DANIEL EDWARD CALLIES

Climate Engineering: For and Against

David Keith, *A Case for Climate Engineering* (Boston: MIT Press, 2014)

Mike Hulme, *Can Science Fix Climate Change? A Case against Climate Engineering* (Cambridge, UK: Polity Press, 2014)

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With global greenhouse gas emissions continuing to rise each year, many climate scientists have begun to question whether mitigation and adaptation policies alone can protect us from the brunt of climate-related harms. Thus, the previously-considered taboo subject of geoengineering has emerged as a potential policy response to climate change. Defined as 'the deliberate, large-scale manipulation of the planetary environment in order to counteract anthropogenic climate change,'[1] geoengineering — or climate engineering — has garnered both supporters and ardent critics.

The divide between supporters and critics is not due merely to the empirical complexities of the various technologies being investigated — the divide also has many normative roots. These normative roots grow from, among other things, concern regarding humanity's relationship to the natural world and the legitimate governance of technologies with theoretically enormous impacts on distributive justice. In what follows, I explore these normative concerns after presenting Harvard physicist David Keith's case for climate engineering and climatologist Mike Hulme's countervailing account of why research into climate engineering ought to be abandoned. I argue that concerns stemming from respect for nature seem misplaced or inconsistent, and that while legitimate governance of climate engineering will prove a difficult ideal to reach, whether the proposed technologies alleviate or intensify particular negative distributive effects associated with unabated climate change is dependent upon how we deploy them.

A Case for Climate Engineering: David Keith

In his book *A Case for Climate Engineering*, Keith lays out a cautious, yet ambitious, argument in favor of his preferred method of geoengineering: stratospheric sulfate injection.[2] Stratospheric sulfate injection would

1 Royal Society, 'Geoengineering the Climate: Science, Governance, and Uncertainty', (2009), <https://royalsociety.org/~/media/Royal_Society_Content/policy/publications/2009/8693.pdf>, p. 1.

2 For the rest of this review, when geoengineering and climate engineering are mentioned it is this proposal of stratospheric sulfate injection that is in mind.

introduce large quantities of sulfate aerosols into the upper atmosphere in order to reflect a small fraction of the incoming sunlight, thus creating a kind of sunshade for that would reduce global surface temperatures.

As Keith notes, this is the most widely discussed of all geoengineering proposals for at least two reasons. First, such a proposal could begin with a projected cost of roughly a billion dollars — which is miniscule when compared both to other geoengineering proposals and to the cost of cutting greenhouse gas emissions to yield the same amount of cooling. Second, stratospheric sulfate injection is, in a way, a tried and tested approach. In 1991, Mount Pinatubo released somewhere between 10-20 million tons of sulfur into the stratosphere that resulted in an average global cooling of 0.5°C for the year. Stratospheric sulfate injection aims to mimic this volcanic effect in order to offset some of the inevitable warming that we are to experience due to the accumulation of greenhouse gases in the atmosphere.

Tempering his enthusiasm regarding the prospects of geoengineering, Keith is sober about the ultimate potential of such a technology. He is quick to note that geoengineering should be regarded merely as one tool 'in our kit for managing climate risk'; a kit that includes conservation, decarbonization, and adaptation.[3] In fact, Keith cautions that 'solar geoengineering may reduce [climate] risks in the short term but it cannot get us out of the long-term need to cut emissions'.[4] In addition to geoengineering's inability to provide a long-term solution to climate change, the technology is accompanied by short-term risks such as ozone depletion, air pollution, and conceivable negative impacts on regional precipitation.

Notwithstanding the limitations and risks associated with the technology, Keith advocates a specific four-step scenario for eventual deployment. Phase One is restricted to theory and laboratory work. In this preliminary phase, researchers would investigate the potential impacts of stratospheric sulfate injection using climate models. Phase Two would include very small-scale atmospheric experiments designed to test the theoretical conclusions arrived at in the laboratory. The experiments would be on such a small scale—'less than one ten-millionth of what we would need … to make a readily measurable impact on climate'[5]—that there would be no risk of harm to the natural environment. 'If, and only if, results from the first two phases warrant, the next step would be deployment at the smallest scale at which a response can be

3 David Keith, *A Case for Climate Engineering* (Boston: MIT Press, 2014), p. xix.
4 Keith (2014), p. 38.
5 Keith (2014), p. 83.

detected'.[6] If this third phase of minimal deployment were to yield promising data, then Phase Four of gradual deployment would begin with a goal of offsetting half of anthropogenic warming. The reason for offsetting only half of anthropogenic warming is two-fold: first, full-scale geoengineering could cause detrimental climate impacts; second, 'offsetting only half the warming also has the advantage of preserving a direct incentive to cut emissions',[7] a factor that Keith claims is essential to any sensible climate policy. With deployment being accompanied by an internationally legitimate governance institution, it is this four-phase plan that Keith argues for throughout his book.

A Case against Climate Engineering: Mike Hulme

While the argument for modest research seems plausible, it certainly does not enjoy universal support. One of geoengineering's most ardent critics is climatologist Mike Hulme of King's College London. In his book *Can Science Fix Climate Change?*, Hulme answers the question posed in his title with a resounding No. Hulme's ultimate conclusions are that responding to climate change with stratospheric sulfate injection is undesirable, ungovernable, and unreliable. It is undesirable because regulating global temperature is not the same thing as controlling local weather and climate. It is ungovernable because there is no plausible and legitimate process for deciding who sets the world's temperature. And it is unreliable because of the law of unintended consequences: deliberate intervention in the atmosphere on a global scale will lead to unpredictable, dangerous, and contentious outcomes.[8]

The first claim, that reducing average global temperature does not necessarily amount to an improvement in local weather, is an extremely important point to make. Even if stratospheric sulfate injection succeeds in mitigating *global* warming, the effect to be had on *regional* climates remains unclear: climate change in some regions of the world may be intensified, while the change in other regions may be alleviated. This will generate concerns of distributive justice since such regional variation will benefit some while possibly harming others. Furthermore, some of the other negative corollaries of climate change (such as ocean acidification) will continue unabated.

The second claim, that geoengineering is ungovernable, rests on Hulme's dismissal of three possible governance schemes. The first possibility is to house geoengineering governance in the multilateral processes of the United Nations. This, according to Hulme, is unlikely to yield positive results given the failure

6 Keith (2014), p. 84.
7 Keith (2014), p. 14.
8 Mike Hulme, *Can Science Fix Climate Change? A Case against Climate Engineering* (Cambridge, UK: Polity Press, 2014), p. xii.

of the UNFCCC to regulate global greenhouse gas emissions to date. The next most-likely candidate for governance would be a minilateral coalition open to any and all states that wanted to participate. But Hulme concludes that this 'would be too unstable to provide effective governance'.[9] The final possibility is unilateral action by a single state, which completely disregards the notion of legitimate governance.

Hulme's third claim, that stratospheric sulfate injection is unreliable, is perhaps the most concerning at first glance. The list of potential untoward side-effects — including change in regional precipitation, depletion of stratospheric ozone, increased acid deposition, and white-washing of the skies – is concerning in its own light. But as even David Keith acknowledges, these known risks are not the largest concern for geoengineering, rather it is the 'unknown-unknowns that may surprise us'.[10]

Analysis

The discussion surrounding the potential negative byproducts of sulfate injection is empirical and our knowledge of these effects can only increase with more research. But Hulme and others[11] have suggested that intentionally manipulating the natural environment could be wrong regardless of the prospect of mitigating climatic harms. Geoengineering 'is not simply about stabilizing or restoring the global climate', Hulme writes. 'It is an intervention that has profound repercussions for what we think it is to be human'.[12] The thought is that intentionally manipulating the climate would show a lack of respect for Mother Nature and exhibit great hubris by mankind.

The claim that intentionally manipulating the climate would show a lack of respect for nature enjoys prima facie plausibility.[13] But I argue we have at least two reasons to be suspicious that such a claim is sufficient to ground a moratorium on climate engineering research. First, what does it mean to show proper respect for nature? If showing respect for nature implies ensuring preservation of the lush biodiversity our world currently boasts, then it is feasible that some human intervention in the climate system may be *required* in order to counteract the loss of species and ecosystems that will accompany unfettered anthropogenic climate change. With its potential to assuage the

9 Hulme (2014), p. 75.

10 Keith (2014), p. 72.

11 See Stephen Gardiner, 'Is "Arming the Future" with Geoengineering Really the Lesser Evil? Some Doubts about the Ethics of Intentionally Manipulating the Climate System', in Simon Caney, Dale Jamieson, Stephen Gardiner and Henry Shue (eds.), *Climate Ethics: Essential Readings* (New York: Oxford University Press, 2010), p. 294. See also Dale Jamieson, 'Ethics and Intentional Climate Change', in *Climatic Change* 33 (1996), 323-336, p. 332.

12 Hulme, pp. 92-93.

13 For a different argument pertaining to respecting nature, see Darrel Moellendorf, *The Moral Challenge of Dangerous Climate Change* (New York: Cambridge University Press, 2014), p. 44.

rapid short-term rise in average global temperatures, geoengineering may save some of nature from the catastrophic effects associated with our 'disrespectful' emission of copious greenhouse gases. Thus, there is at least the possibility that concerns about geoengineering and respect for nature may be misplaced.

Second, even if engineering the climate should count as disrespecting nature, it is doubtful that it is of a different kind or magnitude than the disrespect we have exhibited in the past and present. Large-scale agriculture is one of our oldest and most aggressive ways of 'disrespecting' nature. Yet, few conclude that we should give up our only currently viable means of subsistence. Jamieson writes, 'Perhaps in general we should be more modest in our manipulation of nature, but some human changes of the environment are justified and perhaps even morally required'.[14] If it is conceded that agriculture is a justified form of manipulation of the environment, to avoid inconsistency it should be shown how intentionally manipulating the climate is *categorically* different from agriculture.

If there is a reason to burry all talk of geoengineering before we fully understand its underlying costs and benefits, it isn't found in the claim that intentionally manipulating the climate fails to 'respect' nature, for we are surely past that point. More troubling from a normative standpoint are worries that geoengineering is ungovernable and that such technologies would exacerbate distributive injustices.

When Hulme claims that geoengineering is ungovernable, he must mean that any geoengineering governance institution is incapable of institutional legitimacy. This claim can be assessed at two levels: the theoretical level and the practical level. However, assessment at either level requires a conception of legitimacy. While neither Keith nor Hulme puts forward a conception of legitimacy when talking about geoengineering governance, Buchanan and Keohane maintain that 'Minimal moral acceptability, comparative benefit, and institutional integrity are plausible presumptive substantive requirements for the legitimacy of global governance institutions'.[15]

It is hard to see what is so special about geoengineering that prohibits an institution overseeing it from theoretically meeting the substantive standards of minimal moral acceptability, comparative benefit, and institutional integrity. But at the practical level the same conclusion is less certain. Hulme

14 Jamieson (1996), p. 332.

15 Allen Buchanan and Robert Keohane, 'The Legitimacy of Global Governance Institutions,' *Ethics and International Affairs*, 20/4 (2006), 405-437, p. 424.

is right to point out the failure of the UNFCCC to effectively regulate greenhouse gas emissions, which raises questions about its moral acceptability and institutional integrity. Similarly, we have reason to worry that an institution overseeing geoengineering could meet the same inefficacious fate. Currently, the best principles we have on the governance of geoengineering are the Oxford Principles[16] — which include regulating geoengineering as a public good, public participation in decision making, disclosure of projects and results, independent assessment and review, and governance before deployment. It isn't difficult to imagine scenarios in which these principles would be disregarded. But even so, Hulme's claim that geoengineering is ungovernable might be too pessimistic.

Yet perhaps the most pressing concern related to climate engineering is its impact on global justice. Depending upon how the different climate engineering technologies are deployed, they have the possibility of either rectifying or exacerbating some of the distributive injustices that saturate the problem of climate change. It is now widely known that climate change will disproportionately affect underdeveloped and developing countries and poor populations within developed countries, despite these groups having contributed significantly less to the underlying causes of the problem. Some of geoengineering's most fervent opponents cite potential disruption to the Asian and African monsoons – an effect that could catastrophically impact the food security of billions of already destitute people – as an injustice embedded in the technology.

Now, when stratospheric sulfate injection is deployed to counteract *all* of the anthropogenic warming caused by greenhouse gas emissions, the charge of it disrupting Asian and African monsoons (and thus exacerbating climate injustices) is warranted. Keith admits that if the choice were between an immediate *full* deployment of geoengineering, on the one hand, and abandoning the subject of geoengineering forever, on the other, he would choose abandonment.[17] But he also notes that when sulfates are used to counteract only *half* (as opposed to all) of the anticipated warming over the next half-century, they have an 87% chance of substantially *reducing* climatic change and the accompanying impacts on these regions, thus improving the lot of those who stand to lose the most from forecasted climatic harms.[18] Therefore, the actual impact that climate engineering will have on global justice is not something that can be known ex ante. Rather, how the global

16 See Steve Rayner et al., 'The Oxford Principles,' *Climatic Change* 121 (2013), 499-512.

17 Keith (2014), pp. 12-13.

18 This is according to the same climate models we are using to currently predict future climate change. See Keith (2014), p. 56.

community decides to use such technology will determine whether it improves or aggravates the distributive injustices rooted in anthropogenic climate change.

Given the expanding role geoengineering is playing in the discussion of policy responses to climate change, both Hulme's and Keith's books are essential for anyone interested in climate ethics and justice. Each book is easily accessible to a broad audience and it is worth reading them together in order to simultaneously weigh the arguments against one another. With a more comprehensive understanding of the case for and the case against climate engineering, the topic may lose some of its taboo nature and public involvement in the debate will be able to further the causes of both legitimacy and justice.[19]

Daniel Edward Callies
Excellence Cluster Normative Orders
Goethe-Universität Frankfurt
Email: Daniel.Callies@NormativeOrders.net

the global justice network

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