



Emmett Institute Geoengineering Governance Project

Project Report, January 2021

The Geoengineering Governance Project in the UCLA Emmett Institute on Climate Change and the Environment is a world-leading center for the study of legal and policy issues presented by solar geoengineering and carbon dioxide removal technologies: their societal impacts, risks, and benefits; their interactions with emissions-cutting measures and other climate responses; and their governance challenges and potential responses.

Led by Edward A. Parson, Dan and Rae Emmett Professor of Environmental Law at UCLA Law and Faculty Co-Director of the Emmett Institute, with support from the Open Philanthropy Project, the project conducts interdisciplinary research, engages with and advises decision-makers, and provides training to broad audiences of students, professionals, and citizens.

Background

Solar geoengineering and large-scale carbon dioxide removal are both intentional, large-scale interventions to modify the environment, which aim to counteract some of the harms from elevated atmospheric greenhouse gases. Both are fairly recent additions to the set of potential climate responses. Both promise, in dissimilar ways, the possibility of reducing climate-change risks more than is possible by emissions cuts and adaptation alone. Both also present significant new risks and uncertainties, including novel challenges related to how the technologies may be used, under whose control, with what aims and effects.

Solar geoengineering presents especially acute governance challenges. Major concerns raised about solar geoengineering include potential unilateral use by one country, excessive or over-confident reliance that may weaken needed emissions-cutting efforts, and exacerbating international inequity or conflict.

Our Work

The Project advances knowledge and governance practice on solar geoengineering and carbon dioxide removal, considering both their potential contributions to effective climate response and their diverse risks:

- The project engages with decision-makers in government, international organizations, and the private and civil-society sectors, aiming to start the process of identifying and building needed governance capacity.
- The project supports teaching and training through lectures, conference and workshop presentations, and the 2019 International Summer School on Geoengineering Governance.
- Since 2017, the project has produced more than 50 published outputs, including research and scholarly publications as well as legal, policy-oriented, and popular publications.

Training Future Leaders

The project organized [the Sixth International Summer School on Geoengineering Governance](#), held from Aug 5 – 11, 2019 in Banff, Alberta, co-sponsored by four partner organizations.¹

The Summer School [brought together sixty participants](#) – including leading researchers as faculty, as well as graduate students, researchers, government officials, and civil society representatives from more than a dozen countries – for five days of intensive exploration of the societal, political, governance, and ethical aspects of geoengineering.



Participants in the 2019 International Summer School on Geoengineering Governance

Engaging with policymakers

The project has advised and consulted with climate-change policy-makers in multiple jurisdictions, aiming to build awareness of geoengineering technologies, their potential benefits and risks, and their research and governance needs. Highlights include the following:

1 Harvard's Solar Geoengineering Research Project, the Carnegie Climate Governance Initiative, the Solar Radiation Management Governance Initiative, and the Forum for Climate Engineering Assessment.

2021-2022: Track II Diplomacy Exercise, Partnership with Paris Peace Forum

- Through the work of project Fellow Adrien Abecassis, who served as senior aide to President Francois Hollande at the 2015 Paris Climate Conference, the Emmett Institute and Harvard projects are jointly developing a “Track 2 Diplomacy” exercise: a structured consultation on international governance needs for geoengineering, involving a globally diverse participant group of senior policy-makers, experts, and civil-society leaders.
- The exercise is being convened in partnership with the Paris Peace Forum, a distinguished international platform for dialogs on high-stakes global challenges and potential solutions. The first meeting is planned for April 2021, with work continuing through 2021 and 2022.

2017-2019: California

- At the request of Gov. Gerry Brown following an August 2017 briefing by Ted Parson and other geoengineering experts, the project organized a workshop for ~ 25 senior state officials and experts in February 2018.
- The workshop, led by Dr. Louise Bedsworth (Governor’s Office of Planning and Research), Dr. Jane C.S. Long (California Council on Science and Technology) and Ted Parson, aimed to raise awareness of geoengineering and associated issues and controversies across the state government, and to prepare for the programmatic, governance, and political needs associated with anticipated proposals to conduct solar geoengineering field research in the state.
- Since Gov. Brown left office, Dr. Bedsworth has continued working on geoengineering research governance, including chairing the Advisory Committee established by Harvard University to develop governance, oversight, and consultation mechanisms for the proposed Scopex experiment, the first small-scale solar geoengineering field experiment. The UCLA Emmett project has continued to advise Dr. Bedsworth and the Advisory Committee throughout this process.

2017-2020: Canada

- Project director Ted Parson and Prof. David Keith of Harvard University have conducted a series of briefings with senior officials in the Government of Canada, promoting development of a Canadian geoengineering research program and a leadership role for Canada in supporting international consultations on governance of geoengineering.
- After publishing an op-ed in the Toronto Globe and Mail, Parson and Keith were invited to brief the Chief of Staff to the Minister of Environment and Climate Change in December 2017. After several subsequent discussions with mid-level officials, they were invited to provide a full day of briefings for officials and scientists on Sept 5, 2019, hosted by Deputy Minister Steven Lucas, including a cross-government presentation as part of the Deputy Minister’s Seminar series. Following a subsequent Cabinet shuffle and changes in senior executives in Fall 2019, Parson had follow-up conversations with the new Minister (Jonathan Wilkinson) and Deputy Minister (Christine Hogan) at COP25, December 2019, in Madrid.
- Based in part on these conversations, the Government of Canada is now developing plans to support geoengineering research. No announcement or decision has yet been made regarding a governance initiative, but we continue to engage them in discussions on this.

2019-2020: IRGC report commissioned by governments of Switzerland and Germany

- Following participation in the 2019 Summer School by Amb. Franz Perrez of Switzerland and Dr. Marie-Valentine Florin, executive director of the International Risk Governance Center (IRGC) in Lausanne, the Government of Switzerland asked IRGC to prepare a report on scientific, technological, governance, and ethical issues posed by geoengineering. Project fellow Dr. Jesse Reynolds worked closely with IRGC in planning the activity and authored the final chapter of the report, while project PI Ted Parson provided invited commentary and spoke at the project's review workshop in April 2020. The report was published in Summer 2020 and provided by request to sponsoring offices in the Swiss and German governments.

2019-2020: US federal research agencies

- The FY 2020 US federal budget for the first time included modest funding for solar geoengineering research (\$4 M in NOAA), along with substantially larger amounts for CDR research (~ \$100M total, in three agencies), and future increases are widely expected.
- Project PI Ted Parson and fellow Jesse Reynolds have collaborated with researchers and officials at NOAA's Boulder Laboratory and the National Center for Atmospheric Research in a series of planning activities for the design and oversight of this research and the development of scenarios to coordinate the research. They spoke at four workshops and continue to consult with agency staff who would be responsible for these programs, and with leading scientific researchers expected to participate in these programs.

Research and Scholarship: Publications as of January, 2021

Books

J.P. Sapinski, Holly J. Buck, and Andreas Malm, editors, *Has it come to this? The promises and perils of geoengineering on the brink*. Rutgers University Press, November 2020. [Link](#).

Jesse L. Reynolds, *The Governance of Climate Engineering: Managing Climate Change in the Anthropocene*, Cambridge University Press: 2019. [Link](#).

Holly Buck, *After Geoengineering: Climate tragedy, repair, and restoration*. Verso: 2019. [Link](#).

Andrew E. Dessler and Edward A. Parson, *The Science and Politics of Climate Change: a guide to the debate*. Cambridge University Press: 3rd edition, 2019. [Link](#).

Articles in Scientific Journals and Law Reviews

Holly J. Buck, I. Mettiäinen, D. MacMartin, K. Ricke, "Bog there, marshland here: Challenges in co-producing scientific knowledge on climate geoengineering in the Arctic," in review.

Jesse L. Reynolds, "Novel Technologies and Global Environmental Governance: Theoretical Perspectives on Solar Geoengineering, Biotechnology, and Digital Technology" (with Sikina Jinnah, Josh Horton, Matthias Honegger, Karsten Schulz, Marian Feist, Valentina Nakic, Florian Rabitz, Oskar Gstrein, Ina Möller, Marielle Papin-Manjarrez). In review.

Jesse L. Reynolds, Janos Pasztor, Nicholas Harrison, Arunabha Ghosh, Ying Chen, Ronald Jumeau, and Carlos Nobre, "Playing with Fire: Strengthening Governance of Large-scale Climate Altering Technologies and Interventions," *Global Policy*, in review

Charles Corbett, “Muddling through: Climate Emergencies and the Deployment of Solar Geoengineering,” in review.

Charles Corbett, “Glacial Geoengineering and the Antarctic Treaty System,” in preparation for 2021 law review submission

Charles Corbett, “Nature-based Solutions: Understanding Debate and Dysfunction in Carbon Removal Policy,” in preparation for 2021 law review submission.

Charles Corbett, “Extraordinary and Highly Controversial: Federal Research on Solar Geoengineering under NEPA,” *Northwestern Law Review* 2021, forthcoming.

Edward A. Parson and Jesse L. Reynolds, special collection of six articles from 2019 Summer School Scenario exercise, under review in *Futures*, 2021 – individual titles follow.

Edward A. Parson and Jesse L. Reynolds, “Solar Geoengineering: Scenarios of Future Governance Challenges,” *Futures*, under review, 2021.

Zachary Dove, Joshua Horton, Katharine Ricke, “The Middle Powers Roar: A Scenario of Minilateral Solar Geoengineering Deployment,” *Futures*, under review, 2021.

Felix Schenuit, Jonathan Gilligan, Anjali Viswamohanam, “Vulnerable States Demand and Act: A Solar Geoengineering Deployment Scenario,” *Futures*, under review, 2021.

Anne Pasek, Tyler Felgenhauer, David Morrow, “Reflections on a Decentralized Grassroots Solar Geoengineering Deployment Scenario,” *Futures*, under review, 2021.

Mariia Belaia, Amanda Borth, and Weili Weng, “The Private Sector to the Rescue? A Private-Sector Solar Geoengineering Deployment Scenario,” *Futures*, under review, 2021.

Edward A. Parson and Jesse L. Reynolds, “Geoengineering Governance: Insights and Challenges from a Scenario Exercise,” *Futures*, under review, 2021.

Jesse L. Reynolds, “Engineering Biological Diversity: The International Governance of Synthetic Biology, Gene Drives, and De-extinction for Conservation.” *Current Opinion in Environmental Sustainability* 49:1 – 6, April 2021. [Link](#).

Jesse L. Reynolds, “Is Solar Geoengineering Ungovernable? A Critical Assessment of Governance Challenges Identified by the IPCC.” *Wiley Interdisciplinary Reviews: Climate Change*, 2020:e690. [Link](#).

Holly J. Buck, “Should carbon removal be treated as waste management? Lessons from the cultural history of waste,” *Interface Focus* 10:5, 2020. [Link](#).

Charles Corbett, “Chemtrails and Solar Geoengineers: Governing Online Conspiracy Theory Misinformation,” *Missouri Law Review* 85:3, Fall 2020. [Link](#).

Holly J. Buck, Jay Fuhrman, David R. Morrow, Daniel L. Sanchez, Frances M. Wang. “Adaptation and carbon removal,” *One Earth* 3:4, P425-435, Oct 22, 2020. [Link](#).

Holly J. Buck, O. Geden, M Sugiyama, O Corry, “Pandemic politics —lessons for solar geoengineering,” *Nature Communications Earth & Environment*. 1:16 (2020). [Link](#).

Charles Corbett and Wil Burns, “Antacids for the Sea?: Artificial Ocean Alkalinization and Climate Change,” *One Earth* 3:2, P154-156, Aug 21, 2020. [Link](#).

- Simon Nicholson and Jesse L. Reynolds, eds., “Taking Technology Seriously: Special Issue on New Technologies and Global Environmental Politics,” *Global Environmental Politics* 20:3, Aug 2020. [Link](#).
- Edward A. Parson and Holly J. Buck, “Large-scale Carbon Dioxide Removal: The problem of phasedown,” *Global Environmental Politics* 20:3, August 2020, 70-92. [Link](#).
- J. L. Reynolds, “Governing new technologies for biodiversity: Gene drive, international law, and emerging politics” *Global Environmental Politics* 20:3 Aug 2020. [Link](#).
- J.L. Reynolds and E.A. Parson, “Nonstate governance of solar geoengineering research,” *Climatic Change* 160: 323-42 (2020). [Link](#).
- Holly J. Buck, L.J.Martin, O.Geden, P.Kareiva, L.Koslov, W.Krantz, B.Kravitz, J.Noël, E.A. Parson, C.J.Preston, D.L.Sanchez, L.Scarlett, S. Talati, “Evaluating the efficacy and equity of environmental stopgap measures,” *Nature Sustainability*, 3:499-504 2020. [Link](#).
- Sean Low and Holly J. Buck, “The Practice of Responsible Research and Innovation in Climate Engineering,” *Wiley Interdisciplinary Reviews: Climate Change* 11:3, e644, 2020. [Link](#).
- Holly J. Buck, “Understanding inaction in confronting ecosystem collapse: community perspectives from California’s Salton Sea,” *Ecology and Society* 25:1 27, 2020. [Link](#).
- J.L. Reynolds and Joshua B. Horton, “An Earth System Governance Perspective on Solar Geoengineering,” *Earth System Governance* 3:10043, 2020. [Link](#).
- J.L. Reynolds and Gernot Wagner, “Highly Decentralized Solar Geoengineering,” *Environmental Politics* 29:5, 917-933, 2019. [Link](#).
- J.L. Reynolds, “Solar Geoengineering to Reduce Climate Change: A Review of Governance Proposals,” 475 *Proceedings of the Royal Society A* 20190255, 2019. [Link](#).
- Holly J. Buck, “Challenges and opportunities of bioenergy with carbon capture and storage for communities,” *Current Sustainable/Renewable Energy Reports* 6:4 124-130, 2019. [Link](#).
- T. Svoboda, Holly J. Buck, P. Suarez, “Climate Engineering and Human Rights,” *Environmental Politics* 28:3, 397-416, 2019. [Link](#).
- Holly J. Buck, “On Carbonscapes by Design,” *Log* 47, 2019. [Link](#).
- Holly J. Buck. “The politics of negative emissions and decarbonization in rural communities,” *Global Sustainability* 1, 2018. [Link](#).
- Holly J. Buck. “Perspectives on solar geoengineering from Finnish Lapland: Local insights on the global imaginary of Arctic geoengineering,” *Geoforum* 91:78-86, 2018. [Link](#).
- J. Horton, J.L. Reynolds, H.J. Buck, D. Callies, S. Schafer, D.Keith, S. Rayner, “Solar Geoengineering and Democracy,” *Global Environmental Politics* 18:3, 5-24, 2018, [Link](#).
- E. A. Parson, “Climate Policymakers and Assessments must get serious about climate engineering,” *Proc of the Nat Acad of Sci*, 114(35), 9227-9230, August 29, 2017. [Link](#).

Chapters in Edited Books

- JesseL.Reynolds, F. Rabitz, E. Tsioumani, “Emerging Technologies in Biodiversity Governance: Gaps and Opportunities for Action,” in *Transforming Biodiversity Governance*, Ingrid

Visseren-Hamakers and Marcel Kok, eds., Cambridge University Press, forthcoming.

Jesse L. Reynolds, “Solar Geoengineering could be consistent with international law,” in *Debating Climate Law*, B. Mayer and A. Zahar, eds., Cambridge University Press, 2021.

Holly J. Buck, “Climate engineering doesn’t stop ocean acidification: addressing harms to ocean life in geoengineering imaginaries,” in *Blue Legalities: The Law and Life of the Sea*, eds. Irus Braverman & Elizabeth Johnson, Duke University Press, 2020. [Link](#).

Holly J. Buck, “Village science meets global discourse: The Haida Salmon Restoration Corporation’s ocean fertilization experiment,” in *Geoengineering Our Climate: Ethics, Politics, Governance*, Jason Blackstock & Sean Low, eds., Earthscan, 2018. [Link](#).

Policy-oriented and Popular Publications

Marie-Valentine Florin, Paul Rouse, Anna-Maria Hubert, Matthias Honneger, Jesse L. Reynolds, *International Governance Issues on Climate Engineering: Information for Policy-Makers*. Lausanne: EPFL International Risk Governance Center, June 2020. [Link](#).

Holly J. Buck, “How to cool an ocean,” *MIT Technology Review* 122:3 56-61, May 2019. [Link](#).

Olúfẹ̀mi O. Táíwò and Holly J. Buck, “Capturing carbon to fight climate change is dividing environmentalists,” *The Conversation*, Jan. 31, 2019, [link](#).

Holly J. Buck, “The need for carbon removal,” *Jacobin*, July 24 2018, [link](#).

Geoengineering: The Need for Governance, Carnegie Climate Governance Initiative report, 2019. (Jesse Reynolds, contributing author). [Link](#).

Jesse L. Reynolds, “Is There Nothing New under the Sun? Analogs for the Governance of Solar Geoengineering,” in *Governance of Deployment of Solar Geoengineering*, Harvard Project on Climate Agreements, R. Stavins and R. Stowe, eds., 2019.

Jesse L. Reynolds, “Decentralized Nonstate Environmental Intervention: The Case of Solar Geoengineering,” discussion paper, Harvard Kennedy School Belfer Center for Science and International Affairs, 2019.

D.W. Keith and E.A. Parson, “Solar Geoengineering: Science Fiction – or Saviour?” op-ed, *Toronto Globe and Mail*, December 8, 2017, [link](#).

E. A. Parson, “Starting the Dialogue on Climate Engineering Governance: a World Commission,” Policy Brief 8, Fixing Climate Governance Series, Centre for International Governance Innovation, August 2017, [link](#).

Online publications, Blog posts, etc.

More than 40 posts on geoengineering-related topics by project participants on [Legal Planet](#), the environmental law blog jointly run by Emmett Institute and Berkeley Law school.

Public lectures, seminars, workshop and conference presentations (Selected):

Scenarios for Solar Geoengineering. American Geophysical Union annual meeting, December 9 and 14, 2020. Invited presentations by Ted Parson.

Community Climate Interventions Strategies Workshop, National Center for Atmospheric Research (NCAR), Boulder CO, October 28 – 30, 2020. Invited presentation by Ted Parson.

Rand Corporation/IIASA international workshop on geoengineering, July 28, 2020. Invited presentation by Ted Parson.

Philanthropies Roundtable on Solar Geoengineering, convened by World Resources Institute, June 15, 2020. Invited presentation by Ted Parson.

Community Climate Interventions Strategies Workshop, National Center for Atmospheric Research (NCAR), Boulder CO, April 15-17, 2020; invited presentation by Ted Parson.

Space-based Geoengineering: in need of reconsideration? Harvard University Center for the Environment, Nov 24 – 25, 2019; invited presentation by Ted Parson.

Global Development Network Conference, Bonn, 23 – 25 October 2019; invited plenary presentation by Jesse Reynolds.

Breakthrough Dialog; invited presentations by Holly J. Buck, Sept 2018 (“achieving disagreement”) and September 2019 (“Environmental policy after neoliberalism”).

Conference on Environmental Security, National Intelligence University, Washington DC, Sept 12, 2019; invited presentation by Holly Buck.

Workshop for NRC Committee on solar geoengineering research, Stanford University, Sept 10 - 11, 2019; invited presentations by Ted Parson and Holly Buck.

Intelligence-Squared Debates (IQ2), New York, April 18, 2019. Ted Parson and David Keith (Harvard) debated solar geoengineering with Anjali Viswamohanan (Oxford) and Clive Hamilton (Charles Sturt University Australia). Debates scored by pre/post-test agreement: Support for Parson/Keith proposition pre 37%, post 75%. [Link](#).

Scenarios Forum, University of Denver, March 11 – 13, 2019; invited presentations by Ted Parson and Jesse Reynolds.

Crafting the Long Tomorrow, Biosphere II (Univ of Arizona), Feb 23, 2019. Keynote address by Holly Buck.

Earth Systems Governance Conference, Utrecht, 5 – 8 November 2018; two sessions organized by Jesse Reynolds.

Workshop on Environmental Stopgaps, UCLA Nov 7, 2018. Workshop organized by Holly Buck, scenario exercise designed and led by Ted Parson. Holly, Ted, and Will Krantz are co-authors on subsequent paper, published in Nature Sustainability, April 2020.

Geoengineering Research Governance: Issues and Opportunities for California, UCLA, February 12-13, 2018. Workshop sponsored by project, organized and led by Ted Parson, Louise Bedsworth, and Jane C.S. Long at request of Governor Brown.

Climate Engineering Conference 2017, Berlin, October 9 – 12, 2017. Four sessions organized by Ted Parson, Holly Buck, and Jesse Reynolds, including [scenario exercise on governance challenges](#). Holly Buck served on steering committee for Conference.

Plus ~ 40 other lectures, conference and workshop presentations by project team, 2017-2021.