NATIONAL ACADEMIES *Sciences Engineering Medicine*

Roundtable on Macroeconomics and Climate-related Risks and Opportunities

Public Meeting

January 23rd, 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 National Academy of Sciences (NAS) building in Washington, DC. Remote participants will convene on a ZoomGov platform. The meeting will be an open session. Please review the meeting details provided below.

DATES & TIMES

- Monday, January 23rd, 2023: 10:00 am–4:00 pm ET

MEETING CONTACTS

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

IN-PERSON LOCATION

- The NAS building is located at 2101 Constitution Ave. NW, Room 120, Washington DC 20418 (Parking and Driving Instructions are included below).

ZOOM CONNECTION

- Please see page 8 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

- Lunch and a tea/coffee service with snacks will be served in the building. Vegetarian/vegan and gluten free options will be available. Federal participants will be 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

Roundtable on Macroeconomics and Climate-related Risks and Opportunities

Executive Meeting 01

CLICK HERE TO JOIN

Meeting ID
160 986 2849
Passcode
453062

Phone Only
Find your local number here

NAS Building
2101 Constitution Ave NW,
Room 120
Washington, DC 20418

MONDAY, JANUARY 23, 2023 | OPEN SESSION

Meeting Goals

- Ground Roundtable discussions with user capabilities and needs to ensure utility of activities
- Provide brief high-level overview of macroeconomics and current state of approaches for consideration of climate change impacts and variables
- Provide brief high-level overview of climate science and how it intersects with economics
- Consider available policy pathways and their implications on socioeconomic outcomes

10:00–10:15 **Welcome**

• **Wendy Edelberg and Robert Kopp,** Co-Chairs

10:15–10:20 **Opening Remarks**

• **Marcia McNutt,** President, National Academy of Sciences

10:20–12:00 **Panel on User Capabilities and Needs**

Moderator: Brad Colman, American Meteorological Society

• **Heather Boushey,** Council of Economic Advisors

• **Joseph Kile,** Congressional Budget Office

• **Adele Morris,** Federal Reserve Board

• **Sarah Kapnick,** National Oceanic and Atmospheric Administration

• **Zachary Liscow,** Office of Management and Budget

12:00–13:00 **LUNCH**

13:00–14:20 **Macroeconomics Primers**

Moderator: Emi Nakamura, University of California, Berkeley

Discussion Questions:

• What is macroeconomics and why should macroeconomists care about climate change?

• What is the current state of economics of climate change?

• What are the predominant macroeconomic models and how do they consider climate, distributional effects, equity, etc?

- What are the challenges and barriers to representing climate?
- What are the opportunities and limitations of coupled human-natural models?

Speakers:

- **Jim Stock,** Harvard University
- **Lars Hansen,** The University of Chicago
- **Solomon Hsiang,** University of California, Berkeley
- **Eric Kemp-Benedict,** Stockholm Environment Institute US
- **Sathya Gopalakrishnan,** The Ohio State University

14:20–14:40 **Climate Primer**

Moderator: Paulina Jaramillo, Carnegie Mellon University

What is the climate science everyone should understand and how does economics inform climate projections?
Chris Field, Stanford University

14:40–15:00 **BREAK**

15:00–15:55 **Policy + Social Science Primers**

Moderator: Paulina Jaramillo, Carnegie Mellon University

What policy pathways are available to address climate change and what are their associated macroeconomic transition risks?
Rachel Cleetus, Union of Concerned Scientists

How does public policy consider and affect socioeconomic equity?
Sanya Carley, Indiana University

How does public policy affect human and economic wellbeing?
Jason Hickel, London School of Economics

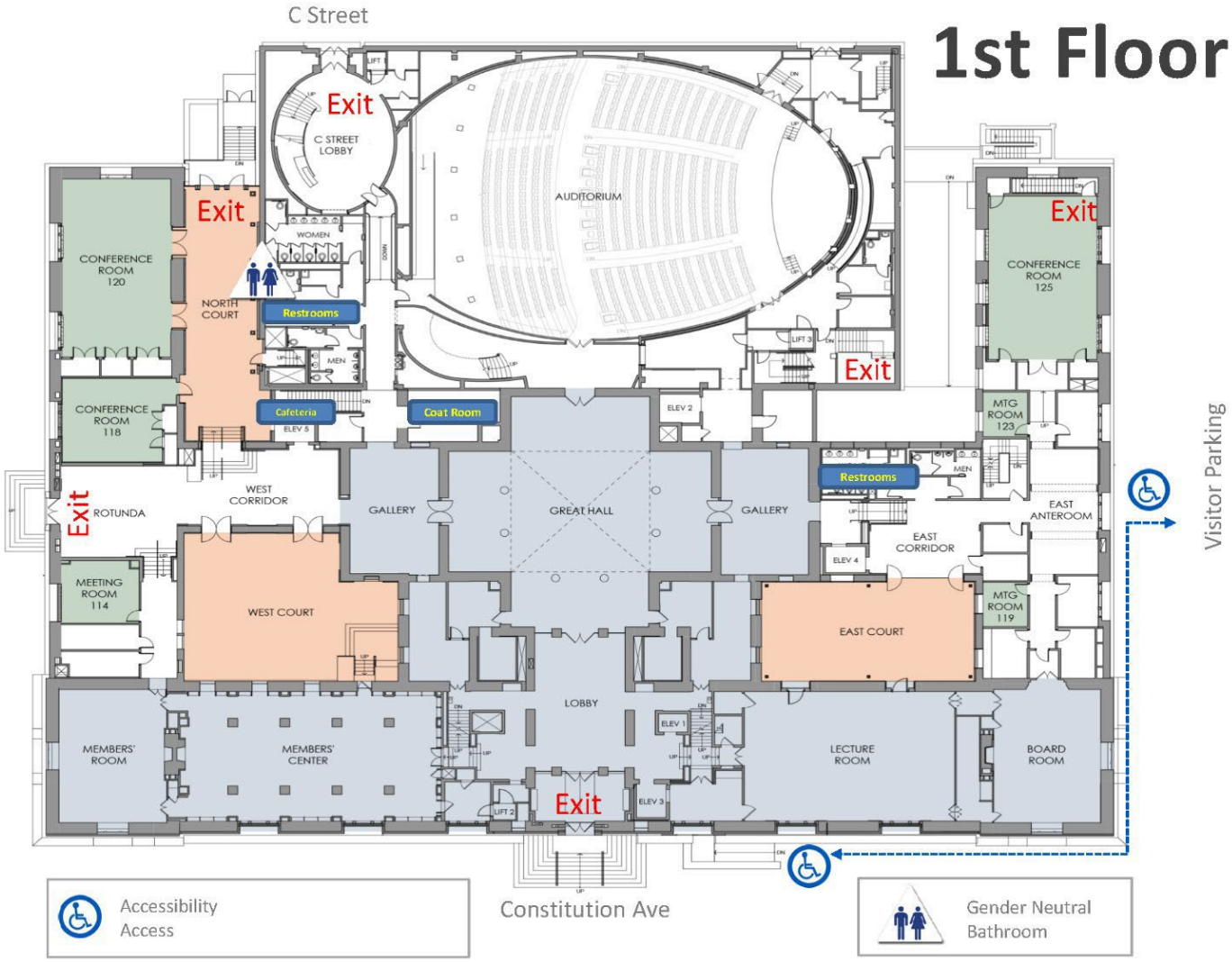
15:55–16:00 **Wrap Up Day 1**

Wendy Edelberg and Bob Kopp, Co-chairs

MEETING ADJOURNS

NAS Building Map, Location, Parking, and Metro

The Roundtable meeting will take place in Room 120, which is located on the west side of the building on the 1st floor.



LOCATION & PARKING

- The National Academy of Sciences building is located at 2101 Constitution Ave NW, Washington DC.
  - The main entrance is in the Front of the building (2101 Constitution Ave).
  - A secondary entrance is located at 2100 C Street.
  - There is a ramp at the C Street entrance and an elevator at the Constitution Avenue entrance to accommodate wheelchairs and the physically challenged.
- Limited parking is available for meeting participants in the visitors parking area of the NAS building. Parking is provided on a first-come basis, and overflow is directed to public parking garages. Parking entrance is at the intersection of 21st and C Streets NW.
- The public parking facilities closest to the NAS Building are Colonial Parking (20th Street, NW, between E and F Streets) and Columbia Plaza (23rd and Virginia Avenue, NW).

BY METRO

- Take the Orange or Blue Line to Foggy Bottom-GWU Metro stop.
- Turn right when you exit the station.
- Walk south down 23rd Street NW for approximately 7 blocks.
- Turn left onto C Street NW (after the State Department).
- Cross 22nd Street NW.
- The main entrance is the Front of the building (2101 Constitution Ave). A secondary entrance is located at 2100 C Street.

ZoomGov Links

January 23rd, 2023 (10:00 am–4:00 pm ET)

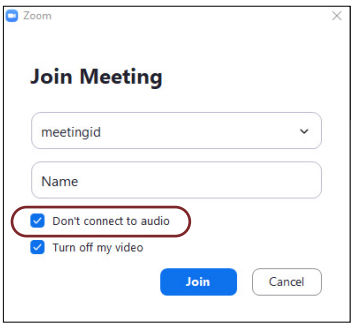
Enter ZoomGov Meeting
Meeting ID: 160 986 2849
Password: 453062

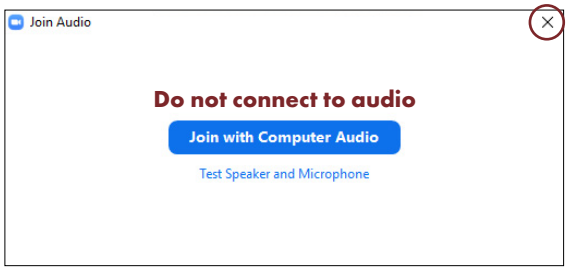
Local Numbers to Join by Phone

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.

Statement of Task

The National Academies of Sciences, Engineering, and Medicine will establish a Roundtable on Macroeconomics and Climate-related Risks and Opportunities, with a goal of improving understanding of how the physical and transition effects of climate change relate to and affect macroeconomic performance and the implications for fiscal, monetary, and financial stability policies.

The Roundtable will be a venue for federal agencies and cross-disciplinary experts in academia, industry, and non-governmental organizations to discuss challenges associated with incorporating climate change risks and opportunities into macroeconomic analysis, including: (1) how to translate the uncertain impacts of climate change and the transition to net-zero carbon emissions economies into inputs to macroeconomic analyses; and (2) how to adjust macroeconomic models and analytic approaches to accommodate the unique characteristics of climate risks and opportunities.

Activities of the Roundtable will help identify currently available data and analyses that can inform policy-making as the nation transitions to a net-zero carbon economy and prepares for anticipated impacts of climate change, highlight gaps in needed data and analyses, and provide a mechanism to expand relevant research efforts among both established and early career researchers. The Roundtable will focus on advancing data and methodologies that would support the development of macroeconomic analysis that inform the federal budget process in the United States, drawing upon international expertise and policies.

Speaker Bios

Heather Marie Boushey is a member of President Biden's Council of Economic Advisers. Dr. Boushey is co-founder of the Washington Center for Equitable Growth, where she was President and CEO from 2013–2020. She previously served as chief economist for Secretary Clinton's 2016 transition team and as an economist for the Center for American Progress, the Joint Economic Committee of the U.S. Congress, the Center for Economic and Policy Research, and the Economic Policy Institute. Dr. Boushey received her Ph.D. in Economics from The New School for Social Research.

Sanya R. Carley is a Paul H. O'Neill Professor and Director of the Master of Public Affairs programs at the O'Neill School of Public and Environmental Affairs at Indiana University, where she also co-directs the Energy Justice Lab. Her research focuses on energy justice and just transitions, electricity and transportation markets and policy, and public perceptions of energy infrastructure and technologies. Dr. Carley chairs the Technical Advisory Council for the National Renewable Energy Laboratory, is an author of the Fifth National Climate Assessment report, and is a member of the National Academies' Innovation Policy Forum. Dr. Carley's research has been recognized with several prestigious awards, including the David N. Kershaw Award in 2021, honored by the Association of Public Policy Analysis and Management, and the 2022 Indiana University Tracey Sonneborn Award. She received her Ph.D. in public policy from the University of North Carolina at Chapel Hill, M.S. in urban and regional planning from the University of Wisconsin-Madison, and bachelor's degrees in economics and sustainable development from Swarthmore College.

Rachel Cleetus is the policy director with the Climate and Energy program at the Union of Concerned Scientists. She leads the program's efforts in designing and advocating for effective and equitable policies to address climate change. Dr. Cleetus has over twenty years of experience working on policies to promote clean energy, drive deep cuts in heat-trapping emissions, and promote climate resilience. She also researches the risks and costs of climate impacts on people and the economy. She has co-authored numerous reports and articles including *Compound climate risks in the COVID-19 pandemic*; *Killer Heat in the United States: Climate choices and the future of Dangerously Hot Days*; *Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate*; *Surviving and Thriving in the Face of Rising Seas*; and *A Transformative Climate Action Framework: Putting People at the Center of Our Nation's Clean Energy Transition*. She is also an expert on the United Nations Framework Convention on Climate Change (UNFCCC) process and has been attending international climate negotiations since 2009. Dr. Cleetus has testified several times before Congress, including before the House Select Committee on the Climate Crisis, the Senate Committee on Banking, Housing and Urban Affairs and the House Committee on Financial Services. She has also been quoted widely in the media. Dr. Cleetus holds a Ph.D. and an M.A. in economics from Duke University and a B.S. in economics from West Virginia University.

Christopher B. Field (NAS) is the Perry L. McCarty Director of the Stanford Woods Institute for the Environment and Melvin and Joan Lane Professor for Interdisciplinary Environmental Studies. His research focuses on climate change, especially solutions that improve lives now, decrease the amount of future warming, and support vibrant economies. Recent projects emphasize decreasing risks from coastal flooding and wildfires. Dr. Field was the founding director of the Carnegie Institution's Department of Global Ecology, a position he held from 2002 to 2016. He was co-chair of Working Group II of the Intergovernmental Panel on Climate Change from 2008–2015, where he led the effort on the IPCC Special Report on "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation" (2012) and the Working Group II contribution to the IPCC Fifth Assessment Report (2014) on Impacts, Adaptation, and Vulnerability. His widely cited work has earned many recognitions, including election to the U.S. National Academy of Sciences, the American Academy of Arts and Sciences, and the American Philosophical Society, as well as the Heinz Award,

the Max Planck Research Award, the BBVA Frontiers of Knowledge Award, the Roger Revelle Medal, and the Japan Prize. Dr. Field obtained his Ph.D. in Biology from Stanford University.

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 received her Ph.D. in Environmental Economics and Policy from Duke University in 2010.

Lars Peter Hansen (NAS) is the David Rockefeller Distinguished Service Professor and the Director of Becker Friedman Institute's Macro Finance Research Program at the University of Chicago. He was the Director of Milton Friedman and the Becker Friedman Institute for Economics, 2009–2017; Co-Chair of the Macro Financial Modeling Project, 2012–2019; President of the Econometric Society, 2007; Chairman of the Economics section of the National Academy of Sciences, 2009–2012; and Chairman of the Department of Economics at the University of Chicago, 1998–2002. Dr. Hansen is a leading expert in economic dynamics who works at the forefront of economic thinking and modeling, drawing on approaches from macroeconomics, finance, and statistics. His research has focused on ways to capture broadly based notions of uncertainty in economic models with applications to the study of climate change policy and asset market fluctuations. He was the co-recipient of the 1984 Frisch Medal of the Econometric Society, recipient of the 2006 Erwin Plein Nemmers Prize, the 2010 BBVA Foundation Frontiers of Knowledge Award in Economics, Finance and Management, and the 2013 Nobel Prize in Economic Sciences. Previous NRC service includes the report entitled, "Strengthening the Linkages Between the Sciences and the Mathematical Sciences," published by the National Academies Press in 2000. Dr. Hansen received his Ph.D. in economics from the University of Minnesota in 1978.

Jason Hickel is an academic, author, and a Fellow of the Royal Society of Arts. He is Professor at the Institute for Environmental Science and Technology at the Autonomous University of Barcelona, and Visiting Senior Fellow at the International Inequalities Institute at the London School of Economics. He is Associate Editor of the journal World Development, and serves on the Statistical Advisory Panel for the UN Human Development Report, the advisory board of the Green New Deal for Europe, and the Harvard-Lancet Commission on Reparations and Redistributive Justice. Dr. Hickel's research focuses on global political economy and ecological economics, which are the subjects of his two most recent books: The Divide: A Brief Guide to Global Inequality and its Solutions (Penguin, 2017), and Less is More: How Degrowth Will Save the World (Penguin, 2020), listed by the Financial Times and New Scientist as among the best books of the year. He received his Ph.D. in economic anthropology and political economy from the University of Virginia.

Solomon Hsiang is currently the Chancellor's Professor of Public Policy at the University of California, Berkeley, where he directs the Global Policy Laboratory. Hsiang Co-Directs the Climate Impact Lab, is a Research Associate at the National Bureau of Economic Research (NBER), a National Geographic Explorer, and an Andrew Carnegie Fellow. Hsiang is the Lead Author of the first Economics Chapter for the Fifth National Climate Assessment. Hsiang's research has focused on using data to understand

the impact of climate change on the economy and human well-being. Hsiang first empirically linked macroeconomic performance to climate in a 2010 research article published in PNAS, results that his team and others have since replicated, generalized, and extended in additional studies. Hsiang received a Ph.D. in Sustainable Development from Columbia, a B.S. in Earth, Atmospheric and Planetary Science, and a B.S. in Urban Studies and Planning from the Massachusetts Institute of Technology. He was a Post-Doctoral Fellow in Applied Econometrics at NBER and a Post-Doctoral Fellow in Science, Technology and Environmental Policy at Princeton University.

Sarah B. 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.

Eric J. Kemp-Benedict 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 received his Ph.D. in physics from Boston University.

Joseph Kile is Director for Microeconomic Analyses at the Congressional Budget Office. He has directed a broad portfolio of economic analysis relevant to federal budget issues and Congressional decision making. That portfolio includes energy and natural resources, transportation and infrastructure, and labor markets and income security. Before joining CBO in 2005, Dr. Kile held various positions at the Government Accountability Office where, during his 16-year tenure, he was an author or coauthor of over 50 reports and testimonies for the Congress. He has also served as an adjunct faculty member at Georgetown University's McCourt School of Public Policy. Dr. Kile earned a Ph.D. in economics from the University of Wisconsin and an undergraduate degree in mathematics and economics from Saint Olaf College (Minnesota).

Zachary Liscow is an economist and a lawyer. He is the Chief Economist at the Office of Management and Budget and a Professor at Yale Law School. His three main interests are tax policy, cost-benefit analysis, and understanding what drives the high costs of building U.S. infrastructure. He also works in a variety of other areas, including environmental policy and empirical legal studies. He has been a Staff Economist at the Council of Economic Advisers and worked for the World Bank Inspection Panel. Dr. Liscow earned his Ph.D. in economics from the University of California, Berkeley, and his J.D. from Yale Law School. He graduated summa cum laude from Harvard College with degrees in Economics and in Environmental Science and Public Policy.

James H. Stock is Vice Provost for Climate and Sustainability, Harvard University; the Director of the Salata Institute for Climate and Sustainability, Harvard University; and the Harold Hitchings Burbank Professor of Political Economy at Harvard University. His current research includes energy and environmental economics with a focus on fuels and on U.S. climate change policy. He is co-author, with Mark Watson, of a leading undergraduate econometrics textbook. In 2013–2014, he served as Member of President Obama's Council of Economic Advisors, where his portfolio included macroeconomics and energy and environmental policy. He was Chair of the Harvard Economics Department from 2007–2009. He holds a M.S. in Statistics and a Ph.D. in Economics from the University of California, Berkeley.

Volunteer Membership Roster

Wendy Edelberg (*Co-Chair*)
The Brookings Institution

Robert Kopp (*Co-Chair*)
Rutgers University

Bilal M. Ayyub
University of Maryland

Sanya R. Carley
Indiana University

J. Mijin Cha
Occidental College

Rachel Cleetus
Union of Concerned Scientists

Brad R. Colman
The Climate Corporation *(retired)*

Christopher B. Field (NAS)
Stanford University

Sathya Gopalakrishnan
The Ohio State University

Lars Peter Hansen (NAS)
The University of Chicago

Jason Hickel
London School of Economics

Solomon Hsiang
University of California, Berkeley

Lori Hunter
University of Colorado Boulder

Paulina Jaramillo
Carnegie Mellon University

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Justina W. Gallegos
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Alex L. Marten
Environmental Protection Agency

Adele C. Morris
Federal Reserve Board

Tara M. Sinclair
U.S. Department of Treasury

Maria Uhle
National Science Foundation

Running List of Suggested Papers

INTRODUCTORY MATERIAL

Hsiang, S., & Kopp, R. E. (2018). An economist's guide to climate change science. *Journal of Economic Perspectives*, *32*(4), 3-32. https://doi.org/10.1257/jep.32.4.3

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Lavoie, M. (2022). *Post-Keynesian Economics: New Foundations*.

MacDonald, J. (2021). *Rethinking Macroeconomics*. (Preview of 1st edition ch. 1)

Romer, D. (2012). *Advanced Macroeconomics*, chapters 1-3.

REVIEW ARTICLES

Auffhammer, M. (2018). Quantifying economic damages from climate change. *Journal of Economic Perspectives*, *32*(4), 33-52.

Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G., & Tanaka, M. (2018). Climate change challenges for central banks and financial regulators. *Nature Climate Change*, *8*(6), 462-468.

Gillingham, K., & Stock, J. H. (2018). The cost of reducing greenhouse gas emissions. *Journal of Economic Perspectives*, *32*(4), 53-72.

Kopp, R. E., Shwom, R. L., Wagner, G., & Yuan, J. (2016). Tipping elements and climate–economic shocks: Pathways toward integrated assessment. *Earth's Future*, *4*(8), 346-372.

Monasterolo, I. (2020). Climate change and the financial system. *Annual Review of Resource Economics*, *12*, 299-320.

RESEARCH ARTICLES

Armstrong McKay, D. I., Staal, A., Abrams, J. F., Winkelmann, R., Sakschewski, B., Loriani, S., ... & Lenton, T. M. (2022). Exceeding 1.5° C global warming could trigger multiple climate tipping points. *Science*, *377*(6611), eabn7950.

Barrage, L. (2020, May). The fiscal costs of climate change. In *AEA Papers and Proceedings* (Vol. 110, pp. 107-12).

Burke, M., & Tanutama, V. (2019). *Climatic constraints on aggregate economic output* (No. w25779). National Bureau of Economic Research.

Burke, M., Davis, W. M., & Diffenbaugh, N. S. (2018). Large potential reduction in economic damages under UN mitigation targets. *Nature*, *557*(7706), 549-553.

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Colacito, Riccardo, Bridget Hoffmann, and Toan Phan. 2019. "Temperature and Growth: A Panel Analysis of the United States," Journal of Money, Credit, and Banking, vol. 51, nos. 2-3 (March-April), pp. 313–368, https://doi.org/10.1111/jmcb.12574 .

Depsky, N., Bolliger, I., Allen, D., Choi, J. H., Delgado, M., Greenstone, M., ... & Hsiang, S. (2022). DSCIM-Coastal v1. 0: An Open-Source Modeling Platform for Global Impacts of Sea Level Rise. *EGUsphere*, 1-47. https://egusphere.copernicus.org/preprints/2022/egusphere-2022-198/

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RELEVANT PROJECT WEBSITES AND MATERIAL

Billion Dollar Weather and Climate Disasters: https://www.ncei.noaa.gov/access/billions/

Climate Mapping for Resilience and Adaptation: https://resilience.climate.gov/

Famine Early Warning System Network: https://fews.net/

How the federal budget current considers climate, on p. 34: https://www.whitehouse.gov/wp-content/uploads/2022/04/ap_3_long_term_fy2023.pdf

IIASA Justice project - https://iiasa.ac.at/news/apr-2022/justtrans4all-updates

National Integrated Drought Information System: https://www.drought.gov/

National Integrated Heat Health Information System: https://www.heat.gov/

NCEI: https://www.ncei.noaa.gov/

NOAA Climate.gov: https://www.climate.gov/

Sea Level Rise Viewer: https://coast.noaa.gov/slr/

U.S. Climate Resilience Toolkit: https://toolkit.climate.gov/

COVID-19 Vaccination Policy for Non-Staff Access to National Acadamies Facilities

COVID-19 Vaccination Policy for Non-Staff Access to National Academies Facilities

Guidance for Visitors

In accordance with the organization's commitment to provide a safe and healthy workplace, the National Academies are establishing a COVID-19 Vaccination Policy for any persons that are not officially staff members to permit access to our facilities. Beginning March 10, 2022, all visitors to NASEM facilities—including volunteers, Academy members, invited guests, fellows, sponsors, presenters, vendors, contractors, consultants, temporary workers, and other nonstaff— must be up-to-date on their vaccinations against COVID-19 (as defined by the CDC). Visitors must show their official COVID-19 Vaccination Record Card (or a digital photo of the card) to the security staff at the Keck Center or the NAS Building, or to the management staff at the Beckman Center, when they enter the facility. A visitor's vaccination information will not be recorded or stored by the National Academies; the information will simply be verified to allow them to access the facility. Anyone who fails to present a vaccination card (or its copy) will not be allowed access to our facility; no exemptions or exceptions will be accommodated. Children under the age of 6 months are currently ineligible for a COVID-19 vaccine, but may still enter National Academies' facilities. All visitors from a temp agency or contracting service with whom the National Academies have contract will be screened for vaccination compliance by their agency. The vaccination compliance requirements will be stated in contracts with those agencies.

Vaccination

Consistent with the CDC's guidance, the National Academies are adopting this policy to support preventing the infection and spread of the COVID-19 virus, and as an integral measure towards the safety and health of everyone in our buildings.

Operating Status

The National Academies' Operating Status webpage provides the current information regarding access to the Academies' facilities. This information will be updated to be consistent with applicable government mandates and Academies policies. The operating status will include any requirements regarding vaccinations, masks/respirators, social distancing, and occupancy limits.

Requirements for Meetings and Activities

Non-staff participants are not obligated to travel to participate in meetings being held at one of National Academies facilities during this time. Remote attendance is encouraged to the meeting for anyone who is not comfortable traveling to or participating in an in-person meeting. The National Academies have made investments in new equipment in our meeting rooms to accommodate interactive, hybrid meetings so that the experience for those not in the room will be as engaging as possible. In certain circumstances, such as for meetings involving classified or controlled information or events of significance importance, a request for participants to attend in-person may be extended. These events should still provide accommodations for those that cannot attend in-person, if possible. Vaccination and masking/respirator requirements for non-staff participants in National Academies activities that take place in an off-site location are subject to the requirements of the offsite facility and based on the local guidance and requirements.

Revised: 09/26/2022

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).
- **Respect confidentiality** of the identities of any individuals involved in a conduct concern while it is being reviewed and addressed.
- **Comply with requests to stop behavior.** If any NASEM staff, Roundtable member, or other person in a facilitation or leadership role asks you to stop a behavior deemed unacceptable, please immediately and respectfully comply.

DO NOT

- **Intentionally talk over or interrupt others.**
- **Engage in conduct or make comments that are biased, demeaning, intimidating, coercive, or harassing/hostile,** whether seriously or in jest (examples include derogatory, exclusionary behaviors or comments toward others based on gender, sexual orientation, disability, physical appearance, body size, race, religion, national origin, or any identity-based factors).
- **Engage in personal attacks or bullying.**
- **Comment on personal appearance,** seriously or in jest, unless you know such comments are welcome.
- **Display nudity and/or sexual images** in public spaces or presentations.
- **Disrupt or engage in violence or abuse, threats of violence, harm, or threats of harm of any kinds.** Do not create/contribute to a safety threat or unsafe or exclusionary situation.
- **Drink or use other legal intoxicants** to the extent that your ability to act professionally is compromised.
- **Take or distribute pictures or recordings without approval.**
- **Retaliate against or disadvantage anyone for reporting a concern** or cooperating in an investigation. Do not make bad faith accusations.

How to Report Misconduct

If you experience or witness behavior that appears to violate this Code of Conduct, please notify us immediately so we can take appropriate steps to address your concerns. Feel free to use any of the following options:

- Contact NASEM event staff: Bridget McGovern, BAMcGovern@nas.edu.
- Contact NASEM Office of Human Resources, HRServiceCenter@nas.edu.

**This code of conduct was adapted from the Geological Society of America's Events Code of Conduct, found here: https://www.geosociety.org/GSA/Events/EventConductCode/GSA/Events/Conduct.aspx*

PREVENTING DISCRIMINATION, HARASSMENT, AND BULLYING:
POLICY FOR PARTICIPANTS IN NASEM ACTIVITIES

The National Academies of Sciences, Engineering, and Medicine (NASEM) are committed to the principles of diversity, inclusion, integrity, civility, and respect in all of our activities. We look to you to be a partner in this commitment by helping us to maintain a professional and cordial environment. **All forms of discrimination, harassment, and bullying are prohibited in any NASEM activity.** This policy applies to all participants in all settings and locations in which NASEM work and activities are conducted, including committee meetings, workshops, conferences, and other work and social functions where employees, volunteers, sponsors, vendors, or guests are present.

Discrimination is prejudicial treatment of individuals or groups of people based on their race, ethnicity, color, national origin, sex, sexual orientation, gender identity, age, religion, disability, veteran status, or any other characteristic protected by applicable laws.

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