Arctic Climate Interventions: A Climate Justice Challenge

Explainer

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Introduction

Building huge mirrors in space, brightening clouds, attempting to stabilize ice sheets with underwater curtains, spreading tiny, reflective glass beads over sea ice—while this list might invoke science fiction, all of these geoengineering techniques have been proposed for implementation in the Arctic.

Interest in researching and potentially deploying climate interventions is growing, in the hope that they could buy countries time to mitigate carbon emissions through other methods.

Discussions around climate geoengineering tend to focus on the technical feasibility of specific approaches or global governance issues. However, it is likely that many proposed climate interventions will have "uneven" risks and effects. Region-specific research on climate interventions generally, and a focus on the Arctic specifically, provide an important lens through which to examine a broader suite of issues, including legal, social, cultural, and ethical questions.

In particular, the Arctic is an important region for thinking through the climate justice challenges associated with these novel technologies. In July 2025, the International Court of Justice (ICJ) ruling on state liability for climate inaction[1] brought dialogues on state liability for climate inaction to the fore, marking a growing global movement to litigate, contest, and reshape climate governance.

Using the Arctic as a case study, this explainer examines potential climate justice challenges associated with climate intervention technologies.

What are climate interventions?

The term 'climate intervention' refers to a deliberate, large-scale attempt to alter the climate system in a way that halts, slows down, or reverses global warming.[2] This definition includes a wide range of geoengineering technologies, typically organized into the two categories of Carbon Dioxide Removal (CDR) and Solar Radiation Modification (SRM). CDR methods are human-initiated activities that remove carbon dioxide from the atmosphere, whereas SRM refers to interventions that increase the reflectivity of Earth's atmosphere to solar radiation with the aim of reducing warming.[3]

Encompassing a variety of techniques, climate interventions range from "serious research projects to back-of-the-envelope calculations,"[4] and no comprehensive framework(s) currently exist to ensure ethical research on and effective governance of climate interventions.

1 https://www.icj-cij.org/sites/default/files/case-related/187/187-20250723-pre-01-00-en.pdf
2 https://www.agu.org/ethicalframeworkprinciples
3 https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_AnnexI.pdf
4 https://www.uarctic.org/news/2023/10/saving-the-frozen-arctic-a-new-assessment-evaluates-potential-climate-action-measures-and-their-feasibility/

Why is interest in climate interventions growing?

While there is still significant variation in projected global warming scenarios, the latest Intergovernmental Panel on Climate Change (IPCC) assessment puts Earth on track to reach 3°C of warming by the end of the century, double that of the Paris Agreement's most ambitious target.[5] As the delta grows between climate mitigation actions and global warming scenarios, an increasing number of scientists and policymakers are taking an interest in climate interventions. While climate interventions cannot negate the pressing need for accelerated emission reduction efforts, some see them as tools that could contribute to slowing global warming and/or reducing its impacts regionally.

Why do many climate intervention proposals focus on the Arctic?

There are several reasons that the Arctic garners significant attention as a venue for climate interventions. First, the Arctic is warming three to four times faster than the global average,[6] and it is the location of many climate tipping points.[7] The Arctic also plays a significant role in regulating Earth's climate and influencing global weather systems. As a result, many geoengineering researchers and advocates want to explore technologies that could help slow or reverse climatic changes to the Arctic.

Additionally, the Arctic represents an attractive venue for potential stratospheric aerosol injection (SAI) in particular, because the stratosphere is at a relatively low altitude in the polar regions, which makes them the only geographic locales where current aircraft could feasibly deploy.[8]

Lastly, the Arctic appeals as a location for testing and deploying climate interventions because of a long-held assumption that it is a sparsely inhabited space, suitable for experimentation and exploitation.[9] In reality, approximately four million people live in the Arctic, including over 500,000 Indigenous Peoples, with their own distinct languages, cultures and territories.[10]

5 UNEP Emissions Gap Report, 2023: https://wedocs.unep.org/bitstream/handle/20.500.11822/43922/EGR2023.pdf
6 https://www.amap.no/documents/download/7310/inline
7 https://www.nature.com/articles/d41586-019-03595-0
8 https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2024EF005567
9 Ray, S.J. and Maier, K. (eds.) (2017) Critical Norths: space, nature, theory. University of Alaska Press: Fairbanks, AK
10 https://www.arcticpeoples.com/#story

Why do Arctic climate interventions raise climate justice concerns?

The Inuit Circumpolar Council (ICC) has expressed a concern regarding "the risk that, in the rush of rapid solutions, exploitative colonial dynamics will be reproduced."[11] Large-scale climate interventions risk repeating patterns of land control and displacement, with Indigenous Peoples often being structurally excluded from the spaces where geoengineering is debated or designed.[12]

The climate justice movement contends that the effects of climate change disproportionately affect marginalized groups.[13] Those who have contributed least to emissions are often the most vulnerable to the effects of global warming. This is evidently the case in the Arctic; Arctic Indigenous Peoples have continually had to advocate for themselves due to a lack of appropriate recognition. Arctic Indigenous Peoples have not been the main contributors to human-induced climate change, yet their livelihoods and ways of life are directly and dramatically impacted by its effects.[14] Climate interventions risk exacerbating these existing inequalities, as distribution and development (and thus control) of climate intervention technologies are driven by government leaders and private funders. This is particularly relevant in the case of the Arctic, a region experiencing accelerated climate change impacts, and now on the front lines of climate intervention proposals that are enacted in the name of 'national' or 'global' needs, but that might incur negative regional and local impacts.

Colonialism underlays relations between Indigenous Peoples and governments which often maintain inadequate forms of recognition, consent, and participation. How can consent to research or deploy climate interventions be understood in a setting where Indigenous Peoples have not contributed or consented to the conditions that serve to make these drastic actions necessary? Colonialism created and maintains conditions in which the full implementation of the rights of Indigenous Peoples, in particular the obligation to obtain free, prior, and informed consent, still rely on Indigenous Peoples exercising sometimes inadequate local, regional, and national leverage to ensure those rights are upheld.[15] Current frameworks for "consultation" often assume equal footing, despite centuries of systematic disempowerment. Efforts to define appropriate forms of consultation have been clearly set out by Indigenous Peoples, such as the ICC's Protocols for Equitable and Ethical Engagement, published in 2022.[16]

11 https://policylabs.frontiersin.org/content/policy-outlook-geoengineering-inuit-homelands
12 Kyle Powys Whyte (2018) Indigeneity in Geoengineering Discourses: Some Considerations, Ethics, Policy & Environment, 21:3, 289-307, DOI:10.1080/21550085.2018.1562529.
13 https://www.lse.ac.uk/granthaminstitute/explainers/what-is-meant-by-climate-justice/
14 https://www.inuitcircumpolar.com/wp-content/uploads/Arctic-Peoples-Statement-Final35.pdf
15 https://www.tandfonline.com/doi/full/10.1080/21550085.2018.1562529; Kyle Powys Whyte (2018) Indigeneity in Geoengineering Discourses: Some Considerations, Ethics, Policy & Environment, 21:3, 289-307, DOI:10.1080/21550085.2018.1562529.
16 https://www.inuitcircumpolar.com/wp-content/uploads/EEE-Protocols-LR-WEB.pdf

Are climate interventions a form of green colonialism?

Green colonialism refers to the imposition of sustainability projects on Indigenous lands. Climate change therefore poses a double threat to the culture and existence of Indigenous Peoples, such as the Sámi—firstly, through direct environmental impacts, and secondly through the multiplying number of energy projects and resource extraction in Sápmi under the authority of "green" development and the "clean" energy transition.[17] The case of an onshore wind farm in Norway illustrates this dynamic. Operated by Fosen Vind, the building of 151 wind turbines on Sámi lands impacted Sámi culture and livelihoods, including reindeer herding.[18] Frequently, the state benefits from such projects, while the costs are felt by Indigenous communities. These green 'solutions' often work in opposition to Indigenous Peoples' worldviews that understand human communities and the natural world in a connected and reciprocal relationship. Indigenous Peoples continue to advocate for interventions that uphold the rights of Indigenous Peoples, including with respect traditional land use, marine ecosystems, and Indigenous-led conservation approaches.

The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP, 2007) affirms Indigenous Peoples' rights to self-determination as a foundational principle. Article 19 asserts that states must consult in good faith to obtain Free, Prior, and Informed Consent (FPIC) before adopting measures that may affect them. As a result, those involved in climate intervention activities have a responsibility to respect Indigenous Peoples' self-determination and sovereignty. Already, there have been cases where climate interventions have been advanced without upholding the right of Indigenous Peoples to self-determination, or to Free, Prior and Informed Consent. This erodes trust that is critical to enable substantive discussions on these complex issues.

The U.S. nonprofit Arctic Ice Project (formerly Ice911),[19] which aimed to slow Arctic warming by sprinkling tiny, sunlight-reflecting silica beads over sea ice, closed down its operations and experiments in the Arctic in early 2025 due to the project's potential to harm marine ecosystem organisms.[20] The project had been subject to continual opposition from community members, including Iñupiat, in Utqiagvik because of fears around disruption to delicate Arctic ecosystems.[21] The decision to end operations was certainly influenced by this ongoing community-led resistance.[22] In this instance, Indigenous voices were ultimately heard, but only a decade into the project.

17 https://www.amnesty.org/en/documents/eur20/8913/2025/en/
18 https://iwgia.org/en/news/5278-press-fosen-oct2023.html
19 https://www.arcticiceproject.org
20 https://srm360.org/news-reaction/arctic-ice-project-shuts-down/
21 https://handsoffmotherearth.org/resources/press-release-geoengineering-fails-again-arctic-ice-project-shuts-down-over-ecological-concerns/
22 https://www.arcticwwf.org/the-circle/stories/news-from-the-arctic-2025-02/

The failure of project proponents to adequately consult with communities represents only one facet of the justice issue. It is also important to consider the potential unfair distribution of risks and benefits associated with geoengineering techniques. CDR options are land-intensive and perpetuate the exploitation of Indigenous Peoples' homelands in the name of the greater good, while SRM technologies could induce regional cooling with varied impacts on regional ecosystems: the distributional effects will not be experienced evenly or fairly.[23]

Is 'consent' enough?

Meaningful recognition of Indigenous leadership and knowledge systems is a necessary basis for climate intervention governance mechanisms in the Arctic. In particular, upholding the right of self-determination and securing Free, Prior and Informed Consent should be a baseline, not a ceiling. Indigenous Knowledge should be recognized as valid and rigorous in its own right; not as "supplementary" to Western science, but as integral to knowledge production. A range of measures can and should be taken to encourage meaningful engagement, such as Indigenous-led assessments, advisory boards, and co-governance structures.[24]

However, in centring Indigenous Peoples' Knowledges and lifeways, it is important that the full burden of mitigating the climate crisis not be shifted onto Indigenous Peoples. Investment in education and capacity-building that enables Indigenous Peoples to engage in climate intervention debates is required for meaningful inclusion. Decisionmakers, funders, and researchers should coordinate efforts to facilitate Indigenous involvement in ways that minimize the consultation load placed on Indigenous Peoples and lessen the effects of engagement fatigue.

Where do we go next?

Climate governance is at a crossroads. The Arctic has established unique regional governance systems and norms, characterized by strong intergovernmental collaboration among states and Arctic Indigenous Peoples' Organizations, through the Arctic Council and other forums. The region might therefore offer unique potential when it comes to designing equitable, ethical and representative governance mechanisms for geoengineering technologies. However, these rules and norms should not be taken for granted. Threats posed by shifts in global stability, brought on by Russia's war in Ukraine, and the Trump administration's withdrawal from the Paris Agreement, present significant challenges to regional collaboration through the Arctic Council and other forums.

23 https://direct.mit.edu/glep/article-abstract/20/3/93/95054/Steering-and-Influence-in-Transnational-Climate

24 https://www.belfercenter.org/research-analysis/arctic-geoengineering-governance

These challenging undercurrents have placed some limitations on cooperative regional governance structures such as the Arctic Council, although not upended the cooperation. This turbulent trend presents significant challenges for cooperation between the Arctic 14—the 8 states and 6 Indigenous Peoples' Organizations as Permanent Participants of the Arctic Council, who comprise a unique regional governance structure for the Arctic.

The Arctic is more than a climate laboratory. It is home to Peoples, cultures, and unique governance systems that must shape the future. The landscape of climate interventions is currently characterised by uncertainty. But in many ways, this offers a distinct chance to create and establish innovative and empowering new governance models. In building robust governance structures to manage these unprecedented interventions, there is an opportunity to foster a human rights-based ethic of climate justice as a guiding principle.