussed.

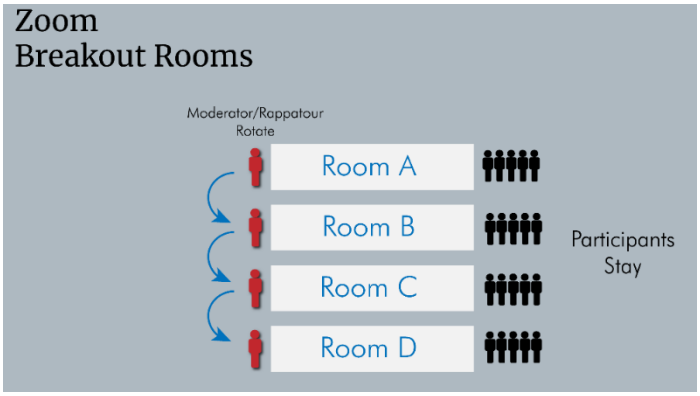
Source: https://www.involve.org.uk/resources/methods/world-cafe

Breakout Format

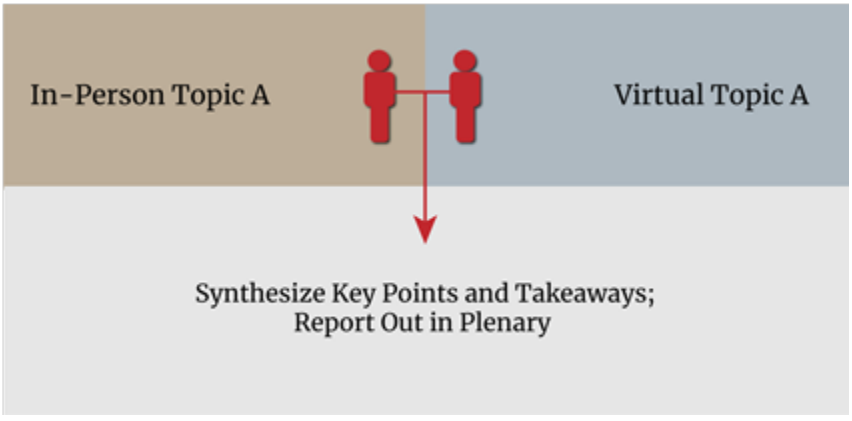
In-person World Café: Participants rotate through tables



Virtual World Café: Rapporteurs and Moderators rotate through breakout rooms



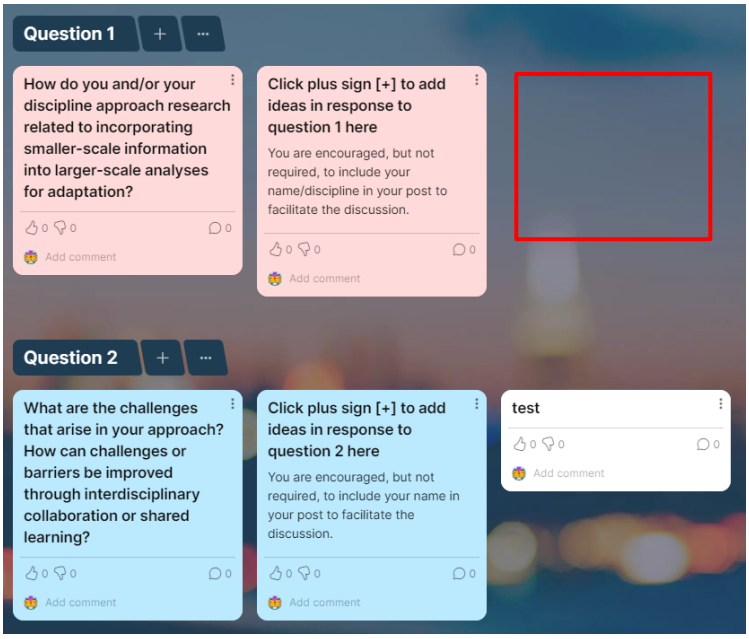
Synthesis: Results are reported



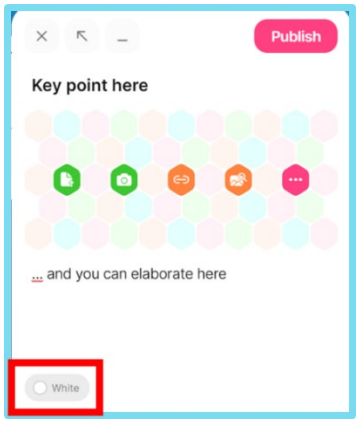
Padlet Instructions

1. Navigate to the appropriate Padlet: each breakout discussion will have its own Padlet page. The Padlet is pre-populated with the discussion questions and a section for key takeaways.

2. Use the "+" button beside the question or double-click anywhere in the open space to add your ideas.



3. Type your input. Padlet also allows you to add attachments (e.g., links, images, etc.). Click "Publish" to add your post.



4. You can "thumbs up" or add comments to posts from others.

Statement of Task

The National Academies of Sciences, Engineering, and Medicine will convene an ad hoc planning committee to organize a 2-day hybrid workshop to examine the state of understanding of physical climate risks and implications for the macroeconomy. This workshop will build on a prior workshop organized by the Roundtable on Macroeconomics and Climate-related Risks and Opportunities. In particular, this workshop will explore complex climate dynamics—including nonlinear, compounding, and cascading risks—and how these dynamics will affect and may propagate in the macroeconomy. The workshop will also consider physical climate risks across spatial and temporal scales, distributional effects in socioeconomic systems, and connections and feedback between these systems. Discussions will focus on identifying needs and opportunities to advance scientific understanding and foster transdisciplinary dialogue to inform macroeconomic modeling.

Speaker Bios

David Armstrong McKay is a Research Impact Fellow at the University of Exeter's Global Systems Institute, working on understanding and enhancing Earth system and socio-ecological resilience. He completed his PhD in Ocean and Earth Science on modelling ancient climate disruptions at the National Oceanography Centre Southampton, followed by postdocs at Southampton University and Stockholm Resilience Centre. His research uses numerical modelling and analysis to investigate Earth system resilience in the past and future, including climate-biosphere feedbacks and tipping points, dynamics and indicators of ecological resilience, and the sustainability of local to global agroecosystems. Current projects involve leading Section 1 of the Global Tipping Points Report on Earth system tipping points, and helping the Earth Commission set safe and just Earth system boundaries for climate change and nutrient pollution. He is also a keen science communicator, explaining issues like climate change, resilience, and tipping points for the wider public.

Vellore Arthi is an assistant professor in the Department of Economics at the University of California, Irvine. Her work focuses on labor, health, and economic demography, primarily in low-income settings. Her current research falls into two main threads. The first of these explores questions of maternal and child health, early-life development, and human capital formation, particularly as these relate to local environmental, public health, and labor market conditions. The second studies the role of internal migration as a mechanism through which individuals adjust to and propagate localized shocks. A more recent research agenda uses financial microdata to examine local economic activity and inequality in the US. Arthi holds a doctorate from the University of Oxford, and is a Faculty Research Fellow at the National Bureau of Economic Research (NBER), a Research Affiliate at the Center for Economic Policy Research (CEPR), and a Faculty Affiliate at the Center for Effective Global Action (CEGA). Prior to joining UC Irvine, she worked at organizations including the World Bank, United Nations Development Programme, and Deloitte Consulting.

Laurence Ball is Professor of Economics at Johns Hopkins University, a Research Associate at the National Bureau of Economic Research, and a consultant to the International Monetary Fund. He holds a PhD in economics from MIT and has received fellowships including the NBER Olin Fellowship, the Sloan Research Fellowship, the Professorial Fellowship in Monetary Economics at the Reserve Bank of New Zealand, the Houblon-Norman Fellowship at the Bank of England, and the Wim Duisenberg Fellowship at the European Central Bank. His research addresses fiscal and monetary policy and financial regulation, and he is the author of The Fed and Lehman Brothers: Setting the Record Straight on a Financial Disaster.

Markus Brunnermeier is the Edwards S. Sanford Professor in the economics department at Princeton University and director of Princeton's Bendheim Center for Finance. His research focuses on international finance markets, monetary theory, and macroeconomics. He established a webinar series as a platform for leading thinkers. He was was awarded his PhD by the London School of Economics and a Doctor honoris causa from the University of Regensburg. His award-winning books include "The Resilient Society" and "The Euro and the Battle of Ideas." Brunnermeier is president of the American Finance Association, nonresident senior fellow at the Peterson Institute, a research associate at the National Bureau of Economic Research, the Centre for Economic Policy Research, CESifo, ABFER, and a member of the Bellagio Group on the International Economy. He is a Sloan Research fellow, fellow of the Econometric Society, Guggenheim Fellow, and the recipient of the Bernácer Prize. He is a member of several advisory groups, including to the US Congressional Budget Office, the Bank for International Settlements, Bank of Japan, and the Bundesbank as well as previously to the International Monetary Fund, the Federal Reserve of New York, and the European Systemic Risk Board. He has been awarded several best paper prizes and served on the editorial boards of a number of leading economics and finance journals. He has worked to establish the concepts of: liquidity spirals, Financial Dominance, CoVaR as a measure of systemic risk, the Volatility Paradox, Paradox of Prudence, Resilience, European Safe Bonds, the redistributive monetary policy, the Reversal Rate, and Digital Currency Areas.

Yongyang Cai is a computational and environmental economist at Department of Agricultural, Environmental and Development Economics of The Ohio State University. His research is focused on dynamic and stochastic integration of climate and the economy; integration of regional food, energy, water systems, and economy; and computational methods in economics. He has published peer-reviewed papers in leading academic journals, including *Journal of Political Economy, JEEA, Quantitative Economics*, *JAERE*, *JEEM, Nature Climate Change*, *PNAS*, and *Operations Research*. He is a co-investigator on several research projects funded by the National Science Foundation and USDA. He currently

serves as an Associate Editor at *Climatic Change*, and an editorial board member at *Computational Economics*. Prior to joining the OSU, he was a Senior Research Scientist at the University of Chicago and a Visiting Fellow at the Hoover Institution of Stanford University. In 2021, he received the Erik Kempe Award in environmental and resource economics.

Mikhail Chester is a professor of Civil, Environmental, and Sustainable Engineering and the director of the Metis Center for Infrastructure and Sustainable Engineering at Arizona State University's School of Sustainable Engineering and the Built Environment. He manages a research program focused on infrastructure disruption and innovation describing the challenges and needs for transforming critical systems for the Anthropocene. A large portion of his work centers on adaptation to climate change and other extreme events considering infrastructure design and operation, people, and changing environmental hazards (including heat, wildfires, and flooding). In 2017 he was awarded the American Society of Civil Engineer's Huber early career research prize for his contributions to infrastructure resilience and sustainability. He is a co-author on the U.S. Fifth National Climate Assessment transportation chapter and contributing author on the U.N. Intergovernmental Panel on Climate Change Sixth Assessment Report (AR6) chapter on Cities, Settlements, and Key Infrastructure. He has recently published two books: *The Rightful Place of Science: Infrastructure in the Anthropocene*, and *Urban Infrastructure: Reflections for 2100*.

Kristie L. Ebi is a Professor in the Center for Health and the Global Environment in the School of Public Health, University of Washington. She has been conducting research on the health risks of climate variability and change for 30 years. Her research focuses on estimating the current and future health risks of climate change; designing adaptation programs to reduce those risks; and quantifying the health co-benefits of mitigation policies. She was a lead author for the Intergovernmental Panel on Climate Change (IPCC) 6th assessment cycle, including the special report on warming of 1.5°C and the human health chapter for Working Group II. Her scientific training includes an M.S. in toxicology and a Ph.D. and a Master of Public Health in epidemiology, and two years of postgraduate research at the London School of Hygiene and Tropical Medicine. She edited fours books on aspects of climate change and has more than 250 peer-reviewed publications.

Étienne Espagne is a senior climate economist at the World Bank EFI chief economist office and an associate researcher at CERDI. His research focuses on building theories, models and methodologies to assess the macro-financial aspects of low-carbon policies as well as climate and nature impacts, especially in developing and emerging economies context. He co-leads two major programs at the World Bank on analytical tool development and capacity development for finance ministries. Prior to this, as a senior economist at AFD (Agence Française de Développement), the bilateral development bank for the French government, he developed and contributed to a research program on the modelization and evaluation of climate damages, adaptation and mitigation strategies in developing and emerging economies. He holds a PhD in environmental economics from the École des Hautes Études en Sciences Sociales (EHESS) and is also a graduate from the French École des Mines de Paris and the Paris School of Economics. He has published several papers in academic journals in the field of climate change and energy economics and regularly teaches at Paris 1 University, EHESS, Ecole Polytechnique and ENSTA Paristech. He has previously worked at France Stratégie, CEPII and CIRED.

Karen Fisher-Vanden is the Distinguished Professor of Environmental and Resource Economics and Public Policy, and Director of the Institute for Sustainable Agricultural, Food, and Environmental Science (SAFES) at Pennsylvania State University. She is currently President of the Association of Environmental and Resource Economists (AERE) where she previously served on the Board of Directors. She was a Lead Author of the IPCC's Fifth Assessment Report Working Group III, was a member of the EPA Science Advisory Board on Economy-wide Modeling, and served on the External Review Panel for EPA's 2022 Report on the Social Cost of Greenhouse Gases. Her areas of research include economic and integrated assessment modeling for climate change impacts and policy analysis. She has led a number of large externally-funded research programs and is currently Principal Investigator of the Program on Coupled Human and Earth Systems (PCHES), a large Cooperative Research Agreement with the US Department of Energy.

Stephie Fried is a senior economist at the Federal Reserve Bank of San Francisco. Prior to joining the SF Fed, she worked at Arizona State University and Carleton College. Her work focuses on the impacts of climate change and climate policies on the macroeconomy.

Elisabeth Gilmore is an Associate Professor in Environmental Engineering and the School of Public Policy and Administration at Carleton University, Ottawa, Canada and is a Senior Researcher at the Peace Research Institute Oslo (PRIO), Norway. She focuses on evaluating the effectiveness, economic viability and equity dimensions of climate

mitigation and adaptation pathways; understanding the interactions between adaptation, climate impacts and societal responses, including the implications for violent conflict and migration; and improving scenario development. She is currently holds funding from the Canada's National Science and Engineering Research Council, Canada's the Social Science and Humanities Research Council, and the US Department of Defense's Minerva Research Initiative. She was a lead author for the 6th Assessment Cycle for Working Group II for the Intergovernmental Panel on Climate Change (IPCC) and drafting author on the Summary of Policymakers (SPM), was a technical contributor to the 5th US National Climate Assessment and is currently a lead author for the Global Environmental Outlook (GEO-7). She sits on the Scientific Committee for the UN World Adaptation Science Programme (WASP).

Catherine (Catie) Hausman is an Associate Professor in the School of Public Policy at the University of Michigan and a Research Associate at the National Bureau of Economic Research. Her work focuses on environmental and energy economics. Recent projects have looked at electricity transmission infrastructure; the role of R&D in climate policy; electricity markets and climate change; inequality in pollution exposure; and the natural gas sector's role in methane leaks. Prior to her graduate studies, Catie studied in Peru under a Fulbright grant. She has taught Statistics, a policy seminar on Energy and the Environment, and a course on Government Regulation of Industry and the Environment. She holds a BA from the University of Minnesota and a PhD in Agricultural and Resource Economics from the University of California, Berkeley.

Matthew Huber is a Professor and Director for the Institute for a Sustainable Future in the Department of Earth, Atmospheric, and Planetary Sciences at Purdue University. He leads the Climate Dynamics Prediction Laboratory, where his research focuses on the past, present, and future climate, the mechanisms that govern climate, the different forms that climates can take on Earth, and the relationship between climate change and life. His research aims to better understand the "greenhouse" climates of the Paleogene by applying state-of-the-art global climate models to draw connections to understanding modern and future climates. His works draws on atmosphere-ocean dynamics, paleoceanography, geology, paleontology, and computer modeling. Huber was awarded his PhD in Earth Sciences for the University of California, Santa Cruz, an MS in Atmospheric Sciences at the University of California, Los Angeles, and his BA in Geophysics with honors at the University of Chicago.

Matthew E. Kahn is a Provost Professor of Economics at the University of Southern California. He is a research associate at the National Bureau of Economic Research and a research fellow at IZA. He is a Senior Fellow at the Schaeffer Center for Health Policy and Economics at USC. Starting in September 2023, he will serve as a Visiting Fellow at the Hoover Institution at Stanford University. He has taught at Columbia, the Fletcher School at Tufts University, UCLA, and Johns Hopkins University. He has served as a Visiting Professor at Harvard, Stanford and the National University of Singapore. He is a graduate of Hamilton College and the London School of Economics. He holds a Ph.D. in Economics from the University of Chicago. He has published eleven books. He is the author of "Green Cities: Urban Growth and the Environment" and the co-author (joint with Dora L. Costa) of "Heroes and Cowards: The Social Face of War." He is also the author of "Climatopolis" and "Blue Skies over Beijing: Economic Growth and the Environment in China" (joint with Siqi Zheng. In March 2021, he published his book titled "Adapting to Climate Change," and in January 2021, he published his book "Unlocking the Potential of Post-Industrial Cities" (joint with Mac McComas). In April 2022, he published his book: "Going Remote." His research focuses on urban and environmental economics.

Katharine Mach is a professor at the University of Miami Rosenstiel School of Marine, Atmospheric, & Earth Science and a faculty scholar at the UM Abess Center, focused on environmental science and policy. Her research assesses climate change risks and response options to address increased flooding, extreme heat, wildfire, and other hazards. Through innovative approaches to integrating evidence, she informs effective and equitable adaptations to the risks. Mach was the 2020 recipient of the Piers Sellers Prize for world leading contribution to solution-focused climate research. From 2010 until 2015, she co-directed the scientific activities of Working Group II of the Intergovernmental Panel on Climate Change. Mach is a chapter lead for the US Fifth National Climate Assessment and was a lead author for the IPCC Sixth Assessment Report. Mach received her PhD from Stanford University and AB summa cum laude from Harvard College.

Brian O'Neill is an Earth Scientist and Laboratory Fellow at the Joint Global Change Research Institute, a collaboration between Pacific Northwest National Laboratory (PNNL) and the University of Maryland in College Park. His research interests are in human-Earth system interactions, in particular the human dimensions of global environmental change. Previously, he was a professor at the Josef Korbel School of International Studies at the University of Denver and also served as director of research at the Korbel School's Pardee Center for International Futures. He led research groups on

integrated assessment modeling and on climate and human systems at the U.S. National Center for Atmospheric Research and on population and climate change at the International Institute for Applied Systems Analysis. Brian was a convening lead author for the Intergovernmental Panel on Climate Change's Sixth Assessment Report and was an author on the U.S. Fourth National Climate Assessment. He holds a PhD in Earth systems science and an MS in applied science, both from New York University.

Ruth Richardson is the inaugural Executive Director of the Accelerator for Systemic Risk Assessment (ASRA) designed to contribute to the emerging field of systemic risk analysis and response with particular attention to helping decision-makers better understand, assess, and incorporate sensitivity to systemic risks into their decision-making. Prior to this, Richardson was the Executive Director of the Global Alliance for the Future of Food, a unique collaboration of over 25 foundations committed to food systems transformation. In this capacity she was appointed by United Nations Secretary-General António Guterres to the Advisory Committee for the 2021 Food Systems Summit and as Chair, Champions Network. She also served on the Advisory Board of the UN Committee on World Food Security (CFS) as well as on the Steering Committee of TEEBAgriFood led by UN Environment. Bringing over 25 years of experience devoted professionally to social change and planetary health, Richardson has also had the privilege to act as first Director of the Unilever Canada Foundation, Founding Chair of the Canadian Environmental Grantmakers' Network, the first Environment Director at the Metcalf Foundation, and a lead consultant to establish The Circle on Philanthropy and Aboriginal Peoples in Canada. In 2020, Richardson was awarded 2021 Alumni of Influence by her alma mater, University of Toronto, Canada.

Esteban Rossi-Hansberg is the Glen A. Lloyd Distinguished Service Professor in the Kenneth C. Griffin Department of Economics at the University of Chicago (since 2021). Previously, he was a Professor of Economics at Princeton University from 2005 to 2021 and at Stanford University from 2002 to 2005. He earned a Ph.D. from the University of Chicago in 2002. He is a research associate at the National Bureau of Economic Research and a research fellow at the Center for Economic Policy Research. He is the co-director of the International Economics and Economic Geography Initiative at the Becker Friedman Institute. In 2021 he became an Editor of the Journal of Political Economy. Rossi-Hansberg's research specializes in international trade, regional and urban economics, as well as growth and organizational economics. Among other topics, his work has studied the internal structure of cities; the implications of offshoring and changes in firm organization on economic outcomes; and the impact of spatial frictions and agglomeration and congestion forces on the gains from migration and the cost of climate change. In 2007 he received the prestigious Alfred Sloan Research Fellowship and in 2010 he received the August Lösch Prize and the Geoffrey Hewings Award. He is an elected fellow of the Econometric Society since 2017 and won the Robert E. Lucas Jr. Prize in 2019. In 2022 he was elected to the American Academy of Arts and Sciences.

Anthony A. Smith, Jr. (Tony) is the William K. Lanman, Jr. Professor of Economics at Yale University. He has served as Chair of the Department of Economics at Yale since 2019. He received a B.S. in Economics from M.I.T. in 1984 and a Ph.D. in Economics from Duke University in 1990. He has also taught at Queen's University, Carnegie Mellon University, and the University of Rochester and is a Research Associate of the National Bureau of Economic Research. He has served as an Associate Editor at the Review of Economics Dynamics and is currently Co-Editor of Macroeconomic Dynamics. He conducts research in macroeconomics, with a particular focus on income and wealth heterogeneity, and in econometrics, with a particular focus on simulation estimation of structural models. His most recent research takes place at the intersection of macroeconomics and environmental economics, where he is constructing global economy-climate models with high geographic resolution.

Joseph Tainter is a professor in the Department of Environment and Society, Utah State University. He is the author of *The Collapse of Complex Societies*, and co-author with T. F. H. Allen and T. W. Hoekstra of *Supply-Side Sustainability*. With Roderick and Susan McIntosh he edited *The Way the Wind Blows: Climate, History, and Human Action*. With Tadeusz Patzek he wrote *Drilling Down: The Gulf Oil Debacle and Our Energy Dilemma*. Dr. Tainter's research has been used in over 40 countries. His work has been consulted in the United Nations Environment Programme, UNESCO, the World Bank, the Rand Corporation, the International Institute for Applied Systems Analysis, the Beijer Institute of Ecological Economics, the Earth Policy Institute, Technology Transfer Institute/Vanguard, and the Highlands Forum. His research has been applied in economic development, energy, conservation, health care, information technology, urban studies, and the challenges of security in response to terrorism.

Moderator Bios

Yongyang Cai is a computational and environmental economist at Department of Agricultural, Environmental and Development Economics of The Ohio State University. His research is focused on dynamic and stochastic integration of climate and the economy; integration of regional food, energy, water systems, and economy; and computational methods in economics. He has published peer-reviewed papers in leading academic journals, including *Journal of Political Economy, JEEA, Quantitative Economics*, *JAERE*, *JEEM, Nature Climate Change*, *PNAS*, and *Operations Research*. He is a co-investigator on several research projects funded by the National Science Foundation and USDA. He currently serves as an Associate Editor at *Climatic Change*, and an editorial board member at *Computational Economics*. Prior to joining the OSU, he was a Senior Research Scientist at the University of Chicago and a Visiting Fellow at the Hoover Institution of Stanford University. In 2021, he received the Erik Kempe Award in environmental and resource economics.

Sanya Carley is Presidential Distinguished Professor of Energy Policy and City Planning at the Stuart Weitzman School of Design, and faculty co-director of the Kleinman Center for Energy Policy at the University of Pennsylvania. She holds secondary appointments at the Wharton School and the School of Social Policy and Practice. She also co-directs the Energy Justice Lab. Dr. Carley's research focuses on energy justice and just transitions, energy insecurity, electricity and transportation markets, and public perceptions of energy infrastructure and technologies.

Tim Garrett is a Professor of Atmospheric Sciences at the University of Utah. His recent work is aimed at determining how snowflakes swirl in turbulence and developing prediction techniques for how clouds respond to climate variability using research methods including instrument design, field measurement, and simulation. These studies have focused on development of simple theoretical models that employ non-equilibrium and statistical thermodynamics to simplify and constrain understanding of highly complex and dynamic systems. In a series of papers published in Climatic Change, Earth's Future, Earth System Dynamics, PLOS ONE, and the Proceedings of the National Academic of Sciences, he has extended these perspectives drawn from atmospheric physics to develop simplified first-principles models for describing and predicting the forces governing global economic growth and collapse.

Sarah Kapnick is chief scientist for the National Oceanic and Atmospheric Administration (NOAA). In this role, Dr. Kapnick is responsible for advancing policy and program direction for NOAA's science and technology priorities. She has extensive experience at the intersection of climate science and economics. Prior to NOAA, she served as a managing director at J.P. Morgan in the role of Senior Climate Scientist and Sustainability Strategist for Asset and Wealth Management. While at J.P. Morgan, she supported sustainability and climate action efforts and served as an advisor on new business and investment opportunities and risks. Previously, Dr. Kapnick was a physical scientist and deputy division leader on seasonal to decadal variability and predictability at NOAA's Geophysical Fluid Dynamics Laboratory (GFDL). At GFDL, her work spanned seasonal climate prediction, mountain snowpack, extreme storms, water security and climate impacts. Dr. Kapnick is a member of the American Geophysical Union, American Meteorological Society and American Association for the Advancement of Science. She received a Ph.D. in Atmospheric and Oceanic Sciences with a Certificate in Leaders in Sustainability from UCLA, and an A.B in Mathematics with a Certificate in Finance from Princeton University.

Robert Kopp is a climate scientist who serves at Rutgers University as a Distinguished Professor in the Department of Earth & Planetary Sciences. Professor Kopp's research focuses on past and future sea-level change, the interactions between physical climate change and the economy, and the use of climate risk information to inform decision-making. He directs the Megalopolitan Coastal Transformation Hub, a National Science Foundation-funded consortium that advances coastal climate adaptation and the scientific understanding of natural and human coastal climate dynamics. He is also a director of the Climate Impact Lab, a non-profit research organization supporting data-driven approaches to estimating the social and human costs of climate change. He co-chairs the National Academies' Roundtable on Macroeconomics and Climate-Related Risks and Opportunities. He was a lead author of the Intergovernmental Panel on Climate Change's Sixth Assessment Report.

Jeremy Martinich is chief of the Climate Science and Impacts Branch within EPA's Climate Change Division (OAR). The branch's work includes developing indicators tracking the observed effects of climate change, developing climate science

and economic analyses supporting EPA regulations, and coordinating the CIRA project, a collaborative modeling effort to quantify and monetize the impacts of climate change in the U.S.

Kyle Meng is an Associate Professor at the Bren School of Environmental Management and the Department of Economics at the University of California, Santa Barbara. He is currently serving as Senior Economist at the White House Council of Economic Advisers. He is a Faculty Research Fellow at the National Bureau of Economic Research and the Climate and Energy Program Director at the Environmental Markets Solutions Lab. An environmental and resource economist with training in engineering and atmospheric physics, Professor Meng studies the equity and efficiency consequences of environmental policies, with a focus on climate policies. He has published in leading science and economics journals including the American Economic Review, Journal of Political Economy, Nature, Science, and PNAS. Professor Meng received his PhD in Sustainable Development from Columbia University and his Bachelor's in Civil and Environmental Engineering from Princeton University. A first-generation immigrant, he was a recipient of the Paul and Daisy Soros Fellowship for New Americans.

Frances Moore is an Associate Professor in the Environmental Science and Policy Department at University of California Davis. For the 2022–2023 academic year, she was on leave from Davis working as a senior economist at the Council of Economic Advisers. Her research bridges climate science and economics and focuses on quantifying the effects of climate change for human wellbeing and implications for mitigation and adaptation policy. Past work has included estimating effects of climate change on macroeconomic outcomes, natural capital, and agricultural productivity. She holds a PhD in Environment and Resources and a Masters in Economics from Stanford University, a MESc from the Yale School of Forestry and Environmental Studies, and a BA, *summa cum laude* in Earth and Planetary Sciences from Harvard University.

Adele Morris is a Senior Adviser in the Division of Financial Stability at the Board of Governors of the United States Federal Reserve System. She works with the Federal Reserve's Financial Stability Climate Committee, which is charged with incorporating climate considerations into the Federal Reserve's financial stability framework. Before joining the Federal Reserve in October 2021, Dr. Morris was the Joseph A. Pechman senior fellow in Economic Studies and policy director for the Climate and Energy Economics Project at the Brookings Institution. Her academic research relates to climate change, energy, and tax policy, and she is a leading global expert on the design and analysis of carbon pricing policies. She joined Brookings in July 2008 from the Joint Economic Committee of the U.S. Congress, where she advised members and staff on economic, energy, and environmental policy. Prior to that, Dr. Morris was the lead natural resource economist for the U.S. Treasury Department for nine years. On assignment to the U.S. Department of State in 2000, she led negotiations on land use and forestry issues in the international climate change treaty process. Prior to Treasury, she served as the senior economist for environmental affairs at the President's Council of Economic Advisers during the development of the Kyoto Protocol. Morris began her career at the Office of Management and Budget, where she oversaw rulemaking by agriculture and natural resource agencies. Dr. Morris holds a Ph.D. in Economics from Princeton University, an M.S. in Mathematics from the University of Utah, and a B.A. from Rice University.

James (Jim) Neumann is a Principal at Industrial Economics, Incorporated (IEc) and specializes in climate change impact and adaptation analysis, applied environmental economics, and policy analysis. He is a recognized expert on the economics of climate change adaptation, with a particular specialty on coastal hazards associated with climate change; and is a Lead Author for the IPCC Fifth Assessment Working Group II and a lead author for the US National Climate Assessment coastal effects chapter. His recent work includes support for the USEPA's Climate Change Division, which includes new work to expand the relevant peer-reviewed impact and adaptation literature; to synthesize physical and economic impacts in the U.S.; and to quantify risks of climate change to socially vulnerable populations, through multi-sectoral routes of impact. He is also has worked with three state governments to estimate climate change impacts, including recommendations for adaptation investment priority setting toward disproportionately affected socially vulnerable populations.

Brian O'Neill is an Earth Scientist and Laboratory Fellow at the Joint Global Change Research Institute, a collaboration between Pacific Northwest National Laboratory (PNNL) and the University of Maryland in College Park. His research interests are in human-Earth system interactions, in particular the human dimensions of global environmental change. Previously, he was a professor at the Josef Korbel School of International Studies at the University of Denver and also served as director of research at the Korbel School's Pardee Center for International Futures. He led research groups on

integrated assessment modeling and on climate and human systems at the U.S. National Center for Atmospheric Research and on population and climate change at the International Institute for Applied Systems Analysis. Brian was a convening lead author for the Intergovernmental Panel on Climate Change's Sixth Assessment Report and was an author on the U.S. Fourth National Climate Assessment. He holds a PhD in Earth systems science and an MS in applied science, both from New York University.

Jisung Park is an Assistant Professor at the University of Pennsylvania, with appointments in the School of Social Policy and Practice (primary) and the Wharton School's Department of Business Economics and Public Policy (secondary). He is also a research affiliate at the Institute of Labor Economics (IZA), a faculty affiliate of the California Policy Lab (CPL), and a faculty fellow at the Kleinman Center for Energy Policy at the University of Pennsylvania. Park is an environmental and labor economist interested broadly in how environmental factors shape economic opportunity. He is particularly interested in the effects of the natural environment on labor and human capital outcomes, the process of adaptation to environmental change, and the implications of climate change for economic inequality. He received a PhD in economics from Harvard University (2017) where he was an NSF Fellow, and master's degrees in Environmental Change and Management (MSc) and Development Economics (MSc) from Oxford University (2010, 2011), where he was a Rhodes Scholar.

Peter J. Wilcoxen is a Professor in the Department of Public Administration and International Affairs at Syracuse University's Maxwell School and Director of the Policy Studies Program. He is also a Laura J. and L. Douglas Meredith Professor for Teaching Excellence, Director of Maxwell's Center for Environmental Policy and Administration, and a Nonresident Senior Fellow at the Brookings Institution. In addition, he has been a member of the U.S. Environmental Protection Agency's (EPA's) Chartered Science Advisory Board, a member of the US EPA's Environmental Economics Advisory Committee, and a Review Editor for the Intergovernmental Panel on Climate Change. Dr. Wilcoxen's work focuses on environmental and energy policy, particularly as it relates to climate change or the electric grid. He has published more than 70 papers and has co-authored three books: one on the design of an international policy to control climate change, one on the design and construction of large-scale economic models, and one on using environmental taxes as part of fiscal reform in the United States. Wilcoxen is a Fellow of the National Academy of Public Administration. He holds a Ph.D. in economics from Harvard University and a B.A. in physics from the University of Colorado.

Committee Bios

Eric J. Kemp-Benedict (Co-Chair) is a Senior Economist and Director of the Equitable Transitions program at the Stockholm Environment Institute's (SEI's) US Center. He was SEI's Asia Center Director from 2013 to 2016 and has served in various SEI global leadership roles. Dr. Kemp-Benedict's research focuses on the macroeconomics of a sustainability transition, addressing questions around long-run growth, decoupling, structural change, and economic development. He contributes to interdisciplinary studies on diverse topics of relevance to sustainability at national, regional, and global levels. Among his other contributions, he is a key contributor to the Shared Socioeconomic Pathways (SSPs), part of the global climate scenario framework that underpins a wide range of climate studies. Dr. Kemp-Benedict is currently a member of the National Academies' Roundtable on Macroeconomics and Climate-related Risks and Opportunities.

Timothy M. Lenton (Co-Chair) is the founding Director of the Global Systems Institute and Chair in Climate Change and Earth System Science at the University of Exeter. He has more than 25 years of research experience in studying the Earth as a system, and developing and using models to understand its behavior. His books "Revolutions that made the Earth" (with Andrew Watson) and "Earth System Science: A Very Short Introduction" have popularized a new scientific view of our planetary home. Professor Lenton co-authored the "Planetary Boundaries" framework and is renowned for his work identifying climate tipping points. This award-winning work has led him to examine positive tipping points within our social systems which could help accelerate progress towards a more sustainable future. Professor Lenton's accolades include Philip Leverhulme Prize, 2004; European Geosciences Union Outstanding Young Scientist Award, 2006; Times Higher Education Award for Research Project of the Year, 2008; the Royal Society of London William Smith Fund, 2008; and the Royal Society Wolfson Research Merit Award, 2013. Professor Lenton is a member of the Earth Commission, an ISI Highly Cited Researcher, and in the top 100 of the Reuters 'Hot List' of the world's top climate scientists. He is also a Turing Fellow, a Fellow of the Linnean Society, Geological Society and the Society of Biology. Dr. Lenton is currently a member of the National Academies' Roundtable on Macroeconomics and Climate-related Risks and Opportunities.

Brad R. Colman is the President of the American Meteorological Society (AMS). Before AMS, he was the Director of Weather Strategy for The Climate Corporation. In this role, he oversaw and guided the design and execution of the Bayer & Climate Enterprise weather programs. As such, he coordinated across multiple business units to set Enterprise priorities and then works closely with vendors, engineers, and scientists to map out the optimal course necessary to meet these priorities. The program spans across global weather stations, data acquisition and validation, data repository architecture and dissemination, and domain expertise. Central to this effort was Dr. Colman's close collaboration with The Climate Corporation's Weather Science Team (a team of statisticians, machine learners, and atmospheric scientists), which developed unique weather, climate, and decision support information for the global agricultural industry. Before Climate, Dr. Colman worked for nearly two years on a Microsoft team chartered to grow a new Microsoft consumer weather service to serve the entire Microsoft ecosystem. Prior to joining the private sector, Dr. Colman enjoyed a long and diverse career with NOAA where he worked at The National Weather Service's forecast office in Seattle, Washington; NOAA's Environmental Research Laboratory in Boulder, Colorado; and was the Acting Director of NOAA's Meteorological Development Laboratory in Silver Spring, Maryland. He is a member and Fellow of the American Meteorological Society (AMS), and has served in a number of different roles within the Society. Dr. Colman is a member of the Washington State Academy of Sciences and is currently Co-Chair of NOAA's Science Advisory Board's Environmental Information Services Working Group. Dr. Colman is currently a member of the National Academies' Roundtable on Macroeconomics and Climate-related Risks and Opportunities.

Wendy Edelberg is the director of The Hamilton Project and a senior fellow in Economic Studies at the Brookings Institution. Edelberg joined Brookings in 2020, after more than fifteen years in the public sector. She is a macroeconomist whose research has spanned a wide range of topics, from household spending and saving decisions to the economic effects of fiscal policy to systemic risks in the financial system. Most recently, she was Chief Economist at the Congressional Budget Office (CBO). Prior to working at CBO, Dr. Edelberg was the executive director of the Financial Crisis Inquiry Commission, which released its report on the causes of the financial crisis in January 2011. Previously, she worked on issues related to macroeconomics, housing, and consumer spending at the President's Council of Economic Advisers during two administrations. Before that, she worked on those same issues at the Federal Reserve Board. She is

currently the co-chair of the National Academies' Roundtable on Macroeconomics and Climate-related Risks and Opportunities and was appointed as a member of the planning committee on Strengthening the Evidence Base to Improve Economic and Social Mobility in the United States in 2021.

Sathya Gopalakrishnan is an Associate Professor in the Department of Agricultural, Environmental and Development Economics (AEDE) in the College of Food, Agricultural, and Environmental Sciences (CFAES) at The Ohio State University (OSU). She is also on the faculty of the Environmental Science Graduate Program (ESGP) and a founding member and former Director of the STEAM Factory—a diverse and inclusive grassroots faculty network at OSU committed to interdisciplinary research, community engagement, and education. Dr. Gopalakrishnan's research is motivated by an interest in applying economic theory to understand ubiquitous interdependencies between human decisions and geophysical processes in complex resource systems. She specifically focuses on developing coupled models of complex human and natural systems, applied to coastal and water resources; non-market valuation of environmental amenities and risks; and resource management problems in which environmental and economic systems are linked by spatial-dynamic processes. She serves as an associate editor for the American Journal of Agricultural Economics, Chair of the Committee for Women in Agricultural Economics, and is a member of the board of directors of the Association of Environmental and Resource Economists (AERE). Dr. Gopalakrishnan is currently a member of the National Academies' Roundtable on Macroeconomics and Climate-related Risks and Opportunities.

Lori Hunter is the Director of the Institute of Behavioral Science at the University of Colorado Boulder where she also Professor of Sociology. Dr. Hunter's research and teaching focus on links between environmental context and human population dynamics. Specific settings include rural South Africa and Mexico, where her scholarship connects rural livelihoods strategies, including migration, to local shifts in rainfall, temperature, and natural resource availability. She has been an invited speaker on the topic of migration and climate change at a variety of settings including the United Nations, National Academies of Sciences, Engineering, and Medicine (NASEM), the Rio+20 Earth Summit, Future Earth, and the French Demographic Research Institute. Dr. Hunter received her Ph.D. from Brown University in 1997. She is a member of NASEM's Board on Environmental Change and Society and the Board's liaison to the NAS Committee on Managed Retreat on the Gulf Coast. Dr. Hunter is also currently a member of the National Academies' Roundtable on Macroeconomics and Climate-related Risks and Opportunities.

Paulina Jaramillo is currently a Professor of Engineering and Public Policy at Carnegie Mellon University. Professor Jaramillo's past research focused on life cycle assessment of energy systems with an emphasis on climate change impacts and mitigation research. She is currently involved in multi-disciplinary research projects to better understand the social, economic, and environmental implications of a low-carbon transition in the U.S. energy system. Over the past five years, Professor Jaramillo's research and education efforts have expanded to include issues related to energy access and development in the Global South. She has also worked to incorporate values and beliefs in energy planning in historically disenfranchised communities and to understand the implications of energy access in gender equity. Professor Jaramillo was a coordinating lead author for the Transportation chapter of the Working Group III report that was part of the IPCC's 6th Climate Assessment Report. She was a 2020 Andrew Carnegie Fellow of the Carnegie Corporation of New York. Dr. Jaramillo is currently a member of the National Academies' Roundtable on Macroeconomics and Climate-related Risks and Opportunities.

Meeting Conduct*

We are committed to fostering a professional, respectful, inclusive environment where all participants can participate fully in an atmosphere that is free of harassment and discrimination based on any identify-based factors.

DO

- **Show respect and consideration** for all people, and do not dominate discussions.
- **Listen to others.** Make room for a diversity of voices in group discussions, on panels, and the like without pressuring those who choose not to speak.
- **Be collegial and collaborative.** Be mindful of your tone and the potential impact your position, experience, and/or privilege may have on others.
- **Show that you value differing perspectives.** Communicate openly and civilly—critique ideas, not people.
- **Be inclusive** and intentional about welcoming a diversity of individuals and their perspectives and identities when leading sessions or inviting others to share ideas.
- **Act professionally and responsibly.**
- **Report concerns immediately** so that we can act quickly to address and resolve issue (see below for details on how to report concerns).
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- **Display nudity and/or sexual images** in public spaces or presentations.
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- Contact NASEM event staff: Bridget McGovern, BAMcGovern@nas.edu.
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Sexual harassment is unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature that creates an intimidating, hostile, or offensive environment.

Other types of harassment include any verbal or physical conduct directed at individuals or groups of people because of their race, ethnicity, color, national origin, sex, sexual orientation, gender identity, age, religion, disability, veteran status, or any other characteristic protected by applicable laws, that creates an intimidating, hostile, or offensive environment.

Bullying is unwelcome, aggressive behavior involving the use of influence, threat, intimidation, or coercion to dominate others in the professional environment.

REPORTING AND RESOLUTION

Any violation of this policy should be reported. If you experience or witness discrimination, harassment, or bullying, you are encouraged to make your unease or disapproval known to the individual at the time the incident occurs, if you are comfortable doing so. You are also urged to report any incident by:

- Filing a complaint with the Office of Human Resources at 202-334-3400 or hrservicecenter@nas.edu, or
- Reporting the incident to an employee involved in the activity in which the member or volunteer is participating, who will then file a complaint with the Office of Human Resources.

Complaints should be filed as soon as possible after an incident. To ensure the prompt and thorough investigation of the complaint, the complainant should provide as much information as is possible, such as names, dates, locations, and steps taken. The Office of Human Resources will investigate the alleged violation in consultation with the Office of the General Counsel.

If an investigation results in a finding that an individual has committed a violation, NASEM will take the actions necessary to protect those involved in its activities from any future discrimination, harassment, or bullying, including in appropriate circumstances **the removal of an individual from current NASEM activities and a ban on participation in future activities**.

CONFIDENTIALITY

Information contained in a complaint is kept confidential, and information is revealed only on a need-to-know basis. NASEM will not retaliate or tolerate retaliation against anyone who makes a good faith report of discrimination, harassment, or bullying.

Updated December 2, 2021

NATIONAL ACADEMIES Sciences Engineering Medicine

A GUIDE TO THE

Harassment Complaint Process for Participants

AT THE NATIONAL ACADEMIES

Review the Policy here.

Complaints regarding violations of the National Academies anti-harassment policies should be reported by:

- Filing a complaint with the Office of Human Resources at 202-334-3400 or hrservicecenter@nas.edu or
- Reporting the incident to an employee involved in the activity in which you are participating.

Complaints of harassment, discrimination, or bullying should be filed as soon as possible after an incident. The Office of Human Resources will investigate the alleged violation in consultation with the Office of the General Counsel.

When reporting an incident, please provide as much of the following information as is possible and applicable:

- Name and role of the person or persons allegedly causing the harassment;
- Description of the incident(s), including the dates, locations and the presence of any witnesses;
- Steps taken to try to stop the harassment; and
- Any other information that may be relevant.

If the National Academies determines that a participant in a National Academies activity has violated this policy, the National Academies will take action as it deems appropriate to address the situation and to prevent the participant from engaging in future discrimination, harassment, or bullying in National Academies activities, up to and including banning that individual from current or future participation in National Academies activities.

All inquiries, complaints, and investigations are confidential, and information is revealed only on a need-to-know basis. Information contained in a complaint is kept confidential. The National Academies will not retaliate or tolerate retaliation against anyone who makes a good faith report of discrimination, harassment, or bullying. or participates in a complaint investigation.

For more information, please watch the following videos from our Expert Volunteer Orientation:

- Making a Commitment to Diversity, Equity, and Inclusion
- Preventing Discrimination, Harassment, and Bullying