Geoengineering Our Climate?

Ethics, Politics and Governance

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Research Ethics and Geoengineering

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Geoengineering (GE) raises grave ethical concerns.[1] Even some GE research is ethically problematic. Large-scale tests of solar radiation management (SRM) technologies, in particular, would create serious risks for people, animals, and ecosystems.[2] This commentary proposes a set of ethical principles to guide regulation of risk-laden GE research.

Since it will take time to develop the principles and institutions necessary for the ethical conduct of risk-laden GE research, academics and policymakers will need to begin now if they are to develop appropriate regulations by the time the world decides whether to pursue risk-laden research such as large field trials. The principles and institutions created to govern GE research could also provide a foundation for the regulation of GE deployment, if that ever becomes necessary. The ethical principles for regulating GE deployment, however, will differ from those for regulating research, just as the ethical principles for medical practice differ from those for medical research. Research aims primarily at producing knowledge; practice (or deployment) aims at producing benefits other than knowledge, such as health or greater security. Medical ethicists generally agree that there are stricter ethical limits on what we may do to gain knowledge than on what we may do to try to produce other benefits. Similarly, the ethics of GE research differs from the ethics of deploying GE or of implementing any other risk-laden public policy that aims to produce benefits other than knowledge.

In earlier work, we identify three basic ethical principles for large-scale, risk-laden GE research, such as global trials of SRM technologies. The Principle of Respect requires that decisions about such GE research be made by legitimate international bodies. The Principle of Beneficence and Justice requires that risks be minimized and distributed justly. The Principle of Minimization requires that experiments be no larger, longer, or more intense than necessary.[3] Small-scale SRM research, such as the release of small quantities of aerosols into the atmosphere to observe their behavior, and research in carbon dioxide removal technologies do not pose the same risk as large-scale SRM trials. Thus, these principles do not necessarily apply to them.

These principles derive from well-established ethical principles for research with human and animal subjects. Before beginning research involving human subjects, researchers need approval from their institution's Internal Review Board (IRB).[4] IRBs grant expedited clearance to studies that pose minimal risk, but they require closer scrutiny of studies that pose more than minimal risk or involve "vulnerable populations" (i.e., persons who might not be able to defend their own interests). Ethicists identify three conditions that such research must meet. Researchers must convince their IRB that a study meets three conditions before it may begin. Since large-scale SRM trials would put millions of people at risk for the sake of producing knowledge, they should meet similar conditions.

The first condition of ethical research, on which we base our Principle of Respect, is that all subjects must participate in the re-

[1] For example, see Tuana, 2013.
[2] Morrow et al, 2009
[3] Morrow et al, 2009
[4] A basic introduction to research ethics is freely available through the U.S. National Institutes of Health at http://phrp.nihtraining.com.

search willingly and with full knowledge of the nature and risks of the study.[5] No one may be coerced or manipulated into participating. This enables individuals to exercise autonomy in deciding what happens to them and what risks to undertake. Traditionally, this principle is implemented by requiring each participant's informed consent. Since SRM experiments are collective decisions, the relevant standard is not universal consent but a legitimate decision made by a politically legitimate institution representing all affected persons.[6] To say that an institution is politically legitimate is to say that it has the moral authority to make collective decisions on behalf of its constituents. A particular decision is a legitimate decision only if it is made by a legitimate body and meets certain substantive conditions, chief among which is respecting the individuals who are affected by the decision.[7] For example, a decision to allow unsafe dumping of radioactive wastes near a town inhabited by an unpopular minority group would be an illegitimate decision, even if it were made by a legitimately elected legislature. Since a large-scale SRM trial would affect persons in many countries, only an international body or agreement would have the political legitimacy to authorize the experiment. Such authorization would constitute a legitimate decision only if it adequately respects and protects those who would be endangered by it. Identifying or designing an effective governance institution that has moral authority over large-scale, risk-laden GE experiments is a theoretically and practically daunting task, beyond the scope of the present paper.

This dovetails with the second condition of ethical research, which is that risks and benefits be appropriately balanced.[8] This is especially difficult to implement in large-scale SRM trials, since risks and benefits will be distributed unevenly across regions, economic sectors, etc. Some people might face risks for which they receive no offsetting benefit, especially if the benefits from research come decades later. One partial response is to establish a fund to compensate those who suffer climate-related harms during an experiment.[9] Another is to choose experiments whose anticipated risks fall on those best able to bear them, although much work remains to be done in figuring out how to implement that guideline.[10]

The third condition of ethical research is that all participants must be treated justly.[11] In particular, the burdens of risk-laden research may not be shifted unfairly to those least able to refuse participation, and the benefits of research must be shared with those who undertook the risks. For GE research, this condition requires distributing expected benefits and risks of GE experiments justly. For instance, a country sponsoring an SRM trial should not deliberately structure the experiment to shift the risk to other countries. The exact principles by which expected benefits and risks should be distributed—to the extent that this can be controlled at all—still need to be worked out.[12] Conventional research ethics provides little guidance here; decision makers should look to political philosophy. Our Principle of Beneficence and Justice de-

[5] National Commission, 1979
[6] Morrow et al, forthcoming
[7] Morrow et al, forthcoming

[8] National Commission, 1979
[9] Such compensation schemes face serious challenges, however. See Svoboda & Irvine 2013, forthcoming.
[10] Morrow et al, 2009
[11] National Commission, 1979
[12] Morrow et al, 2009

rives from these second and third conditions for ethical research.

Our Principle of Minimization derives from the ethics of animal research, where the "replacement, reduction, and refinement" of animal use guides experimental design. In the GE context, this slogan implies that experiments should be as small (in geographic scale), as short (in duration), and as non-disruptive (in terms of climatic and environmental impact) as is necessary to test specific scientific hypotheses. To be scientifically useful, SRM trials would have to be global, multi-year interventions that change the climate in noticeable ways, but they should not be any longer or more intense than necessary.[13]

The three principles articulated here complement the Oxford Principles for GE governance.[14] The Oxford Principles address both GE deployment and research. Where they address large-scale, risk-laden GE research, the Oxford Principles cohere well with our three principles. Our Principle of Respect requires politically legitimate institutions, which, we argue elsewhere[15], would need to be transparent and accountable to the public; this requirement coincides with the Oxford Principles' requirements for public participation in decision-making, the disclosure of research results, and independent impact assessments. Our Principle of Beneficence and Justice and our Principle of Minimization add further ethical constraints on large-scale SRM trials—constraints that do not conflict with the Oxford Principles.

A great deal of conceptual and political work remains to be done to operationalize these principles and create the institutions needed to apply them. The need for regulating GE research is coming faster than the need to regulate GE deployment. Fortunately, the existing framework for regulating other research provides a model for regulating GE research.

[13] Morrow et al. 2009
[14] See Rayner et al, 2013
[15] Morrow et al 2011 forthcoming

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