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Geoengineering Implementation and Policy

Policy regarding the regulation of geoengineering is in it's infancy and largely undefined. Geoengineering proposals are generally macroscopic in scale, thus affecting every country in the world. International law is essential to the implementation of geoengineering. Ideas range from space-based mirrors at the earth-sun Lagrange point to marine carbon sequestration. The laws that apply to these ideas are no less diverse; some are nonexistent while others are far along in their development. At this point most proposals seem unfeasible for the time being, however domestic base geoengineering proposals could be implemented.

International law requires many countries, all with their own self-interests, coming together for a common cause and so is difficult to establish any effective policy. Being a part of an environmental policy is a self-imposed choice. Countries that do not agree, or think it is not in their best interest, can simply choose not to be a part of a particular policy or institution. In the case of institutions, there will be times when an institution acts in opposition to some of the individual members. To keep a dissenting individual in such an organization requires that it be viewed as a legitimate organization. According to Bodansky, "legitimacy does not depend on whether a rule or a decision is substantively correct (judged by whatever standard); rather, it reflects more general support for a regime, which makes subjects willing to substitute the regime's decisions for their own evaluation

of a situation."[1] He continues citing origin, fairness, and success as sources of legitimacy.

When considering international environmental policy, legitimacy of origin is predominantly derived from the consent of nations. Fairness must be judged by the inner working of the organization or institution; in particular, from the decision making process. The decision making process is two-fold when dealing with environmental law and geoengineering. Before policy can be considered, the science of the issue must be accounted for. An organization must be able to identify and obtain information from legitimate sources. Subsequently, the organization must have a just government system.

Currently, democracy is the dominant legitimate government on the international scale. It gains its legitimacy from the voting system, the equality (or more appropriately relative equality) of states, and the transparency that comes with a participatory government. Obviously, some problems exist. For many issues on the international scale there is a lack of common interests. For example, the United Nations was essentially obsolete during the cold war because of the differing opinions of the United States and Soviet Union. However, the stalemate within the organization was also influenced by the inequality of states. Because the U.S. and U.S.S.R. were powerful they both held permanent seats on the security council and had veto power over each other and nations not on the council.

Though legitimacy from origin and fairness are required at the outset (what country or state would willfully join an institution it saw as unfair and ill-bred), Success is perhaps the most important factor in the ongoing legitimacy of an international institution. If an institution has a long track record of success, "people may accept a regime's decision in a

1 Bodansky, Daniel. *The Legitimacy of International Governance: A Coming Challenge for International Environmental Law.* The American Journal of International Law, Vol. 93, No. 3. (Jul., 1999), pp. 596-624.

particular case, even if they are not convinced that the decision is correct" (Bodansky, 612). Consequences of geoengineering on a macroscopic level will be widespread for better or for worst and will certainly effect any countries of dissenting opinions. It is essential that any body governing the implementation of geoengineering be viewed as legitimate and have a track record of success in order to first gain members and influence and subsequently appease dissenters.

Currently, the United Nations is the predominant international policy maker. It is large and, although limited in scope of its effectiveness, is generally viewed as legitimate. Although nations and smaller international bodies can make more specific, regional, international agreements, members of the UN must fit more specific policy within the regulations of the UN. As such, it is the top authority regarding implementation of geoengineering. The UN is already involved to some extent regarding policy dealing with marine carbon sequestration, iron fertilization of the oceans, and solar shield geoengineering proposals.

Several proposals have been formed suggesting a reduction in incoming solar radiation to offset the temperature increase due to global warming via reflectors in space and earth orbit. Proposals to reduce global temperature in this way are quite economical[2] and so the difficulty lies in the implementation. In theory, any country with space flight capabilities could go through with one of the proposed plans. The issue is that of liability. All countries with the capability to implement any of these space-based proposals are members of the UN. Therefore, they must be in compliance with UN regulation regarding space.[3]

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2 Keith, David W. *Engineering the Planet.* Ed. Schnieder, Steven and Mastrandrea, Mike. Island Press.
3 *United Nations Treaties and Principles on Outer Space*. United Nations. New York, 2002.

According to the United Nations *Treatsies and Principles on Outer Space,* use of outer space is to be done for the benefit of all countries and national activity carries international responsibility. A states is responsible for damage caused by objects launched into space by the state, by a joint organization that the state is a member of, or by a separate party that launched from the states territory. The climate is a complex system and there is little knowledge as to the specific effects reducing solar radiation may have.[4] Regional effects might vary greatly. While some countries may benefit, others may suffer from unexpected weather shifts. Potential droughts, famines, and floods are just a few examples of negative effects that could be caused by regional effects. However, because of the complexity of the climate system, it will be hard to prove that such effects stem directly from the reduction of solar radiation.

Damaged countries may make a claim for damages caused by space-based solar shields. If a settlement is not agreed upon, a committee is formed to mediate. The committee is made up of three members, one from the damaged party, one from the defending party, and one neutral party. The decision of the committee is decided by a simple majority vote. However, the decision of the committee is only binding if both parties agree so before hand, otherwise the recommendation is to be taken in good faith. Thus, only so much can be done to regulate liability for space based geoengineering problems. It seems that powerful countries, with enough motivation, could proceed with space-based solar radiation reduction without significant hindrance. However, it would be highly frowned upon by the international community and so would only be feasible with excessive reason for acting.

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4 Bauer, Peter; Seboldt, Wolfgang; Klimke, Michael. *Earth Weather and Climate Control: Can Space Technology Contribute*. German Aerospace Centre. Space Policy 15 (1997) 27-32.

Iron fertilization is the idea that dumping iron into the open ocean can encourage phytoplankton growth that would in turn act as a carbon sink. The UN has set regulations governing open ocean dumping that apply to iron fertilization through the London Convention and London Protocol.[5] The UN has concluded that currently there is insufficient knowledge to justify large-scale operations. However, first steps are being taken to set up policy regarding iron fertilization by asking what legal issues need to be addressed by the London Convention and London Protocol, and what would be contrary to the aims of the Convention and Protocol.

More knowledge must be acquired before any policy can be put in place. This requires experiment and so the first step is to determine if large scale experiments to gain information are justified. If so, scientists can begin worrying about assessment of the experiments. The UN has expressed interest in determining what the impacts of iron and other material released due to iron fertilization are, what the impact of bacteria decay and phytoplankton blooms are, what marine impacts can be expected, what the timescale of carbon sequestration will be, and to determine the carbon mass balance.

Once the scientific facts have been arrived upon, the question becomes how does one utilize and govern iron fertilization. Voluntary markets will be dominated by private companies. Imposing regulation on private companies from non-treaty countries becomes difficult and can only be done by pressuring those countries to comply. It will also be difficult to regulate the accounting of private companies. Because there is no concrete way to measure the amount of carbon sequestered, scientific impartiality is essential. However, in the case of private companies, it will be easy to use scientific estimates that allow for the

5 CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OFWASTES AND OTHER MATTER, 1972 AND ITS 1996 PROTOCOL. *Preparation for the scientific and legal discussions in 2008 of ocean fertilization with a view to its regulation under the London Convention and Protocol.* 29 January 2008

greatest profit for the company. Regulated markets will probably focus on carbon credits from the Kyoto Protocol. Before regulated markets come into being, iron fertilization based carbon sequestration must be shown to be permanent, additional; meaning the carbon would not otherwise have been sequestered, have no leaks, and accountable. Accountability of carbon sequestration provides one of the largest obstacles. As of now, there is no way to accurately predict the amount of carbon sequestered.

Proposals have been brought forth to sequester carbon under the seabed. The London Protocol was made in order to protect the marine environment, including the seabed. The Protocol follows a precautionary principle, meaning that prevention measures may be taken if harm to the environment is even possible and not proven. The precautionary principle is important when dealing with carbon sequestration because the resulting effects are fairly unknown.

The London Convention and Protocol define dumping as "any deliberate disposal of sea wastes or other matter from vessels, aircraft, platforms, or other man-made structures at sea." It has not been established officially whether or not carbon dioxide is waste. However, it seems likely that carbon dioxide will be seen as produced from manufacturing or processing and thus be defined as waste. If it is defined as waste then marine carbon sequestration in the seabed will be illegal unless an amendment is made to the Protocol.

It is early in the process of determining policy for international geoengineering efforts. Right now, no solution seem can be implemented and governed efficiently. However, it is still possible to increase domestic geoengineering efforts to counteract global warming. Reforestation and increasing solar reflectivity are two options that would not require drastic policy change to implement in an attempt to counteract global warming.

Reforestation provides a carbon sink as new growth required carbon. It is completely legal and only needs to be implemented. However, there are several downsides to reforestation. A long term, mono culture land commitment is required. If more economical uses for the land are available, reforestation costs increase. Forests also are only temporary carbon sinks. Once matured, they no longer uptake the carbon required for growth. Furthermore and lesser known is that many forests act in opposition to the goal of reforestation by decreasing albedo.[6] Decreased albedo is even more severe in snow covered areas. Therefore, reforestation might be better considered for lower latitudes. However, tropical forests result in increased evaporation from trees and may effect atmospheric circulation. This could potentially effect local climates, causing similar liability issues as the regional climate changes caused by solar radiation reduction. However, there is no set precedent and so it seems unlikely that any country would be asked to pay for damages caused by reforestation.

The easiest way to fight global warming through geoengineering seems to be by promoting increasing solar reflectivity. Roads and roofs often have high-albedo alternatives within the same cost ranges as low-albedo options.[7] These alternatives have potentially large impacts on the surface albedo. For instance, Bretz et al, estimates that Sacramento could see an albedo increase of 18%. These increases in albedo would probably have minimal negative side effects because they are simply correcting man made low-albedo structures and heat islands.

Implementation of high-albedo material could be done easily and cost effectively. While it would be expensive to retrofit roads and roofs with high-albedo material,

6 Betts, R.A. *Offset of the Potential Carbon Sink From Boreal Reforestation by Decreases in Surface Albedo.* Hadley Centre for Climate Prediction and Research, the Met. Office, Bracknell, UK. 2000
7 Bretz, S.; Akbari, H; Rosenfeld, A; Taha, H. *Implementation of Solar-Reflective Surfaces: Materials and Utility Programs*. Heat Island Project. Lawrence Berkley Laboratory.

switching to them in the future would not be economically negative. Implementation could be done through increasing consumer demand for high-albedo materials and through pushing politicians to advocate the use of high-albedo alternatives. The result could be an "energy star" like campaign for consumers, and switching to high-albedo materials when the government makes new roads, repaves roads, builds new buildings, and so on. The result, although not a solution to the warming problem, would help somewhat and be extremely easy to implement.

Establishing an effective policy is essential to the future of geoengineering. Right now the most powerful authority on international environmental issues seems to be the UN. Being the largest body of international law, it overrides smaller more regional international laws. Thus it is only logical that for a project of global scale, such as geoengineering, that it should be done through the UN. The UN has already declared that "necessary and timely action should be taken to deal with climate change within a global framework". Thus if geoengineering is somehow done through the structure of the UN it may avoid the possible downfall that an "injured state is entitled to obtain compensation from the state which has committed and internationally wrongful act for the damage caused by it". Avoiding this legal issue is key, as any geoengineering process will most likely change the climate in different ways for different parts of the globe and almost certainly be detrimental somewhere.

The best way to implement geoengineering through the UN is to get interested parties to form a Multilateral Environmental Agreement (MEA). This agreement could study effects of geoengineering and perhaps suggest action to be approved by the general assembly. However, it would still be up to individual states to fund these projects. Without

support of the UN, geoengineerings future likely lies solely in the domestic front consisting of reforestation and increasing solar reflectivity. Though these measures are helpful, international projects must be pursued in order to utilize geoengineering to its fullest potential.