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**The Political Prospects of Geoengineering:  
An Assessment of the Convention on Biological Diversity and the London Convention**

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## **Abstract**

This dissertation investigates the ways in which geoengineering interlinks with global environmental politics (GEP) and how they cohere together. The core question is how geoengineering fits in today's political context and how it affects this. To this end, the bulk of this paper aims to analyse two political regimes that have set a regulatory framework for geoengineering activities - the Convention on Biological Diversity (CBD) and the London Convention (LC) - and explore how these contribute to shape climate politics and governance. To do so, I conduct content analysis of their resolutions and combine it with primary literature and interviews to geoengineering experts. My research firstly reveals that the CBD brings a more multilateral and cross-disciplinary approach to environmental politics. Secondly, the LC makes a call for more research and science-based mechanisms as a means to shed light on decision-making processes. Despite these, I argue that geoengineering does not play a major role in GEP due to the lack of scientific research, political adherence, and governance framework. It remains to be seen whether and how geoengineering will acquire political and institutional stability in the future. Heretofore, my hope is that this research may prove useful in tracing some of the first implications of geoengineering in the political domain.

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## List of Acronyms

CBD	Convention on Biological Diversity
CDR	Carbon Dioxide Removal
ENMOD	Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques.
GEP	Global Environmental Politics
GHG	Greenhouse Gases
GGI	Global Governance Institution
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
LC	London Convention
LP	London Protocol
LRTAP	Convention on Long-Range Transboundary Air Pollution
NAS	National Academy of Science
SPICE	Stratospheric Particle Injection for Climate Engineering
SRM	Solar Radiation Management
UNCLOS	United Nations Convention on the Law of the Sea
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention for Climate Change
UNGA	United Nations General Assembly
UNHRC	United Nations Human Rights Council

## 1. Introduction

Grounded in environmental studies and political science, this dissertation studies the current role of geoengineering and its impacts in the environmental and political realms. Drawing on the failure of existing mitigation strategies to fight climate change and the new proposals to engineer the climate as a counter strategy, this dissertation elucidates the institutional and political status of geoengineering technologies and analyses how this new field of study is shaping global environmental politics (GEP).

The incorporation of geoengineering practices in the climate policy agenda constitutes one example of the new innovative projects and tech-based solutions that the international community is embarking on in the hope of countering climate change more effectively. Nonetheless, the modification of the environment has raised many debates on the legal, policy and environmental implications that this may have in the future. The contested role of geoengineering has drawn out the research and deployment of these technologies. And yet, despite the fact that there has been little geoengineering experimentation so far, international initiatives to embrace these issues in a more formal and institutional framework have proliferated over the last years, such as the 2019 UNEA Swiss proposal for a geoengineering governance resolution.

My research brings this institutional and political work on geoengineering into conversation. In so doing, I argue that geoengineering lacks of a coherent international legal policy framework typical of an international regime. This is due to the fact that, even though many scientific and technological research programs and risk assessments reports have been proposed to resolve scientific uncertainties, they “have not materialized at the scale necessary to test potential benefits and risks of [geoengineering] approaches” (Craik and Burns 2016, p.2).

While it may be too early in this emerging domain to draw conclusions on the prospects of geoengineering in fighting climate change, I argue that it has many political and institutional effects that contribute to shape the current global environmental political system. This is especially perceivable in some environmental regimes, which having built a regulatory framework for geoengineering practices to avoid environmental side-effects, have experienced modifications in their institutional set-up and governance framework. An example of this is the Convention on Biological Diversity. This is the central project of my dissertation.

## **1.1. Objectives and motivation**

This is not an advocacy paper trying to promote or discard geoengineering techniques, nor to study the suitability of these in the current environmental context. It is rather focused on studying the political and institutional challenges that geoengineering poses in the global political scenario. In this way, my research engages directly with questions of policy-making and governance. In a world that lacks a global institution to effectively enforce mitigation strategies, do we have the proper mechanisms to adopt geoengineering technologies? Is there a governance framework feasible for climate engineering at all? If not, does the international community possess the capacity-building to address geoengineering in a rigorous way? Governance scholars such as Wil Burns and Andrew Strauss discuss whether we should build a new governance system for geoengineering or use the existing structures. This dissertation aims to contribute to this theoretical debate and identify the exogenous and endogenous challenges in the implementation of a regime for geoengineering.

Research in environmental and political sciences tends to underestimate the role of geoengineering in shaping the political system. When these issues are addressed, scholars argue that geoengineering has “very little relevance (...) because nothing has been done about it”<sup>1</sup>. However, given the relentless outlook of rising global emissions, and the affordability and potential effectiveness of geoengineering in solving the climate crisis, scrutiny of its role in the climate policy agenda is essential. This paper further explores this issue, studying the role of geoengineering in shaping global environmental fora, institutional setups, political dynamics and governance mechanisms.

## **1.2. Research Design**

### **1.2.1. Research Question and Hypothesis**

At the intersection of geoengineering, climate politics and governance, this dissertation seeks to address the following question: *how climate engineering affects global environmental politics?* More specifically, I center my analysis on exploring how the political and institutional dynamics led by geoengineering affect, shape and remodel the environmental political system.

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<sup>1</sup> Interview with Jane Long, former chair of the Task Force on Geoengineering for the Bipartisan Policy Center, interview undertaken on March 13th.



The research thereby addresses the research question assuming that climate engineering has contributed to shaping climate politics. I herein formulate a hypothesis based on the following three premises:

First, geoengineering is leading to new polycentric patterns of interaction and coordination between actors in the domain. Geoengineering, as well as the environmental discipline in general, gathers a multiplicity of actors, ranging from international institutions (UNFCCC and IPCC) and formal political actors (UK House of Commons and US House of Commons Select Committee on Science and Technology) to non-state actors such as corporations, philanthropists, think tanks, NGOs and epistemic communities. These have always collaborated within their respective networks, but given the cross-disciplinarity and interconnectivity of climate modification techniques, new global collaborative networks and cross-bordering initiatives have emerged, gathering stakeholders from different areas and at different levels (Galaz, 2014).

Second, geoengineering has led to a dynamization of politics. Before the new complex environmental scenario, demands have risen urging the stimulation of politics and the implementation of a new political and legal system that evolves within the context and catalyses innovation (Galaz, 2014). This is nicely put by Frances Westley:

With the earth and its ecological systems (...), we need innovative solutions that take into account the complexity of the problems and then foster solutions that permit our systems to learn, adapt, and occasionally transform without collapsing. More important, we need to build the capacity to find such solutions over and over again (Galaz 2014, p.97).

Arguably, geoengineering is one example of these ‘innovative solutions’ that trigger the dynamization of the environmental political system.

Third, scholarly and political debates over the implementation of a governance framework for geoengineering have led to a restructuring of global environmental governance in general, integrating it with a more technical and scientific-based perspective. I center my analysis on exploring how these debates and practical proposals catalyze structural changes in the environmental political system.

### **1.2.2. Research Method**

This study employed different content analysis with a focus on qualitative data gathered from archival and official documents, interviews and a particular case study.

I conducted content analysis on various academic journals and governmental documents in order to identify the main arguments and examine the theoretical debates over geoengineering and environmental politics. These included the work of social science researchers, such as Victor Galaz and Robert Olson; policy statements and working papers, including the National Academy of Science (NAS) reports; and official documents from international institutions, such as the United Nations and the Convention on Biological Diversity (CBD).

I conducted semi-structured interviews to different international experts in the fields of Science and Technology, Energy, Political Science and the Environmental discipline: Dr. Jane C. Long, former Chair of the Task Force on Geoengineering for the Bipartisan Policy Center from the United States; Dr. Peter Wadhams, a British professor of Ocean Physics at Cambridge University; Alex Hanafi, the Director of the Multilateral Climate Strategy and the Lead Counsel in the Environmental Defense Fund's Global Climate Program; and Dr. Victor Galaz, an Associate Professor in Political Science at the Stockholm Resilience Centre (Stockholm University) and the author of the book 'Global Environmental Governance, Technology and Politics: The Anthropocene Gap' (Galaz, 2014). Some of the interviewees provided high-quality content of the role of geoengineering in international climate negotiations, while others did not have the sufficient knowledge to make significant contributions.

Content analysis included close examination of the CBD, which served as the case study for my dissertation. The CBD is an international agreement between 150 countries dedicated to promoting sustainable development and implementing the principles of Agenda 21. It is one example of the environmental regimes that created a regulatory framework for climate engineering technologies, in particular, those that affect biodiversity, its ecosystems and services (Convention on Biological Diversity, 2020). Using the *coding* and *categorising* method, I collected data from the different decisions on geoengineering that the Convention took from 2008 until 2016.

This qualitative data analysis was conducted from the perspective of the neo-liberal institutionalist school of thought. This has been the dominant theoretical school in climate engineering since its origins, advocating for the crucial role of institutions in providing a coherent regulatory framework for research and deployment (Horton and Reynolds, 2016). Herein, this paper critically assessed some of its theoretical debates and further elaborated on the prospects of achieving consensus and global cooperation through geoengineering-based institutions.

### **1.3. Climate-related Engineering: Definition and Proposed Practices**

Climate-related geoengineering does not have yet a universal definition to refer to. This study understands climate-related geoengineering as “a deliberate intervention in the planetary environment of a nature and scale intended to counteract anthropogenic climate change and its impacts” (SCBD 2012, p.23). Two important components characterize geoengineering practices. The first one is the intent. There is an intention of using these technologies with the aim of addressing human-driven environmental phenomena (Keith, 2000; SCBD, 2012). The second component is the scale. The climate is a global phenomenon, its effects are worldwide manifested and, therefore, any technique aiming at modifying it must be delivered at the same level or “a scale enough to have a significant counteracting effect” (SCBD 2012, p.23). It is important to differ geoengineering from mitigation strategies. Both address the root causes of the climate crisis, but whereas mitigation deals with human actions that change climate, geoengineering tackles the climate system itself. Consequently, before an anthropogenic climate problem, mitigation strategies are the first to be deployed, followed by geoengineering techniques, and finally, adaptation processes (SCBD, 2012).

The predominant geoengineering practices are solar radiation management (SRM) and carbon dioxide removal (CDR). SRM consists in “reducing the incidence and subsequent absorption of incoming solar (short-wave) radiation” (SCBD 2012, p.26). In other words, it alters the Earth’s reflectivity in order to reduce the absorption of solar radiation. An example of SRM is the injection of sulphates into the upper atmosphere to scatter sunlight back to space. CDR aims at extracting CO<sub>2</sub> from the atmosphere through the capture and the storage of the captured CO<sub>2</sub>. An example of CDR is ocean fertilization<sup>2</sup> (Craik and Burns 2016, p.2; Leal-Arcas and Filis-Yelaghotis, 2012; SCBD, 2012). For the purpose of this research, I only considered CDR practices, and in particular, ocean fertilization, which is the one addressed by the case study.

### **1.4. Dissertation Outline**

First, I provide a brief literature of geoengineering in global environmental politics. This section mainly evokes scholarly research and debates about climate engineering research, deployment and governance. Second, I expose the empirical study on the CBD and the LC. In this part, I also include analysis of interviews and primary data. The third and final part reveals

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<sup>2</sup> Ocean fertilization consists in “the enrichment of nutrients in the marine environment with the principal intention of stimulating primary productivity in the ocean, and hence CO<sub>2</sub> uptake from the atmosphere” (SCBD 2012, p.27).

the concluding remarks of the study and some potentially important trends that may be interesting to study in the future. The annex includes the content analysis, the interview guides and transcripts.

## **2. The Evolution of Geoengineering: A Literature Review**

For many years, geoengineering has been under consideration as a ‘stop-gap’ if mitigation strategies were not to work, a “portfolio of responses that would provide greater efficiency and flexibility, as well as potentially avoiding some of the more severe impacts associated with large average temperature increases” (Craik and Burns 2016, p.3). But, the meagre results from international responses to climate change have triggered the international community to start considering it as more than a mere ‘Plan B’ and including it in the climate policy agenda (Bodansky 2013, p.540). The 2014 IPCC Synthesis Report on Climate Change reflects this interest in the role, risk and status of CDR and SRM geoengineering technologies. However, the acceptability of geoengineering will be as much determined by its suitability in the international system as by the development of institutional frameworks for its research, implementation and governance (Flegal, 2018).

The inclusion of geoengineering technologies in global environmental politics (GEP) has involved scholarly attention from a wide range of issues: from the moral and ethical justifications of geoengineering research to the political and legal legitimacy of implementation as well as governance framework. Herein, this paper has addressed these issues separately and, following the same approach than Horton and Reynolds (2016), has divided this section in three different areas: research, implementation and governance.

### **2.1. Research**

Even though geoengineering is a relatively new matter of concern, studies and research originated in the beginning of the 20th century. In 1901, Nils Ekholm wrote about the modification of climate engineering, and in 1905, Arrhenius speculated that a huge concentration of CO<sub>2</sub> emissions would lead to advantageous conditions for crops, thus enhancing agricultural productivity (Keith, 2000). While geoengineering research predominated within scientific and technological fields of study, major contributions were made by governmental studies as well. An examples of this is the 1965 report by Johnson’s Science Advisory Committee “Restoring the Quality of Our Environment”, the 1977 reports by the NAS, and the 1995 IPCC report on climate change mitigation (Keith, 2000).

Global environmental research has, since its early stages, focused on the internal aspects of the discipline, ranging from debates on the origins (Dauvergne, 2012; Haas 1990; Mitchell, 2002) to analytical researches on the formation of international environmental regimes (Zürn, 1998)

and structures' causalities (Paterson, 2006; Dauvergne, 2012). However, this literature has been criticised for being inconsistent in methodological approaches, and unable to clearly outline the formal characteristics and regimental boundaries of geoengineering technologies. These inconsistencies have further delayed the incorporation of climate engineering in the political debates (Dauvergne, 2012; Horton and Reynolds, 2016; Keith, 2000).

While environmental research present some various technical contests, obsolescence is not one of them. In fact, there is an increasing number of researches that take into consideration the contemporary globalization-led context. Scholars, such as Corry (2017) and Stephens and Surprise (2019), have started including in their researches new actors and contemplating new areas of implications. Relatedly, an important contribution of geoengineering research was made by Peter Dauvergne, who studied the political, economic and social implications of geoengineering in today's world (Dauvergne, 2012).

Climate engineering research has gradually adopted a more political approach. This is due to the fact that, as a cross-border issue, states see it as a national security concern that may alter political structures and the international stability (Corry, 2017). Scholarly research on the political implications of geoengineering has gone even further, suggesting that states use geoengineering techniques to satisfy their own political, economic and social interests. However, practitioners have not yet explored in-depth the potential utility of such practices (Horton and Reynolds, 2016; Reynolds, 2019).

Although there is an increasing political interest in geoengineering techniques, governments have destined little funding to research (mainly coming from the US). Generally, they consider climate modification as a "moral hazard" which hinders the possibilities of mitigation and covers-up the social and political reasons behind the climate crisis (Leal-Arcas and Filis-Yelaghotis, 2012; Horton and Reynolds, 2016; Stephens and Surprise, 2019). This has led to a vicious circle in which the lack of funding for geoengineering research does not permit to gather the sufficient data needed in the first place to trigger governments to invest.

As illustrated above, geoengineering research has mainly focused on studying the status of geoengineering and the political, economic and social challenges that it presents. However, in scarce cases have scholars focused on studying how all geoengineering-related issues affect the global political scenario in a more structural perspective.

## 2.2. Implementation

Even though theoretical approaches on climate modification appeared in the 1900s, they were not put in practice until 20 years later, when the USSR and the US governments started looking into the environment to harness its usages for political and strategic gains in the framework of the Cold War (Keith, 2000). A major event happened in the 1966, when the US led a campaign on cloud seeding in Vietnam. However, such practices rapidly became rejected by the international community and a new focus on climate change began to emerge (Keith 2000, p.253).

Perhaps the implementation of geoengineering practices is the most controversial aspect of the discipline. This is due to the absence of proper scientific and reliable data on the impacts and risks of CDR and SRM technologies, which has raised many ethical, political and legal concerns (Burns and Strauss, 2013). In this context, many scientific and technological research programs and risk assessments reports have been proposed to resolve these uncertainties, but, thus far, “have not materialized at the scale necessary to test potential benefits and risks of such approaches” (Craik and Burns 2016, p.2).

Hitherto, geoengineering implementation has been restricted to theoretical assumptions and laboratory experiments. These, according to scholars, have proven to be inefficient due to the limited scope of action of small-scale tests (Olson, 2014). Yet, the impacts of geoengineering experiments vary on the type of technologies. While CDR and SRM technologies are often grouped together, each one presents different features and conceivable risks. CDR is likely to have more severe impacts on terrestrial and marine ecosystems, affecting biodiversity and resources, which carry food security implications, thereby affecting human rights and human welfare. CDR technologies are projected to be more expensive and, therefore, much more difficult to deploy and less accessible. SRM technologies are contrarily more affordable, and require a longer-term implementation, but their scientific uncertainty and consequential impacts to the weather and agriculture make them still subjects of further research (Craik and Burns, 2016).

In addition to the inefficiencies of geoengineering experiments, there is a lack of international legal rules to regulate experimentation and deployment. There exist some customary and treaty legal provisions, but they fall short in authority and scope to embrace such newness (Craik and Burns, 2016; Galaz, 2014). The Montreal Protocol, for instance, restricts the production and release of ozone-depleting substances. However, this mechanism becomes ambiguous when

applying it to atmosphere-based geoengineering technologies, which release sulfur aerosols into the stratosphere, indirectly causing ozone-depletion. Even though the Montreal Protocol does not encompass sulfates (*sulfur aerosols*), it is uncertain whether it is still applicable to geoengineering practices that somehow affect the recovery of the ozone layer (Burns and Strauss 2013, p. 196).

There are, of course, other concerns, such as the ethical and moral foundations, which have as well contributed to put on hold the implementation of these technologies. However, while these are being discussed in scientific and political discussions, climate engineering remains technologically and institutionally underdeveloped and polemical (Craik and Burns, 2016).

### **2.3. Governance**

The development of a governance framework has always been in the core of geoengineering debates. As already seen, the first generation of authors started studying about the nature of GEP as well as intradisciplinary power shifts and agenda-setting reasonings (Zürn, 1998). The first attempt to establish a binding policy framework was the 1978 UN Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD), which set the regulatory bases and formal regulations for climate modification techniques in the framework of military action and hostilities (Keith, 2000). However, climate engineering governance has, since then, seen little progress.

As already stated by Galaz (2014, p.44), the environmental system is by nature very difficult to govern. He asserts that “Earth system complexity requires novel institutional solutions, and continuous adaptive coordination between sovereign nation states”, he then follows, “the same complex dynamics seriously dilutes the incentives for collective action”. The callowness and complexity that characterize this discipline hinder the creation of clear policy frameworks and regimental boundaries for climate-related geoengineering technologies. Arguably, scholars have struggled to explain why some environmental issues raised the attention of policymakers, such as climate change, whereas others didn’t (Zürn 1998; Harold and Reynolds 2016).

Geoengineering is one example of the latter. As such, it doesn’t have a coherent governance framework to regulate research nor deployment (Galaz, 2014). Before the absence of a governing institution, scholars have explored other scenarios for geoengineering governance. For instance, Ostrom advocates for a polycentric coordination mechanism, which facilitates information sharing and fosters more coordinated actions (Ostrom, 2015). Others, such as



Burns and Strauss (2013), have explored the creation of a completely new global governance institution (GGI) for geoengineering. Additional governance speculations have been made on the basis of the ‘unilateralism myth’. The fear of unilateral geoengineering deployment comes from the conventional argument that in a situation of environmental catastrophism, countries, unable to gain international support, will resort to geoengineering actions on a unilateral basis (Burns and Strauss, 2013). Bodansky (2013) further explored this future scenario putting especial emphasis on SRM technologies, given their cheap cost and easy accessibility.

Another characteristic commonly assessed by governance scholars is the proliferation of actors and the emergence of multilateral patterns of collaboration. According to Galaz (2014, p.90), there is a “myriad of regulating national and international actors” ranging from private actors, governments, international organizations and non-governmental organizations. But the most interesting part from the perspective of this paper is “how all these political players, entrepreneurs, and intellectuals intermingle and create networked alliances within a highly complex institutional landscape” (*ibid.*, p.92). For instance, in 2009, the Royal Society published a report on geoengineering: ‘Geoengineering the climate -science, governance and uncertainty’. This triggered the attention of the UK House of Commons and the US House of Commons Committee on Science and Technology Committee, which have been essential for bringing geoengineering to the fore of international political debates. Their involvement resulted in several investigations and synthesis reports, mainly funded by private actors, such as the philanthropist Bill Gates and Sir Richard Branson. Simultaneously, these had vested interests in tech-based companies such as ‘Carbon Engineering’, specialized in the development of geoengineering technologies. Environmental NGOs, like the ETC Group, and scholars stepped in to criticize such intermix of commercial, economic and private interests influencing the future of climate (Galaz 2014, p.90).

A central theme has also been whether these new actors hold any decision-making powers or they are mere observants of the process. In fact, there is a noticeable evolution since the 90s, when several authors were rather pessimistic towards emerging civil actors and the scientific community, asserting that they lacked of formal competencies to influence decision-making processes (Zürn, 1998). Contrary, contemporary authors, such as Prideaux (2017), state that scientists and tech-experts, and the civil society play a significant role as global negotiators and lobbyists of environmental affairs and geoengineering policies. In fact, the NAS has asserted that the scientific community in specific is crucial for giving green light to geoengineering

experiments (NRC, 2015). There have been additional calls for a deeper inclusion of science into politics. For instance, Jinnah and Nicholson (2019, p.878) recommend the IPCC to further “evaluate (...) the policy implications of competing policies and technological pathways”. Galaz (2014), as well, recognizes the importance of scientific actors not only because they are providers of qualified knowledge, but also, because they help define political issues and trigger international cooperation.

Even though there is no GGI or international agreement, geoengineering governance can take other forms. Bodansky (2013) asserts that, for the most part, governance provisions come in the form of general rules, including general principles (the precautionary principle), treaty norms (ENMOD Convention), decisions made by international institutions (CBD and the LC), and rules developed by non-state actors (the Oxford Principles<sup>3</sup>). However, the same regulatory scarcities seen in geoengineering deployment applies in governance. The LC framework for CDR technologies, for instance, has not entered into force yet, and the CBD is an advisory body that only offers non-binding decisions on ocean fertilization. As for the ENMOD, UNCLOS , LRTAP, and many others, they are potential treaties that could play a key role in geoengineering governance, but it is uncertain if their clauses include CRD and SRM practices (Burns and Strauss 2013, p.182).

In conclusion, scholarly research and debates about the justification of geoengineering deployment and the implementation of a geoengineering governance framework still take place in global political fora. And while all these will be further examined along this paper, my research engages more particularly with the structural consequences of geoengineering in the international political system.

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<sup>3</sup> The Oxford Principles underlie a set of principles established by a group of researchers who wanted to frame the governance of emerging geoengineering techniques (Rayner et al., 2013).

### **3. Evoking Geoengineering in Climate Politics: Scrutinizing the Convention on Biological Diversity (CBD) and the London Convention (LC) as case studies**

“One of the discoveries of global geopolitics and global governance is that we don’t have a comprehensive system ready to govern these technologies.”<sup>4</sup>

In the above quote, Alex Hanafi makes an explicit argument for undertaking research on the different sources of governance for geoengineering and the international system. In such a view, the Convention on Biological Diversity and the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 and 1966 Protocol (i.e. London Convention and London Protocol) are the two international bodies that have addressed the issue of geoengineering directly. This article undertakes an in-depth analysis of these instruments and their implications in the international political system. Such analysis is particularly timely in a context where the different international responses to limit greenhouse gas (GHG) emissions, such as the Paris Agreement (2015), have proven to be insufficient and ineffective, and more political attention is being drawn to geoengineering techniques and their aspirational role in fighting climate change (Bodansky, 2013).

The analysis focuses on a specific set of geoengineering techniques, CDR technologies, particularly ocean fertilization, which are believed to be the easiest to govern (Burns, 2016). This dissertation relies on qualitative data, including analysis of primary literature, interviews and observation of the CBD and the LC decisions on geoengineering taken between 2008 and 2016. The empirical research proceeds as follows: the first part shows how the CBD frames geoengineering in GEP. The second reveals the contributions of the LC in the field. And the third and final part compares both bodies in different aspects of the discipline, such as geoengineering governance and climate justice.

#### **3.1. The Convention on Biological Diversity**

In 2008, CBD COP 9 adopted a non-binding decision “request[ing] Parties ... to ensure that ocean fertilization activities do not take place” except for “small scale scientific research studies within coastal waters” (Decision IX/16). This was the first one of several processes adopted by the CBD to regulate ocean fertilization activities affecting biodiversity. All of these culminated with the creation of the CBD Moratorium for geoengineering. Although the text is non-binding, it has come into play in the politics and governance of ocean fertilization activities.

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<sup>4</sup> Interview with Alex Hanafi, Legal Counsel at the Environmental Defense Fund, interview undertaken on March 20th.

### 3.1.1. A multilateral and cross-disciplinary system

Given the cross-bordering nature of geoengineering, it is logic to expect that a high number of regimental actors will intervene in the decision-making processes. And this is widely seen in the case of the CBD. In the Decision X1/20 on Biodiversity and Climate Change taken by the CBD COP 11, there were hundreds of representatives from intergovernmental organizations, academic institutions, indigenous groups, non-governmental organizations, local authorities, industry actors, parliamentarians, youth groups and many others. Even though only states are signatory parties to the Convention, the representation of other stakeholders influenced the decision-making processes. This is widely seen in COP10, 11 and 13 in which the parties “[recognize]d the importance of taking into account (...) experience and perspectives of indigenous and local communities when addressing climate-related geoengineering and protecting biodiversity” (Decision XIII/14).

Another aspect that evinces the multilateralism of geoengineering is the myriad of regimental mechanisms that intercede in the field. This analysis shows a remarkable amount of international treaties, institutions, and other legal instruments that are referred in the texts of the Convention. Table 1 lists all these references made in each resolution:

Table 1. List of International mechanisms referred in the CBD decisions on geoengineering.

Resolutions	International mechanisms referred
CBD COP 9 Decision IX/16 on Biodiversity and Climate Change (2008)	London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972) 1996 London Protocol Precautionary principle
CBD COP 10 Decision X/33 on Biodiversity and Climate Change (2010)	Precautionary approach London Convention/London Protocol
CBD COP 11 Decision XI/20 on Biodiversity and Climate Change (2012)	UNFCCC IPCC Precautionary approach Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter 1972 London Convention 1996 Protocol of London Convention United Nations Conference on Sustainable Development Customary international law (with regard to the activities within [states] jurisdiction or control and with regard to possible consequences) UNCLOS Kyoto Protocol Vienna Convention for the Protection of the Ozone Layer Montreal Protocol

	UNGA UNEP World Meteorological Organization Convention on the Prohibition and Any Other Hostile Use of Environmental Modification Techniques Convention on Long-Range Transboundary Air Pollution Outer Space Treaty Antarctic Treaty UNHRC Office of the Commissioner for Human Rights UN Permanent Forum on Indigenous Issues Food and Agriculture Organization of the UN Committee on World Food Security
CBD COP 13 Decision XIII/14 (2014)	Precautionary approach Customary international law UNFCCC

Source: Prepared by the author.

Such analysis illustrates two things. The first is the above-mentioned multidisciplinary of geoengineering. The second is that this cross-regimental interaction of actors is not only existent in informal debates and conversations about geoengineering, but has been introduced in the political fora and decision-making processes. This may be due to the rising interconnectedness of environmental ecosystems, or because of the increasing trend to establish cross-institutional cooperation in a globalized world.

Either way, geoengineering seems to have triggered the international community to create global collaborative networks through which knowledge and information are exchanged by a multiplicity of actors, and build cross-referencing institutional mechanisms to reduce its institutional and political fragmentation (Galaz, 2014; Jinnah and Nicholson, 2019).

### 3.1.2. Prospects for international cooperation

As illustrated briefly above, the conventional rationale for geoengineering deployment is based on the myth of unilateral deployment (Burns and Strauss, 2013). However, the creation of collaborative international mechanisms to regulate climate modification technologies place the above-mentioned myths substantially misleading.

Some critics say that the increasing interaction between actors in climate politics is not new, and therefore, not a product of geoengineering practices<sup>5</sup>. But, in fact, it is precisely geoengineering what may somehow lead international dynamics to create cooperative links rather than foster unilateral trends (Burns and Strauss 2013, p.168). This argument runs as

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<sup>5</sup> Interview with Jane Long.

follows: our current environmental political system is set up on a joint mitigation action plan (Burns and Strauss, 2013). This was coined in the 2015 Paris Agreement in which, “acknowledging that climate change is a common concern of humankind”, parties committed to establish nationally determined contributions to the aim of achieving the long-term temperature goal (UNFCCC, 2015). Despite the calls for a joint mitigation action, in a world of accelerating climate change and a generalized failure to reduce GHG emissions, climate mitigation has proven to be more of a discouragement for international cooperation (Burns and Strauss, 2013). “Although countries prefer collective carbon mitigation, they more strongly prefer other countries reduce emissions while they pursue economic growth unburdened by an effective price on carbon” (*ibid.*, p.177). Conversely, geoengineering leads to international cooperation. To appreciate the logic of multilateralism posed by geoengineering, the case of the CBD is helpful.

Among the decisions to limit ocean fertilization practices, the Convention builds upon existing approaches to collaborative and collective action in the realm of climate politics. Table 2 lists some of these approaches and wording that encourages cooperation. For instance, at COP 9, the CBD proposes the ‘dissemination of results’. Similarly, at COP 11, it requests the creation of a ‘clearing house mechanism’<sup>6</sup>. The propositions of the exchange of knowledge and information pave the way towards the creation of a collaborative framework for geoengineering research and deployment.

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<sup>6</sup> The clearing-house mechanism is a CBD-based mechanism that promotes scientific cooperation between parties in tools for decision-making, training and capacity-building, research, funding, technology transfer, and the repatriation of information (SCBD, 2012).

Table 2. List of decisions related to ocean fertilization taken by the CBD.

<p>CBD COP 9 Decision IX/16 on Biodiversity and Climate Change (2008)</p> <p><i>The Conference of the parties,</i></p> <p>4. ... <i>urges</i> other Governments (...) to ensure that ocean fertilization activities do not take place until there is ... a <b>global</b>, transparent and effective control and regulatory mechanism is in place for these activities;</p> <p>5. <i>Requests</i> the Executive Secretary to <b>disseminate the results</b> of the ongoing scientific and legal analysis (...) to the fourteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice.</p>
<p>CBD COP 11 Decision XI/20 on Biodiversity and Climate Change (2012)</p> <p><i>The Conference of the parties,</i></p> <p>15. <i>Also requests</i> the Executive Secretary, subject to the availability of financial resources, in <b>collaboration</b> with relevant organizations, to:</p> <p>(a) Compile information reported by Parties as referred to in paragraph 9 above, and make it available through the <b>clearing-house mechanism</b>;</p> <p>(b) Inform the national focal points of the Convention (...) so as to facilitate national <b>cooperation</b> in providing input, in particular as it relates to biodiversity considerations;</p>
<p>CBD COP 13 Decision XIII/14 (2014)</p> <p><i>The Conference of the parties,</i></p> <p>5. <i>Also notes</i> that more <b>transdisciplinary research and sharing of knowledge</b> among appropriate institutions is needed (...).</p>

Source: Prepared by the author.

This invitation to cooperation is explained by the fact that states see geoengineering as serving the global interest to tackle climate change, thereby, entailing global collective action. Put simply, the CBD and member states feature collaborative mechanisms and cooperative initiatives as geoengineering requires multi-actor and multi-level coordination if it is to succeed (Burns and Strauss 2013, p.176).

### 3.2. The London Convention

The London Convention (LC) or the “Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972” is one of the first global conventions to protect marine ecosystems from human activities. In 2006, it was replaced by the London Protocol (LP) which was set to modernize and replace the Convention (OMI). In 2008, a non-binding resolution was adopted further elaborating on the work of the CBD. This barred ocean fertilization activities except for “legitimate scientific research”, which would be regarded as

“placement of matter for a purpose other than the mere disposal thereof” (Resolution LC-LP.1 2008).

The data analysis of the LC/LP resolutions showed two different trends worth mentioning for the purpose of the paper: the scientification of politics and the development of research before deployment.

### 3.2.1. Scientification of politics

When it comes to regulatory frameworks, research has shown that science plays a key role in policy processes. Jane Flegal asserts that “in the agenda setting phase of policy development for solar geoengineering scientists are likely to play a greater role in framing and advocacy” (p.56). Indeed, it seems that geoengineering elevates the role of the scientific community in international policy arenas, especially in a context of uncertain complex systems and rapid environmental change (Galaz, 2014). This is clearly seen in the LC, where science is becoming more prominent in decision-making processes for ocean fertilization.

One of the qualitative methods that I used to study this trend was content analysis, through which I counted the frequency of the word “science” and derivatives that appeared in the different LC decisions. Table 3 shows the results.

Table 3. Frequency of the word “science” and derivatives in the LC/LP decisions on ocean fertilization.

International legal decisions	Frequency of the word “science” and derivatives
London Convention 2008 Resolution LC-LP.1 Annex 6	14 times
London Convention 2010 Resolution LC-LP.2 Annex 5	12 times
London Convention 2013 Resolution LP.4	6 times

Source: Prepared by the author.

This shows, on the one hand, that the scientific community as a neutral and objective participant plays a key role in geoengineering policy debates. What it is surprising is that even in later stages of the policy process, where there is more formalization and political contestation, scientific advice is becoming more essential for policymakers.



### 3.2.2. The development of research before deployment

“There isn’t a global governance framework that is well seated right now to govern and manage these emerging technologies or even to govern or manage the research into these emerging technologies.”<sup>7</sup>

From the start, geoengineering governance has been at the crux of taking proposed geoengineering techniques seriously. Principle 5 of the Oxford Principles puts emphasis on this, claiming that “any decisions with respect to deployment should only be taken with robust governance structures already in place, using existing rules and institutions wherever possible” (Rayner et al., 2013). Yet, a strong governance framework can only be built on the basis of high-quality and reliable knowledge. As stated by Dr. Long, “[politics] is not going to play out without research”<sup>8</sup>.

From the start, research and its governance has been vastly overlooked. Even though science has evolved in the last few decades, it has not been conducive to political decision-making on geoengineering<sup>9</sup>. This is something that has been widely acknowledged by the parties of the LC, who adopted a resolution in 2010, requesting the creation of an assessment guidance for scientific research projects involving ocean fertilization (Resolution LC-LP.2).

The need to develop research before deployment politics has been predominant in all decisions taken by the conference of the parties of the LC. In order to assess this issue, the same content analysis than before has been used for the frequency of the word “research”. Table 4 shows that, in all three decisions, there has been a remarkable frequency of references to geoengineering research and its governance.

Table 4. Frequency of the word “research” in the LC/LP decisions on ocean fertilization.

International legal decisions	Frequency of the word “research” and derivatives
London Convention 2008 Resolution LC-LP.1 Annex 6	8 times
London Convention 2010 Resolution LC-LP.2 Annex 5	11 times
London Convention 2013 Resolution LP.4	11 times

Source: Prepared by the author.

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<sup>7</sup> Interview with Alex Hanafi.

<sup>8</sup> Interview with Jane Long.

<sup>9</sup> *Ibid.*

Among all these, Resolution LP.4 stands out for the firmness with which parties refer to research governance:

London Convention 2013 Resolution LP.4 (article 3)

*The Eighth Meeting of the Contracting Parties,*

3. *Confirms* that the Assessment Framework for Scientific Research involving Ocean Fertilization (...) is the relevant specific assessment framework (...) and should continue to be used to determine, with utmost caution, whether a proposed ocean fertilization activity constitutes legitimate scientific research that is not contrary to the aims of the London Protocol;

While this analysis shows a tendency to prioritize scientific research before technology deployment, it is worth mentioning that this is not present in all geoengineering regimes. In the case of the CBD, the word “research” is barely mentioned. This regimental fragmentation may explain why there is not a coherent global governance framework for geoengineering technologies, as referred at the beginning.

### **3.3. Analytical comparison between the CBD and the LC**

There are plenty of discussions of the effectivity of the CBD and the LC in geoengineering techniques, and yet little analysis comparing both of them. As a research field, geoengineering is only beginning to be institutionalized, but evidence presented in this section suggests that the two bodies have significant but differentiated contributions in GEP. Perhaps paradoxically, I argue that they do so in very different ways.

#### **3.3.1. The language strength of regulatory decisions**

In the absence of a strong governance framework, the CBD and the LC have served as international regulatory bodies filling the institutional gaps of climate engineering. This paper has exposed some of their contributions, including cross-regimental cooperation and research governance. Nonetheless, these have not been conducive to a binding policy framework for geoengineering technologies.

This paper has analysed here how the wording of the CBD and the LC decisions on geoengineering influence their authority and effectivity. Table 5 compares the decisions regarding ocean fertilization at the two bodies. It shows that while the CBD uses ‘softer’ wording such as “requests” and “further invites”, the LC provides a more direct and straight language, using words such as “agree”, “reaffirms” and “decides”.

Table 5. Comparison of the language used in the CBD and LC decisions on ocean fertilization.

<p>CBD COP 9 Decision IX/16 on Biodiversity and Climate Change (2008)</p> <p><i>The Conference of the Parties</i></p> <p>1. <b>Requests</b> the Executive Secretary to bring the issue of ocean fertilization to the attention of the Joint Liaison Group;</p>
<p>CBD COP 11 Decision XI/20 on Biodiversity and Climate Change (2012)</p> <p><i>The Conference of the Parties</i></p> <p>8. <b>Invites</b> Parties to address the gaps identified in paragraph 7 and to report on measures undertaken in accordance with paragraph 8(w) of decision X/33;</p>
<p>London Convention 2010 Resolution LC-LP.2 Annex 5</p> <p><i>The Eighth Meeting of Contracting Parties (...)</i></p> <p>3. <b>DECIDE FURTHER</b> that Contracting Parties should use the Assessment Framework to determine, with utmost caution, whether a proposed ocean fertilization activity constitutes legitimate scientific research that is not contrary to the aims of the London Protocol or the London Convention;</p>
<p>London Convention 2013 Resolution LP.4</p> <p><i>The Eighth Meeting of Contracting Parties (...)</i></p> <p>2. <b>REAFFIRMS</b> that resolutions LC-LP.1(2008) and LC-LP.2(2010) continue to apply for all Contracting Parties (...).</p>

Source: Prepared by the author on the basis of Sugiyama (2010).

Arguably, there is a difference in the strength of the languages used in the CBD and the LC, being the former more advisory and the latter more coercive. In light of this difference, Sugiyama (2010, p.7) concludes that “although non-binding, [the LC] is strong enough to effectively prohibit ocean fertilization activities. On the other hand, the CBD (...) may not be as strong as to constitute prohibition or moratorium”.

### 3.3.2. Absence of a binding governance framework

Regardless of the adopted language, none of each has constituted a *de facto* regulatory framework for geoengineering governance, precisely because they have not prevented geoengineering deployment from happening. This can be seen with the creation of a stratospheric aerosol geoengineering project carried by SPICE in 2010, and the 2012 launch of an ocean iron fertilization experiment in the coast of Haida Gwaii (British Columbia) aiming to restore the local salmon community (Galaz, 2014).

Understanding why climate engineering lacks in international binding policies requires going beyond analyzing the existing institutional gaps within the discipline, and exploring the

structural deficiencies of global governance in general. From this perspective, this paper argues that the process of creating a rigorous governance framework for geoengineering, has failed for two possible reasons.

The first is that geoengineering lacks sufficient scientific reliable data needed to call policymakers for action. In a particularly cross-disciplinary regime where events have transbordering impacts, existing information on various aspects is key to identify elements of interdependence (Dimitrov et al., 2007). As Hanafi stated in an interview, “countries may be still don’t have (...) all the knowledge we need yet to have a full discussion, a full kind of understanding of the issues that we can elaborate in the international negotiation.”<sup>10</sup>. The absence of information on the transnational consequences of geoengineering reduces the political incentives for collective action, impeding the creation of a binding policy framework (Dimitrov et al., 2007, p. 252).

The second relates to global governance structures. When it comes to geoengineering, politics and governance develop at a slower pace than technology does. Hanafi claims that “governance seems generally reactive, so it takes time for the governance systems and the politics to catch up where the technology is going”<sup>11</sup>. This context may raise new challenges to the international community and their capacity to react to major events, such as climate change. As one interviewee stated, “whether the political system can evolve, I think it takes time. I think the question is ‘can it evolve fast enough?’”<sup>12</sup>. Based on the institutionalist rationale, this view points to the importance of designing institutions capable of effectively reconciling technological advancements and policymaking processes.

### **3.3.3. The ethical concerns of climate politics**

One of the most controversial challenge in climate politics is environmental justice. At present, most of the knowledge on climate-related issues, including geoengineering, is produced in developed countries. Arguably, scholars have continuously urged international institutions to diversify knowledge in order to create equity in decision-making processes between the North and the South (Jinnah and Nicholson, 2019). However, this study shows that neither the CBD

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<sup>10</sup> Interview with Alex Hanafi.

<sup>11</sup> *Ibid.*

<sup>12</sup> *Ibid.*

nor the LC have tackled these issues so far, as there is not a single reference to developing countries or their vulnerable conditions in any of the decisions.

Notwithstanding, it is worth mentioning that in the 2019 United Nations Environment Assembly, Switzerland submitted a resolution for geoengineering governance, which did a special mentioning to third-world countries:

UNEA 2019 Resolution for consideration, Geoengineering and its governance (preambular para. 1)

*The United Nations Environment Assembly,*

PP1. *Recognizing* that climate change is one of the greatest challenges of our time, which undermines the ability of all countries, especially those developing countries that are particularly vulnerable to the adverse effects of climate change, to achieve sustainable development and poverty eradication.

### **3.3.4. The localization of governance initiatives**

“Researchers and not just hard science physical researchers, but social science researchers, global governance experts, politics experts, they need to talk to each other at the local level as well within different countries, getting those experts together to talk about these issues could be helpful in building the capacity of countries to actually talk about a global governance framework.”<sup>13</sup>

Early justifications for geoengineering governance tend to center on the need to set up political discussions at a local scale. Several scholars have analysed the efficiency of this framing (Olson, 2011; Galaz, 2014; NRC, 2015). However, evidence from this analysis shows that this has been little applied in the political arena. In the case of the CBD, Decision XI/20 on Biodiversity and Climate Change (2012) contains a specific request to strengthen national cooperation:

CBD COP 11 Decision XI/20 on Biodiversity and Climate Change (2012)

*The Conference of the Parties*

15. *Also requests* the Executive Secretary (...) to:

- (b) Inform the national focal points of the Convention when the review procedures for the Fifth Assessment Report of the Intergovernmental Panel on Climate Change are initiated, so as to facilitate national cooperation in providing input, in particular as it relates to biodiversity considerations;

Contrary, the LC has not considered so far the creation of any local and regional mechanisms as an option for its geoengineering policy toolkit.

If governance decisions are expected to be made in global institutions, where agreements are very difficult to reach and policy agendas are already very packed, without building first the capacity building and expertise within those countries, governance frameworks will most likely

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<sup>13</sup> Interview with Alex Hanafi.

not fit for the purpose. Therefore, building the capacity internally is essential to have a better global geopolitics and more efficient conversations at the global level<sup>14</sup>.

In this section, the empirical study reveals a number of interrelated as well as differentiated ways in which the CBD and the LC frame geoengineering in GEP. While the CBD has significant contributions in the interface of stakeholders and governance, leading to a more multilateral and collaborative decision-making; the LC focuses more on the technicalities of policy formulation and brings into light the role of science and research in these processes. Finally, the analysis also shows that even though these two bodies have different contributions in GEP, they are both still really immature and lack of proper legitimacy to address some of the structural aspects of the discipline.

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<sup>14</sup> *Ibid.*

#### **4. Conclusions**

In a context in which the international community has failed in meeting the 2°C global warming limit, political discussions increasingly consider geoengineering interventions as effective means to combat climate change. The case studies mentioned in this paper, the Convention on Biological Diversity (CBD) and the London Convention (LC), are some of the examples of how geoengineering is sliding into international environmental policy. As geoengineering gains momentum in politics, more literature review appears on the feasibility of geoengineering technologies and their environmental impacts. However, little has been done about the implications of these technologies in the political realm.

The question at the heart of this dissertation is not whether geoengineering technologies will succeed, but rather how the incorporation of these in the policy agenda affects GEP. The bulk of this dissertation aimed to analyse the decisions on geoengineering adopted by the CBD and the LC. This necessarily meant looking at the different resolutions adopted by the two bodies aiming to set a regimental regulatory framework for geoengineering activities, especially for ocean fertilization. Research was complimented with primary literature and interviews to practitioners.

Studying geoengineering in this way brings significant contributions to the existing literature. In general terms, it brings to light some of the ongoing political discussions on environmental issues and presents geoengineering as an innovative alternative to tackle climate change. However, unlike many other research papers, it has a more structural and political approach to climate modification, which goes beyond promoting or discrediting geoengineering. Rather, in the hope of helping inform the debate that is emerging, it addresses its impacts in the political system and the global order. In specific terms, this research provides an extensive analysis of particular geoengineering regimes -the CBD and the LC- and further analyses other mechanisms such as the UNEA. Moreover, it makes an in-depth comparison between these two bodies, and studies how these tackle some of the major issues of the discipline.

The research departs from the hypothetical assumption that geoengineering technologies shape the dynamics of GEP in three different ways: first, by leading to new multilevel and multilateral ways of interaction between actors; second, through a dynamization of the legal and political environmental system; and third, by restructuring global environmental governance.

At first glance, such arguments appear reasonable when applied to any emerging regime that is increasingly moving into political discussions. However, given that geoengineering is a multidisciplinary regime with transnational effects, the different structural impacts it has on the environmental discipline depend on a wide range of factors, both endogenous and exogenous. In general terms, this paper concludes that geoengineering has indeed shaped climate politics by bringing new multidimensional political processes, by providing new modes of knowledge production and policy-making, and by shaping institutional set-ups and regimes. However, the geoengineering discipline is too premature to make a significant impact in the environmental political realm. As Dr. Jane Long stated in an interview, “[geoengineering has] very little relevance really because nothing has been done about it. I mean, it is just ideas. Very little research, very little grounding in the engineering and the science”<sup>15</sup>. Following this view, I argue that the lack of political action in geoengineering regulation and research impedes the development of a proper governance framework for geoengineering. As nicely argued by Victor Galaz:

“the main reason why [geoengineering] has not had a big impact, political impact, is because everyone realizes that if you want to do this, you would need a strong international agreement, and that is going to be very difficult. So you are trying to solve the problems emerging from a failure on not having a robust international agreement on climate, with another even more difficult, or just as difficult, international agreement policy, such as solar radiation management.”<sup>16</sup>

*What kinds of evidentiary contributions has geoengineering had in environmental policy development?*

Evidence in this dissertation suggests that there have been political attempts to put geoengineering on the formal public agenda, shaping the interface of science and policy in GEP. This has been seen in the CBD and the LC. With regard to the CBD, there are at least two issues which it has had an impact on. The first one is the interaction between actors in the discipline. As a cross-regimental field, geoengineering technologies have triggered the parties of the Convention to create cross-disciplinary mechanisms and strengthen global collaborative networks in order to surpass the institutional fragmentation. Relatedly, the second is that geoengineering is being used to promote international cooperation between actors. In the case of the LC, geoengineering is seen to have elevated the role of science and research in the political arenas. In light of absent international agreements, the Convention resorts to scientific research to produce knowledge and set-up governance frameworks.

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<sup>15</sup> Interview the Jane Long.

<sup>16</sup> Interview with Victor Galaz.



Despite the above-mentioned regimental contributions, the analysis shows that they have not been significant enough to bring epistemological changes to climate politics and governance. The paper argues that this is due to two major reasons. The first one is that the CBD and the LC, which are currently the only international treaties regulating geoengineering, may not be the appropriate platforms for geoengineering governance. This may be because their weak language, the institutional inconsistencies, the lack of authority, or a combination of all. As Victor Galaz stated, “the Convention on Biological Diversity has existed I don’t know for how many decades and it has not had that sort of impacts that it needs to have (...). Some people would say it has to do with the set-up of the CBD. Just the way of the mandate, the way it is operated and the way it has negotiated”<sup>17</sup>. Additionally, neither the CBD nor the LC have been able to tackle some of the key aspects of the environmental discipline, such as climate justice or the creation of local political initiatives. According to Hanafi, “there is need to be a better global ‘connectiveness’ on these questions of research. And I don’t just mean at the international/global level, I mean at the practical/bottom-up level as well”<sup>18</sup>. Therefore, if there is no willingness to build capacity-building on geoengineering at the local level, there will never be a coherent policy framework at the global.

The second reason has to do with the incapacity of political actors to adapt to the current context. Within a reactive political system, the community acts only after internationally relevant events take place and demand urgent and immediate political action. Arguably, the international community will never properly address geoengineering until the climate crisis is so deteriorated that there is no other option left. This leaves no room for geoengineering to create a more ready, innovative and dynamic political system. It remains to be seen, therefore, whether and how climate modification technologies will cohere with the existing international political mechanisms, or whether they will be radically disrupted.

Given the low research on geoengineering and the incapacities of the political system to embrace such newness, geoengineering has no shaper role in global governance. Put simply, it is an emerging discipline that lacks proper adherence to become a real regime. Only by persuading international relevant actors that climate intervention is necessary, will they fund research and create an international binding policy framework. “If geoengineering attains

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<sup>17</sup> Interview with Victor Galaz, Associate Professor in Political Science at the Stockholm Resilience Centre (Stockholm University), interview undertaken on April 15th.

<sup>18</sup> Interview with Alex Hanafi.

legitimacy even more, its prospects as a critical tool in the fight against climate change will improve even more, and systemic attributes will favour a multilateral climate intervention solution” (Burns and Strauss 2013, 181). In this line, the greater challenge is not on the institutional set-up, but on building the global perception that geoengineering is needed to speed up efforts to address climate change. Studies should therefore include more social and conceptual variables, including public perception and moral acceptability, in order to question assumptions that ‘uncertainty’ is straightforward in the development of geoengineering.

Geoengineering raises understandable concerns about the future role of technology in our lives. However, with global emissions rising, the geoengineering debate is only the beginning of a new wave of technological alternatives to tackle environmental challenges. The dispersion of authority and the institutional fragmentation of climate modification requires that research and deployment take place on a local scale. Moving forward, it would be interesting to analyse how decisions will be made at a local level, how regional governments and supranational actors will coordinate actions, and which role citizens and civil actors will have in this matter.

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#### **5.4. Interviews**

Interview with Victor Galaz, Associate Professor in Political Science at the Stockholm Resilience Centre (Stockholm University), interview undertaken on April 15th.

Interview with Jane Long, former chair of the Task Force on Geoengineering for the Bipartisan Policy Center, interview undertaken on March 13th.

Interview with Alex Hanafi, Legal Counsel at the Environmental Defense Fund, interview undertaken on March 20th.

Interview with Peter Wadhams, British professor of Ocean Physics at Cambridge University, interview undertaken on March 18th.



## 6. Annex

### 6.1. Content analysis

Categorization							
Official Document	International legal mechanisms	State actors	Non-state actors	Governance mechanisms	Science in Politics	Frequency of 'research'	Drawbacks
CBD COP 9 Decision IX/16 on Biodiversity and Climate Change (2008) UNEP/CBD/COP/DE C/IX/16	- London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972) - 1996 London Protocol - Precautionary principle	- States - Parties - Governments		- Joint Liaison Group - Disseminate the results - Subsidiary Body on Scientific, Technical and Technological Advice	- scientific Groups - scientific basis - scientific research - scientific data - scientific (...) analysis - scientific and technical information Subsidiary Body on Scientific, Technical and Technological	2 times	-Absence of reliable data
CBD COP 10 Decision X/33 on Biodiversity and Climate Change (2010)	- Convention on Biological Diversity - Precautionary approach - London Convention/London Protocol	- Parties	- Indigenous and local communities - Other stakeholders	- Regulatory mechanisms social, economic and cultural impacts - Subsidiary Body on Scientific, Technical and Technological Advice	- science (2') - scientific basis - scientific research - scientific data - scientific information	1 time	-[various] definitions (...) of climate-related geo-engineering
CBD COP 11 Decision XI/20 on Biodiversity and Climate Change (2012)	- Convention on Biological Diversity - UNFCCC - IPCC - Precautionary approach - Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter - 1972 London Convention - 1996 Protocol of London Convention - United Nations Conference on Sustainable Development - Customary international law - UNCLOS - Kyoto Protocol - Vienna Convention for the Protection of the Ozone Layer - Montreal Protocol - UNGA - UNEP - World Meteorological Organization - ENMOD - Convention on Long-Range Transboundary Air Pollution - Outer Space Treaty - Antarctic Treaty - UNHRC - Office of the Commissioner for Human Rights - UN Permanent Forum on Indigenous Issues - Food and Agriculture Organization of the UN - Committee on World Food Security	- Parties - Governments	- Indigenous and local communities - Other stakeholders - Environment Management Group	- socio-economic, cultural and ethical issues - gender considerations - Regulatory mechanisms - Dissemination - Clearing-house mechanism	- science-based - scientific and technical evidence - scientific bases - Subsidiary Body on Scientific, Technical and Technological Advice (2') - scientific reports	1 time	- Difficult to deploy or govern - Gaps in the understanding of the impacts - No [consensus] on where (...) mechanisms would be placed
CBD COP 13 Decision XIII/14 (2014)	- Precautionary approach - Customary international law (with regard to the activities within [states] jurisdiction or control and with regard to possible consequences) - UNFCCC - Convention on Biological Diversity	Parties	Indigenous people and local communities	- Sharing of knowledge - Socio-economic, cultural and ethical issues	sciences	1 time	- Few parties responded to the invitation to provide information on measures they have undertaken

Categorization							
Official Document	International legal mechanisms	State actors	Non-state actors	Governance mechanisms	Science in Politics	Frequency of 'research'	Drawbacks
London Convention 2008 Resolution LC- LP.1 Annex 6	- CBD - UNGA - London Convention - London Protocol	- States (1 time) - Contracting parties (4 times)		- Assessment on a case-by-case basis by Scientific Group	14 times	8 times	- Current knowledge is insufficient
London Convention 2010 Resolution LC- LP.2 Annex 5	- London Convention - London Protocol	- Contracting parties (which are State parties)		- Assessment Framework for Scientific Research Involving Ocean Fertilization - case-by-case basis	12 times	11 time	
London Convention 2013 Resolution LP.4	- London Convention - London Protocol - Precautionary Approach - UNGA - IPCC - UN Conference on Sustainable Development - CBD - Intergovernmental Oceanographic Commission of UNESCO	- Contracting parties (which are State parties)		- independent expert advice	6 times	11 time	- No single geoengineering approach

## 6.2. Interview Guide

1. What is the relevance of geoengineering in today's context the political realm?
2. When conducting my research, I concluded that the evolution of the environment (becoming much more multidisciplinary, and therefore, more complex) is triggering technological changes and evolution (such as geoengineering). How would you say this affects environmental politics?
3. To what extent the geoengineering-led proliferation of actors has led to new ways of interaction between stakeholders of the discipline (more 'multilevel' and 'multilateral')?
4. To what extent will these technological advancements, and geoengineering in general, lead to a dynamization of politics? And how?
5. Some authors have already studied potential scenarios of governance for geoengineering. To what extent these proposals on geoengineering governance are shaping current environmental institutions and governance frameworks? And how?

## 6.3. Interview Transcripts

### Interview with Victor Galaz

*(Introduction and ethical questions)*

Joana: So, as I was saying, I just wanted to ask your consent. If it was fine to audio-record the interview?

Dr. Galaz: Aha

Joana: Okay, perfect.

Dr. Galaz: It is for your personal use?

Joana: Exactly, it is a... I was going to explain it now, but basically it is my final degree project. It is not going to be published. It is part of my university degree. Is it fine as well if I quote you?

Dr. Galaz: Yes, I haven't done geoengineering work for a few years.

Joana: No problem.

Dr. Galaz: I hope it is useful in any way.

Joana: Yes, I am completely sure. So, now the reason of this interview is to get your personal insights, as I said, on how geoengineering affects global environmental politics. So, it is important to let you know that my research is not about listing the impacts of geoengineering, nor to study the suitability of geoengineering in today's world. It is rather focused on studying how the different challenges that geoengineering poses, and that you mentioned in your book, are redesigning and shaping the global environmental politics scenario. So, now going straight to the questions. Now, when conducting my research, I concluded that the evolution of the environment (becoming much more multidisciplinary, and therefore, more complex) is triggering technological changes and evolution (such as geoengineering). How would you say this affects environmental politics?

Dr. Galaz: Are you talking about technological change in general or geoengineering in general?

Joana: I am referring to geoengineering.

Dr. Galaz: Okay, I have been following this field for many years and I think it is influencing global environmental politics on a, I would say, conceptual level, meaning that this is always a topic that is around in discussions around climate change. There are research groups that are interested in different dimensions of geoengineering in terms of testing the technology itself on very very small scale all the way to people that are exploring the governance or geopolitical or public opinion dimensions on geoengineering. But so far it hasn't really...I wouldn't say it is influencing climate politics in a big way yet. But, my only but there is that it varies very much on the type of technology you talk about. So when you talk about geoengineering technologies, are you talking about carbon removal technologies? Or are you talking about Solar Radiation Management?

Joana: Both. SRM and CDR.

Dr. Galaz: Okay. Then in that sense I would say there is much more focus nowadays in climate policy or carbon removal technologies, or negative emission technologies, that you didn't see years ago, I would say. And I think that is simply because of insights evolving from these climate economic models where you can see that there is no way or it is very difficult to get to the Paris Agreement without any sort of negative emissions. And as soon as you talk about those negative emissions, you need to talk about geoengineering technologies and the removal of carbon. And of course what all these technologies and to what they stand. There is a whole issue on reforestation, as some people would say are a type of negative emissions geoengineering technology, but then of course carbon dioxide storage, direct air capture, which is very very small in terms of pilot scale, etcetera. So I would say for the last 5 years, negative emission technologies have become much more important and prominent. And you see much more interest

from the policy domain, and investigations on how you make it happen that you didn't see 5 years ago.

Joana: Okay, perfect thank you. In your book you asserted that due to geoengineering techniques, there is a proliferation of state, non-state, public and private actors in this discipline. However, other experts have said that in fact there is the same patterns than the ones in the climate discipline in general. To what extent this has led to new ways of interaction between stakeholders of the discipline (multilevel and multilateral)? Are there new patterns of interaction due to geoengineering?

Dr. Galaz: When you say 'new', for how many years are we talking?

Joana: My research is based on 2008 and onwards.

Dr. Galaz: So for the last 10 years?

Joana: Yes

Dr. Galaz: I haven't been mapping those collaborations. (bad connection) Some researchers are intentionally trying to expand the tax of expert that they bring to discussion. So for example, all the Global South. I think was Greenpeace that had an article that puts a humanitarian perspective on geoengineering of Global South perspectives on geoengineering. Besides from that, and again I haven't looked into the details, I haven't seen a very rapid expansion of global networks for exploring geoengineering. There are discussions but I haven't seen alliances emerging.

Joana: Okay. but i your book you mentioned some examples such as Haida Gwaii, do you remember?

Dr. Galaz: Yes. Ocean fertilization.

Joana: Yes. And you said that these examples kind of exemplify these new ways of interaction between all these stakeholders from academic research institutions to financial actors to philanthropists. And I don't know when you say there has not been a rapid expansion of these global networks, you refer to this.

Dr. Galaz: For example, yes. For that Haida Gwaii ocean fertilization example, the only follow-up I know of is that the same group of entrepreneurs tried or did the same experiment in the coast of Chile a few years ago. But the problem with these experiments is that there is no validated way to show that there is no needs for carbon removal. And I think the latest analysis that came this year show that this actually doesn't work in that way. It doesn't have that sort of impact. So, if you add that, plus the fact that it is not economically viable, this solution will just not take off.

Joana: Okay. Then you would agree with everyone that says that geoengineering in fact is not leading to new ways of interaction. It is just the climate political system itself is experiencing this proliferation of actors from the South, non-state actors and other kind of actors.

Dr. Galaz: Yes, but I mean it is not quickly going alliance of different interests, I wouldn't say. I mean a lot of exceptions could be if you look into more in these negative emissions technologies, and especially those that are related to reforestation, for example. But those were already out there. So I don't know if they have expanded.

Joana: Okay, thank you. Now, the 3rd question, which is related to my second hypothesis. You as well theorized about the need to update the political and legal systems. Consequently, I hypothesised that geoengineering leads to a dynamization of the political and legal systems. But along my research I have not found evidence on that. Instead I have seen other changes in the political systems. I have concluded that this is because our political system is rather reactive and cannot, and will never, go along with technological advancements. In your opinion, what would you say is the reason for this lack of dynamization?

Dr. Galaz: So, did you say 'dynamization'?

Joana: Yes. In the sense that the legal and political systems have to adapt, kind of tu update.

Dr. Galaz: I don't know what the sources of it are, and I don't know if it is correct to say that it is not going to happen. But as you say, the mode in which global environmental governance operate is reactive, extremely reactive. One very clear example of this is, if you think about it, is the Amazon, for example, or the Boreal forests. You know, these are tipping elements of the climate system. So the way that the global community deals with big fires in the Amazon for example, has been totally reactive and all you see are coordinated efforts to try to through some money at the problem. At the Amazon fires for example, you got France and the G7 countries which came to an agreement that they would fund something that would help them combat the fires in the Amazon. Linke super small amounts of money that didn't address the frontline of the problems of fires in that region, which are climate change and deforestation. If you don't deal with climate change and deforestation, you will see these fires evolving. It doesn't matter if you throw 7 million or 7 billion dollars to the problem, that is nothing and it is very reactive. I think that is a general challenge for a lot of the things that we see in global environmental governance. They are reactive, and they are not very effective either, they don't have that sort of impact. An example of that could be the Convention on Biological Diversity (CBD), which has existed, I don't know, how many decades (...). It just doesn't have that sort of impact that it needs to have.

Joana: Why would you say that? Like why would you say that the Convention on Biological Diversity is reactive and therefore not effective?

Dr. Galaz: It is hard to tell and will probably depend on who you ask. I mean some people would say that it has to do with the set-up of the Convention on Biological Diversity, just the way that the mandate, the way that is operated, the way it has negotiated, etcetera. Another more neorealist perspective would be that the CBD is failing because the countries involved don't want it to succeed because the cost are too high. If you want to protect biodiversity, you will need to do agriculture in very different ways, you will need to stop deforestation, you will need to deal with climate change, you will need to think much more thoroughly on how you expand urban centres, etcetera. All of those things put limits to what states can do with their ecosystems. And since nations don't want to put those limits, they just find the way to undermine the collaborations. It is so depressing but it is just the reality.

Joana: Okay, perfect. Actually, it is interesting because my case study in this research is the Convention on Biological Diversity. It is really interesting as well that you said that may be it is due to the set-up. The problem here is that there is not an effective institutional framework that permits the political system to actually be more effective and not that reactive.

Dr. Galaz: So the CBD has been quite active on the issues of geoengineering. There is the moratorium and that means that it has that expert technical groups that have done some reports on impacts of geoengineering on biodiversity, I was in one of them many years ago, but those are just like advisory things. And the moratorium is also only guidelines etcetera that really doesn't have a binding [character].

Joana: My third hypothesis is related to global environmental governance. Some authors have already studied potential scenarios of governance for geoengineering. To what extent these proposals on geoengineering governance are shaping current environmental institutions and governance frameworks? And how? Because what I found is that there are new trends of global environmental governance and partly is due to geoengineering. Global environmental governance is becoming more inclusive in the sense that it is including the civil society and it is shifting to a more kind of 'consultative' governance, but I don't know to what extent geoengineering has has a role there.

Dr. Galaz: I am very marginal. Because that would be my assessment. And I think one of the main reasons for that is if you look at the Climate Convention, for example, and the discussions on the Paris Agreement. What they were discussing there are CO2 emissions (...) and the 1.5 degrees. If you are interested in Solar Radiation Management, actually what you want to regulate and have an agreement on is solar radiation. Those are two slightly different things, that is not really part of the political process to say 'yes we would allow this amount of solar radiation'. It is just not on the table. So the Paris Agreement doesn't have that component as a central piece. So that is why you don't get

that discussions in the Paris Agreement. There is some in the background reports, some people talk about it, but it is not a main issue. But what you do get discussions is on negative emissions, and that part of geoengineering. And those are more and more important over time because the more you delay, trying to decrease emissions, the more hard will be on those technologies to reach zero emissions or net emissions goals.

Joana: Okay, perfect. Related to that, then, my final question is what would you say is the main impact of geoengineering? I know you said in the beginning that there has not been a huge impact of geoengineering in climate politics, but which would you say is the main impact?

Dr. Galaz: In terms of the climate debate, I think it will always be, as one of the things that people, intellectuals and some policy makers say, it is a possible plan. It will always be there in the discussions. So in that way it affects the narrative of possible solutions for climate change, probably, and the sense of urgency. I would say the other impact, again, would be on discussions on negative emissions policies. I think that community will grow and that will become much more important. But that is the impact I see now at the moment. I mean the main reason why solar radiation management has not had a big impact, political impact, is because everyone realizes that if you want to do this, you would need a strong international agreement, and that is going to be very difficult. So you are trying to solve the problems emerging from a failure on not having a robust international agreement on climate, with another even more difficult, or just as difficult, international agreement policy, such as solar radiation management. It just doesn't solve anything. And that is why it doesn't evolve as a main possible solution.

Joana: Okay, perfect, thank you very much. It was all from my part. Thank you very much Victor for participating in this interview. And, of course, if you want, I can send you a soft copy or a summary of my research when it is finished.

Dr. Galaz: That would be interesting, yes.

Joana: And if you have any recommendations on readings, or even on primary sources, or you have suggestions, please let me know. You have my email, my WhatsApp, you have everything.

Dr. Galaz: One thing I just remember now. There is this quite interesting paper by Dimitrov 'Non-regimes', have you heard about it?

Joana: No

Dr. Galaz: So, 'non-regimes' are essentially international issues that are very urgent and everybody knows that is urgent, and need to be solved, but no international agreement evolves because of internal conflicts.



Joana: Okay, perfect thank you very much Victor. Just keep safe and will keep in touch.  
Thank you very much and kind regards.

Dr. Galaz: Bye

Joana: Bye.

## Interview with Dr. Jane C. Long

*(Introduction and ethical questions)*

Joana: Perfect, then is it fine as well if I quote you in my research?

Dr. Long: Yeah

Joana: Perfect. Now the reason of this interview, as I already told you, is to get your personal insights on how geoengineering affects global environmental politics. Then, it is important to let you know that my research is not about listing the impacts of geoengineering, nor to study the suitability of geoengineering in today's world. It is rather focused on studying how the different challenges that geoengineering has posed are redesigning and shaping the global environmental politics scenario.

Dr. Long: *Uhum.*

Joana: Then, as an introductory question, what would you say is the relevance of geoengineering techniques in today's context?

Dr. Long: Very little relevance really because nothing has been done about it, I mean, it is just ideas. Very little research, very little grounding in the engineering and the science. Some people are trying. I think it has, *a propo* of your topic, there are certain traditional environmentalist that have focused on this as an evil thing, you know, not that we shouldn't do it. And, they tend to be a class of the environmentalist that are anti-technology, that, you know, they are kind of conservative actually. And I think there is a new division among people who want to solve the climate problem between people that are certainly proactionary and reactionary. (...) Geoengineering divides, it is a case in point that divides people. That probably is its major relevance right now, as it really highlights that difference between environmentalist people that are conservative and more reactionary and more proactionary, pro-technology environmentalists.

Joana: I was actually reading, some days ago, a research paper that was published by the National Academy of Science, and they quote you saying that if there has to be any governance framework at all, it has to be about geoengineering research and not deployment because we are really far from it.

Dr. Long: Yes, I think that's true, I think that the focus on international governance is premature. I think that a lot of people in your field, in Political Science, you know sort that out on it, you know, have tried to posit all kinds of realities. And sitting here in California with a reality that didn't exist two days ago, confined, which I was not two days ago, I think it is really premature. But, you know, we should be serious about looking at it, I think that research governance is vastly overlooked. Because the fact that science has evolved in the last few decades has not been conducive to societal decision-

making and I think the scientific enterprise needs to have some guidelines and guide posts and skills. So, if we ever get to the place where there is anything real in that, people can understand it and can have an accurate evaluation, an accurate assessment of what they are being presented with. I don't think that is not a widely held opinion, I don't find a lot of people interested in that.

Joana: I know. Then, when conducting my research, I kind of concluded, draw kind of a relationship. I concluded that the evolution of the environment (becoming much more multidisciplinary, more, therefore, complex) is triggering technological changes and evolution, such as geoengineering techniques. Then, how would you say this affects environmental politics?

Dr. Long: Well, I think, there is a group called CAN, what is it stand for? It stands for, it is a network of environmental activists.

Joana: Climate Action Network, yes.

Dr. Long: Network, yeah. And there is a lot of (...) there about the issue we were just talking about, you know, whether geoengineering should be banned, any thought about it, any discussion should be banned or, whether it is part of a more pragmatic approach to climate driven by necessity. So, there are several ideological vs. pragmatic division in that organization, and there are some reactive members who are very very ideological about it, and so I think that to the extent that CAN provides a political force in negotiations, or in regulation and or in agreements or wherever that conflict is probably significant. I don't know any other venue where it comes up. It is just to say I am not very involved in political science of all this stuff, the politics of it. You know I am not a social scientist, I am a scientist. I think I do understand a lot of it, and I think it is very... there have been venues where this thing has come up and they tend to be the same people that are... You know, there was the biodiversity, the treaty on biodiversity, for example, is the place where this all, this whole got fatt out. And, you know the result I think it was actually pretty reasonable, you know, it's very hard for all the people who are promoting research in geoengineering to hear that it was going to damage ecosystems when the whole purpose of it was to try to safe the ecosystems. And this sort of highlights the difference. Personally, I have to say so, you know, full disclosure, I feel like that the people that are reactionary about this and ideological about this are just as damaging to the cause of solving the climate problem as people that are deniers. Because most of my time is actually spent on trying to figure out what to do about the energy system so that it doesn't emit and, you know, there is the same group, the same ideological group, will try to sell us on, you know, we are going to solve the whole thing on renewable energy and, you know, they don't do the math, you can't do it that way, and I feel like, you know, they are not pragmatic on that either. So, for full disclosure, I stand for, you know, pragmatic solutions that will get us there quickly, and so I see that same battle coming out on energy. I mean it is exactly the same battle because they don't want to do geoengineering, they want to do more solar and wind.

Joana: In fact, your answer is quite linked to my first hypothesis on how, like, in the end geoengineering affects global environmental politics. 'Cause, like, what I have seen is that there is a proliferation of state, non-state, public, private actors in this realm. Like, suddenly, there has been an emergence of a lot of actors that are playing key roles, such as you said CAN Europe, CAN International or CAN whatever, but I mean it is a very powerful actor right now. And my following question is to what extent this proliferation of actors has led to new ways of interaction between stakeholders in the discipline. Like, if there have been new patterns of interaction due to geoengineering or if not.

Dr. Long: You know, I really don't know. Another person you should talk about it is Jane Flegl, because she did her PHD on something very similar to you. Do you want to me come across with her for you?

Joana: Yes, yes please. Jane?

Dr. Long: Flegl. F-L-E-G-L. I will connect you to her. She has looked at that more than I have. You know, I just... it is hard to say this, it is hard to say anything of this very much because again my focus has been on research, and since there is so little research, and it is privately funded mostly, there hasn't... you know, the main interaction or point of discussion friction has been, there are two that I know. One is the SCOPEX Project at Harvard, where they had private money to run a physical experiment and there was a lot of discussion about the fact that, since it was privately funded, how would they vet that they were doing the right thing. And, so, with a lot of discussion in the community, mainly the research community, but not just physical research but social science they ended up appointing an Advisory, an exquisite Independent Advisory Board just, as disclosure, I was involved in that, pushing them to do that. And the second one would be this cloud brightening group. This is a more interesting one in the sense that [an expert] is the person that runs that and I don't to know to call her 'organization as it is soft created but she calls it 'soverlining'. So she has been pushing in the US government to get a research program going on cloud brightening and (...) calling geoengineering programs 'soverligning', for example, is a highly inappropriate thing to do, it gives a completely wrong impression.

So, those are the two areas of kind of conflict. One I think was resolved well and the other, you know Cali comes from a technical innovation Silicon Valley background, you know it is kind of a no-holes barred approach that has really offended, really concerned a lot of people. Other than that I can't think of... Those are the ones that I would know about in terms of... Another person you could talk to would be Alex Hanafi (...) and he is very involved in the CAN, in the politics, in all those COP meetings and everything and he is very involved in geoengineering.

Joana: Is it Alex Alfi, you said?

Dr. Long: Alex Hanafi. H-A-N-A-F-I. And he knows quite a bit more. His email is [aahanafi@edf.org](mailto:aahanafi@edf.org). And Jane Fliegl is [flieglj@gmail.com](mailto:flieglj@gmail.com). This is her private email, she has just taken the job with (...) Foundation. Her PhD was similar to yours and I think she would good contacts for you.

Joana: And like... Sorry

Dr. Long: Yeah, I think Alex is in the arena you are interested in, at least much more than I am and who else did I recommend you?

Joana: You said Jane Fliegl and Alex Hanafi.

Dr. Long: Okay, yeah. There are other people I can recommend to you.

Joana: Thank you. Then, from your kind of more technical scientific perspective, I as well have been several critiques to the political and legal systems claiming that they are not designed to evolve within the context, like in this case of geoengineering, they are not kind of adapting to these kind of new realities. To what extent will or would these technological advancements and geoengineering in general lead to a dynamization of politics? And how?

Dr. Long: Denomination of politics?

Joana: Dynamization.

Dr. Long: We are going through here in the United States, you know, we have basically idiots running the country. Just to give you an example, after Trump was elected a lot of people that I know who wanted to get research funds were kind of coming to the conclusion that they didn't want to take any federal funds while he was president because they didn't want to have any results associated with his presidency. So, yes I think this is kind of the tail wagging the dog because there are way more serious problems associated with the government, you know, government dynamization right now, than geoengineering. But it probably affects geoengineering more than it affects dynamization, I guess I would put it that way. People not wanting to be part of the (...) supporting this dynamization in any way. But, I think may be one thing I have thought about and I think is important is that it is hard to believe we are going to solve this climate problem with a kind of emergent behaviour. Although (...) collabs is a great way to stop emitting carbon dioxide. But, you know, we need to have more strategic approaches and large-scale strategic approaches that make some sense, and I think that geoengineering does force you to think that way because it is fundamentally, you know, some kind of global action that you take to strategically make things better for people and ecosystems. So, in that sense I think it has a very positive effect in making people think strategically and think in terms of their efficiency.

I just published a book chapter also.

Joana: Contemporary Climate Change Debates.

Dr. Long: Yes. So, there is a chapter in here where Rose Cairns and I debate on some of the things we were talking about right now. It is chapter 8 'Is it necessary to research solar climate engineering as a possible backstop technology?', and she said no and I said yes. The whole book is set up in debates, it is kind of a fun book.

Joana: Okay.

Dr. Long: So if you want to...Did you get it all done?

Joana: Yes, Contemporary Climate Change Debates, chapter 8.

Dr. Long: Yes, okay. So, a lot of things we were talking about are just recently published in that. So you can have that as a reference.

Joana: Interesting.

Dr. Long: There are other things in there too about geoengineering, I don't think that is the only article in geoengineering in there. So what were the other questions?

Joana: Yes. My third and final hypothesis is related to global environmental governance. Some authors have studied potential scenarios of governance for geoengineering. To what extent these proposals on geoengineering governance are shaping current environmental institutions and governance frameworks? And how?

Dr. Long: I don't think they are. I just don't think it has got legs. I don't know. Probably talk to people that are more engaged in this than I am. You know David Keith who started the whole thing in Harvard. He would give you a very very different perspective, probably. I have talked to this person, I have talked to that person and he (...), he will probably give you one end of the spectrum, point of view about that, you know, it has had a big effect. One of the guys that really would have been good for you to talk about that things just passed away a few months ago, from Oxford. So I think Jane Fliegl is actually a really good person to talk to about that also, and Alex. They would give you a more measured thing. So if you talk to.... if you want to have a spectrum of points of view. You know I think there is also a AAAS study going on that includes the governance component, so, I don't know what they are doing, I don't know what are their focuses, but may have something going on. I don't think there is much...

Joana: No but I mean it is a very open answer. I expected, actually, for you to say no. I have seen a lot of people really optimistic and people that are kind of down-to-earth saying 'geoengineering is just starting'.

Dr. Long: Well I think, you know, there is a conference next month in Colorado on this topic. You know, what is the strategic use of geoengineering, what are the strategic approaches in climate. And you know, I think there is some evidence, are some people who said “you hit these boundaries, you just can’t, the ideas don’t work, you hit unrealistic requirements, and it is going to be nearly impossible to make anything really work”. So, you know, I have no idea how would play out, but it is not going to play out without research. You know they are going to have to have some research, you know, starting budgets, you know, of 1.000 millions dollars a year. Going up from there, I think, getting that, and we should be doing that right now, I think we would have some answers for some things. You know, there is an awful artwork to be done, that would not require extensive testing. I think people that have looked into the tests thinks that the only way to research geoengineering is to do it. And that is definitely not true. So, there is a lot to be done and I think if you can kind of enforce principles based on climate models show that there is hope or there is not. I think that would be extremely useful to do right now. Because I think there is not much doubt that we are going... Two weeks ago I would have said that.

*(The recording cut)*

## **Interview with Dr. Alex Hanafi**

*(Presentation of myself)*

Joana: I was saying that I got motivated through a local woman that was theorizing about climate engineering in Puerto Rico and I said ‘okay, I want to know more about that’. So, yes basically a brief introduction.

Now, as I told you in the emails, the aim of my research is to find out how geoengineering affects and is affecting global environmental politics. Part of my research consists on speaking to international experts like you in the field in order to get in-field knowledge and expertise. In fact, Dr. Jane Long said ‘you really have to speak to him because he really knows about it’

Dr. Hanafi: Okay, Dr. Jane is great. I worked with her on some of these issues. She has a long history in the climate world. It is very kind of her to suggest me.

Joana: Yes

Dr. Hanafi: Tell me you said you first heard about this through a women’s group talking about climate engineering. That is so interesting. What an interesting and knowledgeable women’s group. How did this come about?

Joana: Actually, I went abroad last year to Canada for international exchange and I went in a trip to Puerto Rico and there I met this local woman and she was talking about how PR was used by the US and somehow she talked about climate engineering as part of a US strategy to influence Puerto Rico

Dr. Hanafi: Interesting. I have not heard about that. But I mean there is a long and interesting history between the US and Puerto Rico, there is a long history of colonial issues and exploitation by the US. So it would not surprise me that those kinds of perspectives are there because there is such a bad history between the US story and Puerto Rico and other states.

Joana: I know, I actually had not heard at that moment and then I started looking for it and then I read that the US started a campaign a climate engineering campaign against Vietnam during the Vietnam War.

Dr. Hanafi: I think they were attempts to change the weather. Some of these lay around the discussion around wording. You will see this in the climate engineering debates. There are debates around whether these even use the word ‘geoengineering’ because... does it apply? What kinds of technologies this is applied to? The same thing applies to the question of climate versus weather. What is weather versus what is climate? Weather is kind of more localized effects whereas climate is more global or general over long periods of time whereas weather is more of a local short periods of time. So, there are



different debates on whether weather modification is considered climate engineering or not. It is not critical right now for this discussion, but there is long history of trying to categorize what it is exactly what we are talking about. We are talking about climate engineering and there is not general agreement on what are we talking about. (...) It is very political, and now with the US backing out of the Paris Agreement once again being a laggard of climate policy means that all of these issues are going to become even more pronounced. This questioning on what is the US doing on these issues, it is very tricky. And for those who are interested in climate engineering technologies, they have to be able to deal with this question of US involvement and what does this mean.

Joana: In fact I was reading this paper that said something that the fact that the US had withdrawn from the Paris Agreement is kind of a crash of the climate governance framework because if made such an impact to the political realm that we really have to take into consideration.

Dr. Hanafi: Yes, we can talk about that. I can give you some perspectives from my experience on that because I work very closely on climate governance issues and with my EDS work at the international climate negotiations. So I have been working with a number of countries on international climate negotiations for some time and I share with you some perspectives on that. But before we get into that, it would be interesting to hear what your research is about, what kinds of questioning...

Joana: Exactly, let's go to the point. Okay, so first of all, I need to check out some things before we get started. I know that when we spoke you agreed to take part in the interview but I want to check that it is still okay for you.

Dr. Hanafi: Can I ask you a question? How will you use the information in the interview? I just want to know whether the information is confidential or not? How will you use the information. Those kinds of things will help me understand.

Joana: Exactly. I wanted to talk about these things now. First of all, if it is find to audio-record that in order to put in my FDP, I would need your consent.

Dr. Hanafi: Yes. It would be helpful to know what is this audio used for. Will it be a public document? Will it be available...?

Joana: No, it is just for my university. It is not going to be published. (...) It is like a course that I have to conduct, there are more university credits, but it is not going to be published.

Dr. Hanafi: Okay. And with your research subjects, are you going to do calling by their name on your paper or will they be anonymized a bit or AA North American Environmental NGO or something like that, or how you will specifically refer to me or my organization?

Joana: No, what I am doing right now is I'm conducting some interviews with different experts. For instance, Jane Long. And I am transcribing the interviews and analysing the different topics that we talk about and then if I can use some of them and some of your arguments to refute and validate my hypothesis then, if I can, I will quote, and if not, I am just going to put anonymous or I am just going to see how I'll do it.

Dr. Hanafi: (Continues to talk about confidentiality)

Joana: Okay, now, going to the topic of the interview. The reason of this interview is to get your personal insights on how geoengineering affects global environmental politics. I am going to develop my hypothesis during the interview, but just to let you know a brief introduction. It is important to let you know that my research is not about listing the impacts of geoengineering, nor to study the suitability of geoengineering in today's world. It is rather focused on studying how the different challenges that geoengineering poses are redesigning and shaping the global environmental politics scenario. I know it is a little bit tricky, but I know a lot of research has been focused on 'what are the impacts of geoengineering' and no, this is not my focus. My aim is to know how climate governance and environmental politics are changing due to different trends such as geoengineering. As an introductory question: what would you say is the relevance of geoengineering in the political realm?

Dr. Hanafi: (*Repeats the question*) Well, I think the relevance is about, it relates to the urgency of the climate challenge. That's the reason that people is talking about this issue. It is because people is increasing realizing that we are in a climate emergency and the tools that we have been trying to use to address this emergency are not working. We haven't done what we need to do. We know exactly what we need to do: we need to cut emissions, we need to cut those emissions extremely rapidly, and we need to do it now, we can't wait. But because we have waited, because the globe has not been able to address the urgent need to cut emissions, people are now bringing up these other ideas. And that's where climate engineering fits in. It is something that have come up because we haven't done what we needed to do already. It plugs in to all those existing global discussions around climate actions, and how we meet the goals that were set out for ourselves to try to avoid the worst effects, the worst impacts of climate change. That's one way. The other way on top of it is, the technological discussion. There's technological approaches that some have brought up as needed or helpful to address climate change. One of these is obviously renewable energy and different new technologies that we can use to solve climate change. Some technologies may be more useful than others, and that is the big debate on whether we should even research climate engineering technologies. Is it useful to even research these things to determine if they are feasible. Because as of now, the science and the research we just don't know enough, to even understand what they would do and how they would work, and if they would work. We just don't know. So, there is a great deal of uncertainty about these climate engineering technologies, whether it is the Solar Radiation Management technologies, blocking some light from

the Earth or bouncing it back to reduce warming or whether it is some of these Carbon Dioxide Removal technologies, these technologies that suck Carbon Dioxide out of the air to try to address the rising levels of greenhouse gases in the atmosphere. There is a lot we don't know about these technologies either.

Joana: You know, in fact, even though we know so little about it, there has been such a huge impact on environmental politics and I don't really understand why.

Dr. Hanafi: Yes. Well, I think that's a tricky question. What do you see as the impacts of the geoengineering discussion on global geopolitics. What is your research?

Joana: I have three hypothesis and I am going to go with them afterwards but in general terms, but I would say there has been a redesigning of environmental politics in the sense that there have been some critiques and some demands for the dynamization of the political system and as well a reconfiguration of the environmental governance and legal system cause like we have noticed that with the emergence of geoengineering that we lack of certain mechanisms that enable us to adapt to the new context. Right?

Dr. Hanafi: Yes, one of the discoveries of global geopolitics and global governance is that we don't have a comprehensive system ready to govern these technologies. There isn't a global governance framework that is well seated right now to govern and manage these emerging technologies or even to govern or manage the research into these emerging technologies. That's what SRMGI was initially set up to try to help with. SRMGI is the Solar Radiation Management Governance Initiative. And it was intended to help spark conversations particularly in developing countries about research into these technologies and try to have conversations about whether and how this research might be governed transparently, responsibly in a way that reflected the will of people, whether it should go ahead or not, that would be up to the people. This is something that SRMGI is continuing to do, by engaging stakeholder communities and developing countries (developing countries are the ones who are most likely to be affected by these technologies as well as by climate change itself, they have the most to gain or lose if these technologies were ever be developed and were deployed). They are a critical piece in these global geopolitics and this global governance and they have not been involved in the initial discussions around research of these technologies because much of the research community is in the West. That's a disconnect that it would be useful to rectify. There is need to be a better global *connectiveness* on these questions of research. And I don't just mean at the international/global level, I mean at the practical/bottom-up level as well. Researchers and not just hard science physical researchers, but social science researchers, global governance experts, politics experts, they need to talk to each other at the local level as well within different countries, getting those experts together to talk about these issues could be helpful in building the capacity of countries to actually talk about a global governance framework. The perspective that I break this that if it is just attempted to be done at the UN, without building the expertise and capacity within those countries about how to discuss those issues, I think you are going to get an outcome of governance

framework that does not fit for the purpose, it will not address the key issues because people do not understand the key issues if they have not had the chance to examine it. So, building that capacity domestically in countries, I think it is very important so we can have a better global geopolitics about it, we can have that conversation at the global level. Building that capacity internally countries is going to be important. That's the first thing, I think this is affecting global geopolitics in the sense that there is a realization that we don't have the governance frameworks well-set to manage these technologies. There are some decentralized centre-specific or geography-specific tools (we looked at some of these in the SRMGI governance paper, I don't know if you have seen this but there was a report that SRMGI put out I think it was in 2011 about governance of geoengineering technologies, if you don't have it I can send it to you).

Joana: Okay

Dr.Hanafi: But it looked at the governance frameworks, global governance frameworks, that might exist to manage the research of these technologies. And it based its conclusion that while there are some regional frameworks (so for example the Arctic, there are some international treaties governing the management of the Arctic, there are some treaties governing space, there are some treaties governing particular regions, there are treaties about the oceans, and what you might do with the oceans around climate engineering, there are some treaties about the air, and how you might, you know, do research in the air about geoengineering) but there is nothing that unites them all, there is nothing about geoengineering and all of its forms that would be comprehensively governed. There is nothing that fits that right now. So that was one of the key findings of this report. So I think that's the first thing, there is a recognition that global politics is not currently set up in a way that manages this.

Joana: Actually, your response is really connected to my second question because when conducting my research I kind of draw this relationship. I concluded that the evolution of the environment, becoming much more multidisciplinary and, therefore, more complex, is triggering technological changes and their evolution (such as we have seen with geoengineering). Now, how would you say this affects environmental politics? In the sense that there is a threefold relationship between environmental change, technological change and politics. The, how would you say that this complexity and multidisciplinary of the environment, which has triggered technological change, is as well affecting environmental politics.

Dr. Hanafi: I see that the problem of environmental politics vary in each country probably. Countries have different cultures around technology and how they view technology. How technology affects the US in environmental discussion may be quite different to how it affects in Spain or in Ghana, in Bhutan, you know, it kinds of varies. I can tell you from my experience at the international level, I have spent much of my time at the UN Framework Convention on Climate Change, the international climate negotiations, and there is a technology mechanism that has been set up under that framework to help

transfer technologies and build capacity to use technologies for climate action. It is not fully robust yet, in terms of the amount of technology that is being transferred (and this is not climate engineering technology, the impact is not climate engineering technology, it is really intended to be technology that help reduce emissions). How do you transfer low-emissions technologies? How do you transfer renewable technologies? Other things that countries need to reduce emissions. That is supposed to be kind of the key part of this. How do you transfer technologies help countries adapt to the impacts of climate change. Those kinds of things. So there is a recognition that we are going to need, countries are going to need technology to address the climate crisis, but what technology is appropriate is an open question. The technology that is appropriate to one country may not be necessarily appropriate to another country. The contexts are different, and it varies across countries. But I can tell you from my experience at the UN, there is not much of a desire or capacity to really discuss climate engineering technology. There is not much of an interest to put this on the agenda for the UN negotiations. And you can ask ‘why is that’?

Joana: Yes, why?

Dr. Hanafi: I think the answer is that, one part states that they have way other stuff to do that is far more pressing in its urgency. It is a very complex system they set up at the UN: you have 190+ countries that have to come together and make decisions by consensus. Imagine how hard that is. Trying 190+ countries to agree on anything, it is hard. And when you are trying them to agree on climate issues, that are so wrapped up in economics and in local politics and in jobs and in all these other issues that are so important to countries. Trying them to agree on what they can do about climate is really tough and they have a very packed agenda already: either very difficult issues they deal with, there is a lot of contention at the UN negotiations between developed and developing countries on issues on finance, on issues on who should take more action, when. It is a very difficult set of negotiations. And so the idea of putting in another agenda item on the list of things to do, on the issue of climate engineering, which is still controversial, so difficult, whether to discuss different opinions on this staff that would really, I think the feeling is that, that would really throw a bench in the negotiations and really make things much more difficult to agree on other issues as well. And so, that is part of the reason why there hasn’t been much of an appetite of countries to try to bring us in to the UN negotiations. Part of it is that countries have other things to do, that are much more urgent, and the second part is that there is a sense that countries may be still don’t have, we don’t have all of the knowledge we need yet to have a full discussion, a full kind of understanding of the issues that we can elaborate in the international negotiation. There was an attempt to have a discussion about climate engineering, and to study it a little bit more at the UN Environment Assembly. There was a proposal by Switzerland. Switzerland proposed to have a discussion at the UN Environment Assembly and convene a group to study the issue of climate engineering and produce a report, I think the report was about looking at what governance frameworks might be available for this, what are the challenges that are putting these climate engineering technologies, that was the intention of the report.

But that proposal by Switzerland, which was supported by few other countries, did not get passed in the UN Environment Assembly, it was not adopted. I am not sure Switzerland is going to go forward with that proposal again in the next assembly but it is possible that this kind of proposal could come up again. So there are efforts to talk about this topic of climate engineering governance in various places but it wasn't passed in the UN Environment Assembly. There is a provision in the Convention on Biological Diversity on this issue, which invites countries to not perform geoengineering experiments (...) a very limited circumstances, there are few exceptions, but that was one of the first frameworks that was set up to talk about how research might go forward globally but, again, the CBD is a very specific agreement, it is focused on biodiversity, so the limitation in that framework was only about biodiversity, it's geoengineering experiments that might affect biodiversity, so it doesn't cover some types of geoengineering experiments. So that goes back to my point about how there is no unified kind of governance framework for this. The London Convention in the Oceans also has some provisions but again they are about the oceans, so they don't cover what is happening necessarily in the air.

So, some have said at the UN FCCC is the place to cover this. It is comprehensive, the climate is all over the world, so that's where you want to do this, but because some of the reasons I think I mentioned, there has not been an appetite to address this there at this point.

Joana: Okay. So many ideas, really interesting all. Okay, moving on to the third question and going straight to my first hypothesis. It is true that due to geoengineering techniques, there is a proliferation of actors, being state, non-state, public and private, and so many others. So, to what extent this has led to new ways of interaction between stakeholders of the discipline, becoming a discipline which is more multilevel and multilateral)? Are there new patterns of interaction at all?

Dr. Hanafi: Do you see there is a substantially different amount of this new interaction on geoengineering as opposed to other areas?

Joana: What I saw is, in the end, the climate crisis, and in general, the environmental discipline has been always focused on environmental-related actors (environmental NGOs, environmental IGOs). But now, with some geoengineering cases, I have seen actors from philanthropists to financial actors to even companies and other countries that are all involved in geoengineering. And I wanted to know if it is a particular case study or it is in fact geoengineering leading to a more multilateral and multilevel kind of discipline.

Dr. Hanafi: Interesting. What, you mentioned financial centres participant companies interested in this topic of geoengineering. Who have you seen in that?

Joana: *(Talks about the case study)*

Dr. Hanafi: My sense is that the proliferation of actors on climate engineering is not that much different than the proliferation of actors on climate issues in general. I think you have got a wide range of actors working on climate issues now. It is not only environmental NGOs, you have got labor organizations who are working on climate issues, there has actually been a lot of effort to try to bring together the labor movement, workers' rights movements, with the environmental movement because they can work together. Climate issues are not just an environmental issue. This is about social justice, about just transition for workers, so they can continue to have a stable job and a new economy that is low-carbon. Addressing that challenge so that no-one is left behind in the transition to a clean energy economy is really important. So, labor is involved, the environmental NGOs are involved, think tanks and academic institutions participate in these international negotiations as well. I am not the only environmental NGO there right? There are so many environmental NGOs, there are many academic institutions represented there, labor movements are represented, trade unions are represented there, the youth movement is there, representatives of youth, the business community is represented there, companies are there, philanthropy, foundations who are funding a lot of this work of environmental NGOs, of think tanks and academics and others. So at the climate space generally there is all sorts of actors who are participating in this. And this has been the growing trend in international governance too. You have brought in more non-governmental actors to help these international negotiations function more effectively. You saw this in the Paris Agreement, I think that was one of the ones that I studied when I was at your position back in school, the Convention on International Trade and Endangered Species. This is an international agreement of governments, but there is a functioning mechanism within that, called Traffic, that is actually largely run and managed by NGOs who monitor the trade in endangered species and interact with the international agreement. So, you are bringing in non-governmental actors to help a governmental agreement function more effectively.

Joana: Okay

Dr. Hanafi: When I was studying these, there was a growing trend to include some of these non-governmental actors in these processes. And we have seen this in the climate talks now. The international climate negotiations, you see, a decreasing willingness and desire to bring in non-state actors into the space because there is a lot they can do to help the climate. Climate change is not going to be solved just by governments making decisions in Madrid, or in Poland, or in London, or Glasgow, or wherever they go. It is going to be solved by sub-national actors, by states, by cities and municipalities, by communities and citizens making different choices about how they go about their lives. So, there is a platform at the UN, other than the UNFCCC, that brings in non-state actors, subnational actors, provinces and states and cities (and when I say states I mean sub-national states, you know, California and others). I think the recognition of these non-governmental, non-national participants is really important.

Joana: How is it called this platform?

Dr. Hanafi: (...) It started as the NASCA back in Peru, the Non-State Actor Zone for Climate Action, it is called the NASCA Platform, and it changed to be called the Climate Action Agenda I think it was. (...) Yes, it is called the Global Climate Action Agenda. If you check that out, look that up at the Global Climate Action Agenda, that will give you some information on the platform.

Joana: Okay. (*Talks again about the case study*) Now, moving to the fourth question. I as well have seen several critiques as I mentioned before of the political and legal systems claiming that they are not designed to evolve within the context, that they are not updated. So here my question is to what extent will these technological advancements, and geoengineering in general, lead to a dynamization of politics?

Dr. Hanafi: Yes, that is a big one. I am not sure I can give much of a perspective that might be useful to you on this but, I think there is always a push and pull between technology and politics and governance. I mean, technology develops much faster than governance does. Governance seems generally reactive, so it takes time for the governance systems and the politics to catch up where the technology is going. In the US right now we see this very strongly with the social media technology, and privacy and data information. It took a while for the EU to catch up on data privacy and to some extent they certainly have and more than the US has. The US has not fully grappled with the implications of big data and how these companies, these technology companies, gather this data and how they use it. We are slow, we are a slow response. And I think it is similar in many other technological fields and geoengineering would be the same. Whether the political system can evolve, I think it takes time. I think the question is 'Can it evolve fast enough?'. I don't know. We have not seen a lot of action on climate engineering really. I mean there aren't a lot of experiments going on, there have been a few but they are quite a few and far between. There is not a lot of funding that I have seen going towards these climate engineering technologies. Why is that, right? Is the technology developing so rapidly? How is that happening? There is not a lot of research, there is not a lot of funding on this. I feel that this is a topic that governance needs to address and in some way I think that. (...) My sense has been that some of the research is not happening because there is not strong governance. The research is being held up because of the lack of the evolution of the political system, right? I think you see this, for example, in the Harvard proposed experiment, which is called SCOPEX, S-C-O-P-E-X, you should check that out. It is a proposed experiment that would put a balloon up in the atmosphere to release a very small amount of I think they are going to be using calcium carbonate as well as a few other compounds and trying to understand how those interact with chemicals in the atmosphere. What happens when you release a small amount of particles. So, the environmental effect in this experiment is very very small, it will have no disturbance impact on the climate at all. It is basically a conceptual experiment. They have not gone ahead with this experiment because they are still setting up the internal governance decision-making about whether the experiment should go forward at all based on social, ethical, other kinds of issues. So, they have been waiting for this governance framework



at the local level to be determined. So they are having a Board putting another Advisory Committee, the Advisory Committee will start to look at the issue around conducting this experiment ethical governance, you know, getting stakeholder input, etcetera about whether to go forward. Is this experiment going to go forward? They have to go forward alongside experiments in governance. The governance needs to evolve alongside these technological developments for the exact reasons that you said. I think that this is absolutely the right way to go. If these are moving forward, experiments and governance should also be moving forward too. You see this healthy relationship between the slowdown of the technological developments with (...) some of these governance developments. That would be my hope. (...)

Joana: Right. Then, my third hypothesis is related to global environmental governance. Some authors have already studied potential scenarios of governance for geoengineering. Actually there are some authors that have said that have hypothesized around the idea of UN-based governance frameworks, others have said: no, we have to use the ones that we have one. So, my question is to what extent these proposals on geoengineering governance are shaping current environmental institutions and governance frameworks? And how?

Dr. Hanafi: I personally don't see a lot of changes right now in the UN climate system. In the UN climate negotiations, I don't see climate engineering having a shaping role in that institution right now for some of the reasons that we discussed, that they have got too many other important things to do, and it would really complicate their negotiations quite a bit. So, that said, like I mentioned there other global environmental governance institutions that have been shaped by these geoengineering debates. So, you do have elements of the Convention on Biological Diversity, that have addressed research into climate engineering technologies that could affect biodiversity and have put in place this framework for determining whether those experiments go forward or not; the London Convention as I mentioned also the geoengineering debate and some of these actions of some of the experimenters like Raas George in British Columbia have influenced the London Convention and have put in place some restrictions on ocean fertilization experiments. So, it is affecting some of these environmental governance regimes but not all of them. I think it is again context-specific and, in some ways, sector-specific and probably depends on whether there is an event or action that has triggered attention, right? So the ocean fertilization case seems like those experiments triggered a reaction and there has not been anything like that I have seen triggering a reaction in the UN climate convention, for example. There have not really been these climate experiments in the air that have triggered any kind of reaction at the UN level. It really has not been discussed in the mainstream elements of the negotiation at the UN climate convention.

Joana: Is it (...) kind of a failure, not a failure, but kind of a drawback that the political system is ad hoc, a posteriori or kind of reactive framework. If we have a case that draws attention and triggers reaction, then we are going to construct or build a governance framework, if not, we are not going to do it.

Dr. Hanafi: Yes, it is interesting. I mean, that is probably true in some cases, but may ain't in all cases. You know, I don't really know what triggered the Convention on Biological Diversity to put in place its restrictions, its proposed restrictions, its voluntary restrictions on climate engineering experiments that could affect biodiversity. There wasn't something specific, I don't recall a specific experiment that could have affected biodiversity that went forward, that triggered them to address this. So, it would be interesting to kind of look at that a little bit more. Why is that the Convention on Biological Diversity, what triggered them to bring this up? I don't know, have you talked to the ETC Group at all?

Joana: No, ETC Group?

Dr. Hanafi: Yes, they are a group based in Montreal that works on a number of issues and has published quite widely on the issue of climate engineering.

Joana: Okay

Dr. Hanafi: They are quite active in the Convention on Biological Diversity and so, they might be interesting to talk to, you know, to see why the Convention on Biological Diversity actually took up the issue of geoengineering. You know, what triggered that? They were quite active in those negotiations. It is possible they were even the ones who brought this into the Convention system, because, you know, NGOs do influence some of these discussions. So, the Swiss proposal to the UN Environmental Assembly, the one I mentioned earlier? The proposal for climate engineering?

Joana: Yes

Dr. Hanafi: The Swiss had put forward that proposal, and it was a proposal that was very similar to a proposal that an NGO called C2G2, the Centre for Climate Geoengineering Governance, I think it was called, they once were called C2G2, headed by a former UN official, by the name of Yanos Pastor, he had been advocating for a similar kind of proposal, and the Swiss then took this and put it at the UN. It was not exactly the same but it would be interesting to see, you know, my sense is that there was an influence there. Because the C2G2 had been strongly advocating for some kind of international platform to address the issue of climate engineering and the Swiss were also introducing this. That became a nice combination of forces that brought it to the UN Environmental Assembly. So, you know, there are some proactive cases, I think in some case, and others it's reactive.

Joana: Okay

Dr. Hanafi: Those might be interesting to study, look at the UN Environmental Assembly process. How that gets started? Who is behind this? Why they started that way? And then

the CBD initiative way to govern climate engineering experiments that are related to biodiversity. That would also be a shame to see how that got started. I think the London Convention one seems to be, for what I understand, more reactive to the experiments that were going on in the oceans.

Joana: Okay, perfect thank you.

Dr. Hanafi: One other thing...

Joana: Yes, yes sorry.

Dr. Hanafi: One other thing. If you haven't come across on some of the research on this you may want to look it up too, because I found it helpful to read. There are some papers about governance asking 'what is the purpose of the governance?'

Joana: Yes, yes please, please. Tell me.

Dr. Hanafi: What you are trying to achieve as a governance may help you determine where is the place to do it and how you would do it. So, there is a guy named Daniel Bodansky, he is an academic at the Arizona State University. He used to be with the US State Department. He wrote a paper in geoengineering governance that, you know very briefly, kinds of lays out what the purpose, you know, what the potential purposes of governance are, and how might that influence your choice of where you go for governance. For instance, you might want governance to prevent something from happening, rights? It is kind of a restrictive force. You might also want governance to help you understand an issue enough so that you can actually decide what to do later on. So, you know one of the frameworks he proposes, you want a governance framework to help you understand how much research you might want to do into something, and may be facilitates some of that research so you can come to a much informed decision, that might be a purpose for governance.

So he proposed these different kind of proposals for governance and then thought what that might mean for what kind of governance systems you need. So, that might be something to look up. He is written a few thing about geoengineering governance but, you know, there is a wide range on this and there are many others who have written about this topic.

Joana: Would you tell me about the title of the paper?

Dr. Hanafi: Let me see if I can find it here.

Joana: Or if not I am just going to type 'Daniel Bedensky' and then, may be I can find out.

Dr. Hanafi: He has written quite a bit of stuff on the (...) experiment, but just a few thing about geoengineering. Let me see if I can find it here.(...) It is called the “who, what, and wherefore of geoengineering”

Joana: The who, where, what and for. Okay.

Dr. Hanafi: Yes, the who, what and wherefore of geoengineering governance.

Joana: Perfect, thank you.

Dr. Hanafi: So I could send this right now, I have got it here right in front of me, so let me send this to you.

Joana. Okay, thank you. That would be great.

Dr. Hanafi: Yes, okay. Alright I will send this to you, and I also found a slight for the, I mentioned the paper that the SRMGI published back in 2011 about the governance on research, and that paper may be interesting to you as well. It looks at some of the existing governance systems and the kind of pros and cons of those systems and for governing geoengineering research. So that might give you a sense of what the current framework looks like.

Joana: Perfect thank you.

Dr. Hanafi And I don't have right now in front of me the UN Environmental Assembly proposal of Switzerland but if you can't find it, let me know.

Joana: Okay

Dr. Hanafi: I can help you trying to find it.

Joana: Okay, thank you very much.

*(We talk about case studies related to local technological initiatives in urban areas or global cities to tackle the climate crisis)*

Joana: Okay, Alex it was everything, all my questions were just laid down. Thank you very much for participating, it was really really fruitful.

Dr. Hanafi: That's great, you know some of the question were, you knew much more than I knew, so I don't know if I was very helpful but hopefully there were some bits that were useful for your research.

Joana: Yes, a lot actually.

Dr. Hanafi: Thanks for looking into this and doing this research. It is great that more people are looking into this and trying to figure out what is needed. So, thank you for doing this.

Joana: Thank you as well. And of course, if you want, I can send you a soft copy of my research when I finish.

Dr. Hanafi: Yes please, please do include me. I would love to read your research and watch what you learned from it. Thank you very much for doing this.

Joana: Perfect, thank you very much and Alex if you have any other recommendation, question, whatever, you have my email, and my WhatsApp and everything.

Dr. Hanafi: Yes (*laughs*), same for you. If other questions come out, feel free to give me a shot and we can talk about this.

Joana: Okay thank you very much Alex, have a good day.

Dr. Hanafi: Yes, bye.

## Interview with Peter Wadhams

*(Introduction and ethical questions)*

Joana: ... and it is fine if I quote you in my research as well?

Peter Wadhams: Yes, that is fine.

Joana: Perfect, thank you very much. And now, the topic of the interview. The reason of this interview is to get your personal insights on how geoengineering affects global environmental politics. It is important to let you know that my research is not about listing the impacts of geoengineering, nor to study the suitability of geoengineering in today's world. It is rather focused on studying how the different challenges that geoengineering has posed are redesigning and shaping the global environmental politics scenario. Then, as an introductory question, what would you say is the relevance of geoengineering in today's context?

Peter Wadhams: Well, I think it is important because it is a transitional method between increasing CO<sub>2</sub> levels and fossil fuel use. And actually taking carbon dioxide out of the atmosphere to bring the CO<sub>2</sub> level down so we can actually beat climate change. We can't beat it really with geoengineering but we can (...) reduce or even eliminate the warming so long as we keep applying the geoengineering technique, but we are not doing anything with the CO<sub>2</sub> level. *(bad connection)* There are certain processes going on such as acidification of the oceans or processes which are purely geoengineering.

Joana: In fact, there are two techniques. Right? There is the CDR and the SRM. And the ones that you are taking about, like the CO<sub>2</sub> missions, are CDR. Right?

Peter Wadhams: CDR, meaning?

Joana: Carbon Dioxide Removal (CDR)

Peter Wadhams: Oh, I am not talking about that at all. I mean, my definition of geoengineering is that it is simply methods of changing the albedo of the Earth so that we reduce or eliminate global warming. Anything related to Carbon Dioxide Removal, I wouldn't call that geoengineering, that is something different.

Joana: Okay perfect. Now, when conducting my research, I concluded that the evolution of the environment (becoming much more multidisciplinary, and therefore, more complex) is triggering technological changes and evolution (such as geoengineering). Now, how would you say this affects environmental politics?

Peter Wadhams: Well, the sort of strange things going on regarding geoengineering is that the word seems to have got a bad connotations. And there is a lot of opposition to the use of geoengineering which isn't there for the use of Carbon Dioxide Removal. And

I don't know why it is there in the case of geoengineering, but an example of that is the 1.5 degree report of the IPCC, which I think it is a completely 'daft' document. It says that we can't get down to keep warming below 1.5 degrees as long as we massively rapidly stop all kinds of emissions and we get our emissions down to net 0 by 2050, which I believe it is completely impossible, well I believe, the authors of the report, now is impossible. Now, what they admit at the end is that (...) you can do a bit of CDR from the atmosphere in order to bring global warming below 1.5. So they admit to allowing CDR. In fact, the only thing would have to be nothing but CDR, but they don't say that. But they specifically say that will not be no geoengineering because we are not sure of what that would do to the climate and I think that is the most supremely idiotic thing I have ever seen. It was made by actually the chair of the IPCC in discussing this report and both the chairman and the vice-chairman both made similar remarks when that report first came out. And what they mean is we don't want to allow a particular technique that is geoengineering, which can hold back global warming because we don't know what it might do to the atmosphere, whereas of course here we are destroying the atmosphere by adding fossil fuels and that is okay. But, doing something to it that is meant to improve matters is not okay. So, I don't understand why geoengineering has such negative connotations, but it does, with the IPCC, they admit the possibility of CDR but they don't admit the possibility of geoengineering. And that is something I simply cannot understand. And I think there are other examples of climate negative views of geoengineering and they all evolve around the idea that we do something to the atmosphere, we don't quite know what it is (that's certainly true, we don't know) but we do know what we are doing now is bad. So, we could do with geoengineering probably couldn't be as bad as what we are doing now. (...)

Joana: Okay, thanks. Now, it is true that due to geoengineering techniques, there is a proliferation of state, non-state, public and private actors in this discipline. However, other experts have said that in fact there is the same patterns than the ones in the climate discipline in general. To what extent this has led to new ways of interaction between stakeholders of the discipline leading to more multilevel and multilateral coordination?

Peter Wadhams: Well, the trouble is, at the moment, I don't think there are any stakeholders in geoengineering because there isn't anything being done. I mean, 'stakeholders', you really thinking about people who have a stake in what is happening, which includes, not only business, but governments as well. If you are trying to do something with global warming, you might have to say "well, we have got to do, we will have to raise taxes, so that we can pay for some CDR or for geoengineering to be done for the good of mankind, but you are going to have to pay some taxes". The stakeholder then is, well it is all of us, but through government bodies. But since nobody is doing any geoengineering, at the moment there aren't any stakeholders. And the frustrating thing is where there is a technique that could do such amount of good, it is not funded because there isn't a stakeholder to fund it. I am thinking about doing cloud brightening, which is a technique that involves putting 'finely divided seaward' into the bottom of clouds. That is something which couldn't possibly be objectionable because it doesn't involve

anything that precedes as a poison. And, also, it is a technique that if it does something that is bad to the climate, you immediately stop pumping the water into the cloud and the effect stops instantly. So, it is a very very safe method, but, and it is being well developed the concept and even the technology, but it can't go ahead because it needs money to deploy this. And nobody is providing the money, including governments. So it is no stakeholder involved because they can't find anybody to fund it. So, the people who are doing the development work, the scientists and geoengineers can't 'to a full start' because there isn't a stakeholder.

Joana: Would you say that this lack of funding is due to political reasons? Like political interests?

Peter Wadhams: Not as such. I mean I can clearly identify political interests in climate. There is the fossil fuel interests massively powerful who want to keep us using fossil fuels until they are all usep up, and the revenue flow can continue to make a profit. So, they make it capitalism and they will use any method, including lies, deceit, propaganda, to be able to influence governments towards what they are doing. That's clear, the fossil fuel lobby is a very clear political entity. But the effort to try to save the climate or safe the world, that is political as well, in the sense that people want to say to the world "I have got a political aim which is the preservation of human rise". There isn't as such a political pro or con as far as geoengineering is concerned, because more and more the people who want to save the word are talking in terms of CDR as being the only long-term answer, because it is. All we can do with emission reduction is lower the rate which the earth warms up. Whereas with CDR we can actually bring the CO2 level to the point where climate can actually be controlled pulled back towards what it used to be. So, there is more and more efforts, I mean, the goods that want to do something about climate, which is supposedly everybody, towards CDR. So, they are not really, they view geoengineering as a useful stop-gap that would enable us to hold back the rater warming until we can get CDR going. So it is a stop-gap method which we should deploy for that reason. But it is not a kind of a holy aim, it is not the final aim. So the positive people are not perhaps as positive as they should be. And the negative people have not particular reason to be negative. In fact, to think about who is the most negative destructive evil person there is in the world that is Donald Trump. And he has actually stated enthusiasm for geoengineering because, of course, it means you can hold back global warming while you (bad connection). So it is an excuse for not doing anything about global warming. So, I don't see a political lobby for or against geoengineering. It is some kind of an irrational gap feeling. It is not a rational political view.

Joana: Then, my second hypothesis goes as follows. I as well have seen several critiques of the political and legal systems claiming that they are not designed to evolve within the context, in this case, of new technological advancements. To what extent will these technological advancements, and geoengineering in general, lead to a dynamization of politics? And how?



Peter Wadhams: I don't quite understand the question.

Joana: Let me rephrase. I have read a lot of authors saying that it is because our political and legal systems, as we don't have for instance a legal system, international treaties and conventions kind of regulating the governance geoengineering. As well the political systems are really kind of closed-minded, or kind of conventional and traditional. So, how these technological advancements would change these and would foster the dynamization and the creation of more innovative political systems.

Peter Wadhams: Oh yeah, okay. Well, that is an interesting question because some years ago I working on another international problem, which was "can we tow icebergs to replace places in need of water?" And immediately leads to the question of 'who owns the iceberg?' and 'what are you towing an iceberg picking it up in somebody's territories waters, towing it to territorial waters in another country and using it'. In fact, the plan was to tow them from (...) to the Canary Islands. And, that was never resulted. And the question really didn't arise because the concept was when an iceberg melts it is just water, so it is an international asset. But in the case of geoengineering, I think in particular there is a legitimate concern there internationally because when you put an aerosol in the stratosphere, it spreads right all over the planet. So the reflective power of the aerosol is exerted throughout the world. And there might be places in the planet where an increase amount of reflection from the stratosphere might have a harmful effect or have an effect which would change some climate processes, the ones that people are afraid of, something like affecting the monsoon (the Indian monsoon) or affecting winds or the precipitation over the Sahara. Those regions where there may be some change that actually is harmful and the fear is that there is one nation that is going to do this deployment -whoever that has got enough money- and will be firing up rockets or balloons or whatever to inject materials into the stratosphere, but the country that does it is only going to be one country while everybody else in the world is going to suffer the consequences, or enjoy the consequences, depending if they are good or bad. So the concern is that you need to have a better idea of what it is going to do to other countries before you do it. This doesn't really applies, as far as I can see to cloud brightening, because that is quite a regional and local effect and also, if it does cause any harm, you could immediately stop it. Whereas putting aerosols into the stratosphere, if it causes harm, you just have to sit it out for several months until all the aerosol comes down from the stratosphere. So, it is an experiment which you can't switch it off immediately, if you made a total mistake. So, I can see there is a rationale behind wanting to have better international control of the stratospheric aerosols as a technique, because it is something that you are affecting the whole planet and it is something you can't switch off. Whereas cloud brightening is affecting only the lower levels, and it is something you can switch off instantly. That's the question I think, cloud brightening is more like iceberg towing. It is harmless and it can immediately stopped. Whereas geoengineering of aerosols, I think there are legitimate reasons for concern.

Joana: Okay, thanks. My third hypothesis is related to global environmental governance. Some authors have already studied potential scenarios of governance for geoengineering, specifically research. To what extent these proposals on geoengineering governance will or are already shaping current environmental institutions and governance frameworks? And how?

Peter Wadhams: Well, I don't think they are. Also, I am not sure there is a governance framework. I mean it ought to be, and we need one, but we haven't got one because of the deliveredly destructive impact of the United States at the moment, which is trying to destroy any system that we might have for governance of climate change. I mean, you had, through the Paris Agreement, and the system was sort of set up there, which is still a problem to the system, so it is not a system of governance, but a voluntary system whereby all nations signed the agreement, agreeing that they would not only name the levels of emissions that they were going to achieve, but tight in the map as the result of internationally meeting and agreeing every year or two that they are going to do better because they know have to better. So those are kind of the framework in place but that was deliveredly blown up by Trump. I mean he destroyed that. Because I was in Madrid for the COP25 meeting, which was meant to be the next meeting vels of agreement from Paris would be discussed and implemented. But nothing was discussed or implemented at all because the US just went to be distractive and they got Brazil to help them be distracted. So with two distractive nations the Paris Agreement is basically destroyed and there is no governments... I mean the world is facing really catastrophe through chaos, and that chaos is deliveredly induced by Trump. I mean he is a very very evil man.

Joana: Okay, thank you. *(Then we discuss some regional initiatives set up by global cities to cooperate to fight against climate change, irrelevant for this research)*