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Open Peer Commentary

Response to Svoboda and Irvine

JESSE REYNOLDS
Department of International and European Public Law, Tilburg University, The Netherlands

In this issue, Svoboda and Irvine (Svoboda & Irvine, 2014) offer the most in-depth consideration thus far of possible compensation for harm from solar radiation management (SRM) geoengineering. This topic is indeed treacherous terrain, pulling together multiple complex debates, ethical and otherwise. Their description of the technical challenges to determining damages and causation in particular are illuminating. The reader cannot help, though, but be left with the sense that both SRM and compensation are futile efforts, bound to do more harm than good.

Before proceeding, throughout any consideration of geoengineering, one must always bear in mind that it is under consideration as a possible complementary response (along with greenhouse gas emissions reductions—or 'mitigation'—and adaptation) to climate change. Climate change poses risks to the environment and humans, among whom the world's poor are the most vulnerable. The Intergovernmental Panel on Climate Change recently concluded that 'Models consistently suggest that SRM would generally reduce climate differences compared to a world with elevated greenhouse gas concentrations and no SRM …' (Boucher et al., 2013, p. 575). Therefore, SRM has the potential to reduce harm to the environment and humans, particularly to already disadvantaged groups. However, SRM is imperfect.

The primary problem with S&I's analysis is that they treat the shortcomings of SRM and of compensation for its potential negative secondary effects as if they were *sui generis*. In fact, these cited shortcomings are found among three existing policy domains, which happen to intersect at the proposed compensation for SRM's harms. The first such policy domain is socially organized responses to other complex problems, and the provision of public goods in particular. In a key passage, S&I write that 'The potential for SRM deployment to result in an unequal distribution of harm and benefit among persons raises a serious ethical challenge. It seems deeply unfair to adopt a climate change strategy that benefits some at the expense of harming others. This is especially the case if those harmed bear little or no responsibility for the problem of anthropogenic climate change' (pp. 160–161). One could replace the phrases 'SRM deployment' and 'a climate change strategy' (and skip the final specific sentence, for now) with references to almost any socially organized response to a complex problem, and the statement would remain valid. Indeed, the primary function of government is arguably to levy taxes in order to provide public goods, which are unlikely to be otherwise adequately provided. These

Correspondence Address: Jesse Reynolds, Department of International and European Public Law, Tilburg Law School, Tilburg University, 5000 LE Tilburg, The Netherlands. Email: J.L.Reynolds@uvt.nl

public goods include (but are not limited to) defense from external threats, police protection to reduce crime, construction of infrastructure, regulation for safety and environmental protection, generation of knowledge through research, and standards setting. In each of these cases, some people benefit more than others, and some pay more than others. Some may be net losers. Policies in which no one is a net loser (i.e., Pareto improving) are sometimes possible, but most often are not or are not pursued. Instead, policies that generate positive total net benefits are adopted. To compensate net losers, side payments can be made and/or other issues can be linked. While these arrangements could be called ethically problematic, they constitute the very core of public policy. In fact, several of S&I's ethical concerns—including raising revenue from those opposed to and/or harmed by a policy, arbitrary rules, and the non-identity problem—could be posed regarding these public goods' provision. SRM might be especially complex, in large part because of its global nature, but that does not make it entirely novel. Other global public goods are promoted through various international mechanisms (Barrett, 2007).

The second policy domain posing similar ethical problems is compensation, particularly in complex situations. Even in a case as simple as accident liability with a single injurer and a single victim, compensation for non-economic and irreparable damages is unclear, and compensation clearly does not grant license for an injurer to harm the victim. In a more complex example, such as the requested compensation by those born with birth defects due to their mothers' use of thalidomide during pregnancy, is it very uncertain who should pay and how much compensation should be provided.

The third existing policy domain is climate change. In the key passage cited above, 'SRM deployment' could be replaced with 'mitigation,' 'adaptation,' and/or 'compensation for climate change damages' and the statement would remain valid. Any climate policy will 'result in an unequal distribution of harm and benefit among persons,' and under all feasible policies, those who 'bear little or no responsibility for the problem of anthropogenic climate change' will experience some harm. Specifically, aggressive mitigation would be expensive and, though it offers some co-benefits, it would hinder economic development, including in poor countries.[1] The cause of the 'ethical uncertainty' is not SRM but climate change and greenhouse gas emissions, whose ethics is discussed thoroughly in the literature. Because of this, no responses to climate change will be impervious to accusations of being unjust. However, S&I's implicit ethical divorce of SRM from climate change has the effect of laying the ethical challenges from climate change at the feet of SRM.

An additional problematic aspect of S&I is that, to some degree, they stack the deck against SRM. Regarding its benefits, they fail to emphasize that SRM appears to hold the potential to greatly reduce climate change risks to the environment and people, particularly to the world's poor. Regarding SRM's costs, they cite four ways in which some might be harmed, each of which is likely to be less severe than they imply. First, SRM would compensate for temperate and precipitation changes unevenly. Yet almost all modeling of SRM's probable effects are not optimized but instead use a determined SRM intensity or one that would return global average temperature to a preindustrial value. Citing them as indicating certain likely harms would require that significantly suboptimal SRM policies be adopted. The one model that does balance temperature and precipitation across regions of the globe found that population-weighted Pareto optimal, globally uniform SRM could compensate for 93% of temperature changes and 56% of precipitation changes (Moreno-Cruz, Ricke, & Keith, 2012, p. 660). Second, S&I point to ocean acidification, but this is not caused by SRM but instead by elevated atmospheric carbon dioxide. It is simply unaddressed by SRM. Third, they note possible damage to

stratospheric ozone. However, this would be caused by only one proposed SRM technique (stratospheric aerosol injection) using one proposed material (sulfate aerosols); other methods and materials are possible. Furthermore, recent research indicates that this impact would be small and the harmful consequences (increased ultraviolet radiation) would be almost entirely offset by the screening of incoming light by the aerosols (Pitari et al., 2014). Fourth, if SRM were to suddenly stop, then the subsequent rapid climate change would be very harmful. But it is not only SRM which poses risks if not implemented properly. For example, society could intend optimal mitigation and adaptation yet fail to implement them, resulting in dangerous climate change. In fact, contemporary society maintains numerous complex operations whose cessation would result in harm. For example, the well being of almost all people relies upon continued global trade powered by fossil fuels, yet we generally do not worry about a sudden cessation of trade and fossil fuel extraction. Lastly, even if SRM were to stop, the benefits might still outweigh the costs (Bickel & Agrawal, 2013). Nevertheless, the authors emphasize that SRM 'could result in substantial harm' (p. 160). This is true in that SRM would pose risks, but S&I emphasize only the misses while downplaying the hits.

Both SRM and the compensation for its negative secondary effects are ethically complex. Yet such 'ethical uncertainty' generally neither raises questions of ethical permissibility and nor induces paralysis among policy makers in other domains such as the provision of public goods, compensation, and mitigation and adaptation in response to climate change. SRM is indeed complex and challenging but S&I fail to indicate why its case should be fundamentally different from these others. A more pragmatic approach, which asks what policies and avenues of research would be most likely to offer the greatest benefits, as opposed to one which seeks only what is problematic, may be more productive.

Note

[1] Developing countries account for the majority of current greenhouse gases emissions and the large majority of projected future emissions. Fossil fuel combustion remains essential to economic development. Aggressive mitigation would reduce fossil fuel combustion, hindering economic development in poor countries.

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