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Interpretation of CBD COP10 decision on geoengineering

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Abstract:

The delegates at the tenth meeting of the Conference of the Parties (COP10) to the Convention on Biological Diversity (CBD) discussed geoengineering, the "deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change," in addition to main topics such as biodiversity conservation targets and access and benefit-sharing of genetic resources.

The draft decision contained a language to preclude geoengineering including its research, although it was a non-binding guidance. The agreed decision added numerous qualifiers and is complicated. It requests countries that "no climate-related geo-engineering activities that may affect biodiversity take place," in the absence of proper scientific knowledge and governance, while allowing for "small scale scientific research studies … in a controlled setting." The decision also gives a tentative definition of geoengineering.

Climate geoengineering is intended to counteract global warming by either reflecting sunlight or removing carbon dioxide from the atmosphere. Although it is not an alternative to emissions reductions, scientists are paying increasing attention to this set of techniques because the slow progress of emissions reduction might lead to a possibility of "dangerous" climate change.

At the COP10 in Nagoya, the delegates were not well informed about geoengineering, and negotiations were conducted in haste without proper scientific consideration.

The following two points are particularly important with regard to the science of geoengineering: (1) There are two categories of geoengineering: solar radiation management (SRM) and carbon dioxide removal (CDR). The science and ecological impact vastly differ between the technologies, and it is difficult to impose a uniform regulation on geoengineering; (2) Owing to large uncertainties in the science of climate change, even a very stringent emissions reduction does not eliminate the risk of "dangerous" climate change. Emissions reductions would be too slow to counter it because of the inertia of the climate system. A blanket ban, as originally conceived, would not have been a wise option if one admitted a scenario of "dangerous" climate change. Viewed in this light, the agreed decision is a reasonable outcome, though the negotiation process was precarious.

Geoengineering is likely to emerge as a crucial topic for environmental negotiations in the future. The Intergovernmental Panel on Climate Change is convening an expert meeting in June 2011. More efforts like this are necessary to better inform policymakers and citizens.

1. Introduction

The tenth meeting of the Conference of the Parties (COP10) to the Convention on Biological Diversity (CBD) was held in Nagoya, Japan, from the 18th of October until the 29th. Negotiations were intense, but the parties eventually reached a package of decisions, including the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, and the Aichi Targets on biodiversity conservation. Although there was little media coverage, the delegates also discussed climate geoengineering, a recently emerging option for counteracting climate change[1].

Geoengineering is intended to artificially counter global warming by either reflecting solar sunlight back to space, or reducing the atmospheric content of carbon dioxide (CO_2). Slow progress of conventional global warming policy has prompted scientists to seriously consider this option.

The draft decision recommended by the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) contained a language to preclude geoengineering activities including its research, although it was merely a non-binding guidance. Nevertheless, some observers voiced concerns that if adopted, such a decision would be considered as precedent in the future international negotiations. The negotiations at COP10 were intense in general, and that on geoengineering was not an exception.

The adopted decision on the non-binding guidance has added numerous qualifiers. It encourages parties and governments to "[e]nsure … that no climate-related geo-engineering activities that may affect biodiversity," except for "small scale scientific research studies … in a controlled setting." To summarize it crudely, the decision allows for research while discouraging deployment of the technology. Such outcome should be welcomed by the scientific community, although the whole negotiation process was not well informed and rather precarious.

In this paper, we briefly describe the previous international negotiations surrounding geoengineering, and the outcome of the CBD COP10 decision on geoengineering. We give an overview of geoengineering and point out the importance of research and field testing. This is followed by the review of the COP10 negotiation and a discussion on the future implications.

2. Importance of geoengineering research

2.1. Geoengineering

Geoengineering is defined as "deliberate large-scale manipulation of the planetary environment to

[1] English news pieces include Kintisch (2010) and Eilperin (2010) (a blog entry). There was no newspaper or magazine article in Japanese that covered this topic, except for the translation of ENDS Europe, as of 2010/11/18.

counteract anthropogenic climate change" (Royal Society 2009). It is often used with the word climate (e.g., climate geoengineering, or geoengineering the climate). Some authors also use the term, climate engineering (e.g., Hegerl and Solomon 2009, The Scientific Organizing Committee for the Asilomar Conference on Climate Engineering Technologies 2010), while there are still different terms such as climate intervention technology and climate remediation technology. The community has not settled on the term yet. Geoengineering is the word that is the most often used.

As the confusing situation of the terminology indicates, the field is relative new[2]. A clear definition of geoengineering, both from scholarly and legal viewpoints, is yet to be given. The CBD decision at COP10 did not yield a concrete definition either.

The CBD uses the word "geo-engineering" rather than "geoengineering." In this paper, we use the un-hyphenated term, except when directly citing the text of the CBD documents.

Geoengineering represents a broad set of various technologies, which can be classified into two categories: solar radiation management (SRM) and carbon dioxide removal (CDR) (Royal Society 2009). Table 1 summarizes the characteristics of each category. The science behind each method and its biological impact varies widely between SRM and CDR techniques, and there is still a large variation within the category. This necessitates tailored approaches of regulation to each category.

For general introduction of each technology, please refer to the Royal Society (2009) and Launder and Thompson (2009), among others.

Note that geoengineering does not represent a perfect alternative to mitigation or adaptation. It is rather a third category of human responses to climate change (Keith 2000). As the Royal Society (2009) pointed out, the safest and most predictable method to moderate climate change is mitigation.

2.2. Case for geoengineering

A recent surge of interest in geoengineering began with papers by Crutzen (2006) and Wigley (2006). The basic premise for geoengineering is that there remains a significant uncertainty in climate change projections, and that even a very stringent emissions reduction does not guarantee avoiding "dangerous" climate change.

Meinshausen et al. (2009) showed that reducing global greenhouse gas emissions by half by 2050 leads to a 12-45% probability of global warming exceeding the international target of 2 degrees Celsius, because of uncertainties in climate sensitivity[3] and carbon cycle. Parry et al. (2009) argued that we might therefore have to adapt to the world with a global warming of 4 degrees in the worst case scenario. Though not a simple threshold, if global warming exceeds 2 degrees Celsius, we will see increasing chances of the Arctic summer sea-ice vanishing, accelerated melting of

[2] To be more precise, the ideas date further back (Keith 2000). But the strong interest in this technology is an only recent phenomenon.

[3] Defined as an equilibrium global mean temperature increase in response to the radiative forcing of a doubling of the atmospheric carbon dioxide concentration relative to its preindustrial level.

Table 1. Geoengineering: two categories and their general characteristics. Update of Table 2 of M. Sugiyama and T. Sugiyama (2010).

Category	**Carbon dioxide removal (CDR)** Take out CO_2, the main culprit of global warming, from the atmosphere	**Solar radiation management (SRM)** Decrease incoming solar radiation by increasing reflectivity
Proposed methods	Fertilize the ocean with iron to enhance photosynthesis, which draws down atmospheric CO_2 (ocean fertilization) Capture CO_2 directly from the atmosphere (direct air capture)	Inject small particles into the upper atmosphere (stratospheric aerosol injection) Spray oceanic salt particles with a fleet of specially designed ships and increase cloud condensation nuclei to increase the cloud reflectivity (cloud brightening/whitening)
Features	As costly as, or costlier than emissions reductions Slow to have an effect, on the order of decades Moderates ocean acidification as well as global warming	Generally cheap to deploy Becomes effective quickly Does not address ocean acidification and likely to change precipitation patterns Has to be continued for the CO_2's residence time (several hundred years to thousands of years); termination might lead to a rapid rise in temperature
Regulatory Consideration	Are existing mechanisms sufficient? London Convention/Protocol and CBD had decisions to cover ocean fertilization before COP10 Extent of allowed commercial activities	How might one create a global governance mechanism? Bottom-up with a small number of governments, or top-down with some UN body?

Greenland ice sheet, and the dieback of the Amazon rainforests, among other devastating damages (Lenton et al. 2008; Ramanathan and Feng 2008).

The heightened recognition of the risk of "dangerous" climate change led to discussions of geoengineering in the West, and in particular the United States and the United Kingdom. The Royal Society (2009) issued a comprehensive report, a first of its kind last year. The Society, along with the TWAS (The Academy of Sciences for the Developing World) and the Environmental Defense Fund, launched the Solar Radiation Management Governance Initiative (SRMGI) (Royal Society et al. 2010) to facilitate discussions on SRM governance. The Intergovernmental Panel on Climate Change (IPCC), the scientific authority of climate change, is planning a joint expert meeting next year, which brings together 3 working groups. Its next assessment report will also review the literature on geoengineering (Table 2).

Table 2. Recent developments with geoengineering, since 2009. Adopted and modified from Table 1 of M. Sugiyama and T. Sugiyama (2010). The list is not exhaustive, and includes future events in the planning stage.

Jun. 2009	States proposed geoengineering as a topic to be covered in the 5th assessment report of IPCC
Sep. 2009	American Meteorological Society issued a statement on geoengineering, advocating research while cautioning against usage[4]
Sep. 2009	Royal Society issued *Geoengineering the Climate*, first comprehensive report on the topic
Sep. 2009	Report on a research program of stratospheric aerosol injection (Blackstock et al. 2009)
Mar. 2010	Solar Radiation Management Governance Initiative (SRMGI) launched[5] by the Royal Society, TWAS, and the Environmental Defense Fund (Royal Society et al. 2010)
Mar. 2010	UK House of Commons Science and Technology Committee issued a report "The Regulation of Geoengineering"
Mar. 2010	Asilomar International Conference on Climate Intervention Technologies discussed norms and governance of geoengineering experimental research
Oct. 2010	US House of Representatives Science and Technology Committee issued a report on geoengineering research needs
Mar. 2011	SRMGI conference planned in the UK
Jun. 2011	IPCC expert meeting on geoengineering planned in Peru

As shown later, some environmental groups, while advocating climate mitigation action, strongly oppose any geoengineering activity. They argue for a blanket ban on geoengineering, including research. But this argument has a pitfall, if one accepts that there exists some kind of tipping point in the climate system, beyond which the risk of climate change becomes significant.

The large inertia of the climate system suggests that once the global temperature exceeds such a threshold, emissions reductions will not bring down temperature on the meaningful timescale. For example, if the Arctic summer sea-ice were about to vanish, the only method that would halt further melting could be an SRM strategy. It is not rational to simultaneously accept a climate emergency scenario and completely prohibit geoengineering.[6]

[4] Available online at <http://www.ametsoc.org/policy/2009geoengineeringclimate_amsstatement.html>.

[5] Its website is <http://www.srmgi.org/>.

[6] On the other hand, these groups' stances are often political and strategic, and they might be attempting to counter arguments made by conservative think tanks and politicians. Those have been quite skeptical of climate change, but some of them at present support geoengineering. Then, one might interpret that those environmental groups see geoengineering as yet another tactic to derail mitigation efforts by these groups. However, this is a strategic argument, not a logical one.

2.3. Geoengineering experiment in the natural environment

The field of geoengineering is young and there are numerous unknowns, which implies that more research is required. The question is then, what kind of research? Computer simulations using climate models, or laboratory experiments, are the same as those in other fields, and researchers should obey the common rules and regulations. What is controversial is experimental research conducted in the natural environment. Might a geoengineering experiment have a risk of damaging the environment?

It is tantamount to distinguish various scales at which field tests would be conducted. Many small-scale experiments would exert negligible risks on the global climate system. For instance, one of the key questions concerning stratospheric aerosols injection is how one might inject aerosols into the stratosphere in order to control the size of such particles. The aerosol size affects their reflectivity, an important factor in the technique's effectiveness (e.g., Rasch et al. 2008). Testing injection methods and particle choices in the field might require a small number of aircraft flights (Keith et al. 2010). Such an experiment should yield virtually no discernible impact on the climate, especially when compared with an operation of large airline operators.

On the other hand, a larger experiment to test the climatic effect of stratospheric aerosol injection would be controversial (Robock et al. 2010). It is then necessary to differentiate between small and large scales of the field testing. Drawing the line between the two is a very hard task, and SRMGI has begun an attempt to discuss the issue.

3. Negotiations

3.1. Path towards COP10

Two international bodies have taken up the issue of geoengineering directly: the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 and 1996 Protocol Thereto (London Convention and London Protocol for short), and the Convention on Biological Diversity.

In 2008, CBD COP9 held in Bonn adopted a non-binding decision to "*requests* Parties … to ensure that ocean fertilization activities do not take place" except for "small scale scientific research studies within coastal waters" (Decision IX/16)[7]. Noting this decision, the SBSTTA meeting in

[7] <http://www.cbd.int/decision/cop/?id=11659>, accessed 2010/11/04.
The following quote is the relevant parts of the COP 9 Decision IX/16 "Biodiversity and climate change, C. Ocean Fertilization":

The Conference of the Parties …

4. *Bearing in mind* the ongoing scientific and legal analysis occurring under the auspices of the London Convention (1972) and the 1996 London Protocol, *requests* Parties and *urges* other Governments, in accordance with the precautionary approach, to ensure that ocean fertilization activities do not take place until there is an adequate scientific basis on which to justify such activities, including assessing associated risks, and a global, transparent and effective control and regulatory mechanism is in place for these activities; with the exception of small scale scientific research studies within coastal waters. Such studies should

May, 2010, discussed geoengineering, recommending a draft decision for COP10. Although non-binding, some countries thought of it as a strong statement, and the text was bracketed after Canada proposed an alternative language (IISD 2010a)

The text of draft decision treated all geoengineering schemes in the same way, and did not recognize the differences among them. It also discouraged even small-scale research, as the wording does not make an exception for research ("no climate-related geo-engineering activities")[8], however small it may be. Moreover, the definitions of "geo-engineering" and its "activities" were not clear.

The parties to the London Convention/Protocol made a non-binding decision on ocean fertilization, effectively barring such an activity except for "legitimate scientific research" (LC-LP.1 (2008))[9]. Scientific Groups were then asked to create an assessment guidance of research projects. The Assessment Framework was adopted in a meeting held in October, 2010 (LC-LP.2(2010))[10].

It is helpful to compare the texts of the decisions made at the London Convention/Protocol and CBD. Table 3 compares the decisions regarding ocean fertilization and geoengineering at the two bodies. The London Convention/Protocol decision is more direct than those at the CBD. At the CBD, the language on ocean fertilization is more direct than that on geoengineering. Because of the difference in the strength of the languages, it could be difficult to call the LC-LP.1 (2008) resolution and the CBD draft decision a "ban" simultaneously. Although non-binding, LC-LP.1 (2008) is strong enough to effectively prohibit ocean fertilization activities. On the other hand, the CBD draft decision may not be as strong as to constitute prohibition or moratorium.

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only be authorized if justified by the need to gather specific scientific data, and should also be subject to a thorough prior assessment of the potential impacts of the research studies on the marine environment, and be strictly controlled, and not be used for generating and selling carbon offsets or any other commercial purposes;

[8] Some claimed that the decision was a "ban" on geoengineering. However, the text in question was a non-binding guidance from the outset. If adopted, it might have become an "effective" ban on geoengineering.

[9] <http://www5.imo.org/SharePoint/blastDataHelper.asp/data_id%3D24337/LC-LP1(30).pdf>, accessed 2010/11/04.

The following is the relevant part of the LC-LP.1(2008):
THE THIRTIETH MEETING OF THE CONTRACTING PARTIES TO THE LONDON CONVENTION AND THE THIRD MEETING OF THE CONTRACTING PARTIES TO THE LONDON PROTOCOL, …

4. **AGREE** that scientific research proposals should be assessed on a case-by-case basis using an assessment framework to be developed by the Scientific Groups under the London Convention and Protocol; …

8. **AGREE** that, given the present state of knowledge, ocean fertilization activities other than legitimate scientific research should not be allowed. To this end, such other activities should be considered as contrary to the aims of the Convention and Protocol and not currently qualify for any exemption from the definition of dumping in Article III.1(b) of the Convention and Article 1.4.2 of the Protocol; …

[10] <http://www.imo.org/MediaCentre/PressBriefings/Pages/Assessment-Framework-for-scientific-research-involving-ocean-fertilization-agreed.aspx>, accessed 2010/11/04.

Table 3. Comparison of the three decisions related with ocean fertilization and geoengineering. The wording is more direct in LC-LP.1 (2008) than CBD COP9 Decision, and the COP9 decision is more direct than the COP10 decision. Note that the quoted parts of the COP10 draft decision did not materially change after the negotiation, except for the insertion of "that may affect biodiversity".

LC-LP.1 (2008) (London Convention/Protocol decision) ⋯ [LC and LP meetings] … 8. **AGREE** that, given the present state of knowledge, ocean fertilization activities other than legitimate scientific research should not be allowed.
CBD COP 9 Decision IX/16 (on ocean fertilization) *The Conference of the Parties … requests* Parties and *urges* other Governments,… to ensure that ocean fertilization activities do not take place
CBD draft decision UNEP/CBD/COP/10/1/Add.2/Rev.1 *The Conference of the Parties …* 8. *Further Invites* Parties and other Governments, … to consider the following guidance… [(w) Ensure, … that no climate-related geo-engineering activities take place …]

3.2. Negotiation at COP10

As mentioned above, the negotiation text discouraged "any climate-related geo-engineering activities," without an exception for research (UNEP/CBD/COP/10/1/Add.2/Rev.1).

At the beginning of the COP10, a strong campaign organized by a Canadian nongovernmental organization, ETC Group (The Action Group on Erosion, Technology and Concentration) (ETC Group 2010a, 2010b), swayed delegates of many parties into total opposition of geoengineering[11]. Table 4 summarizes the positions of various stakeholders, based on three sources. Some observers noted that the information at the site was very limited and delegates were not well informed about the science of geoengineering.

The Philippines strongly supported the original language, while China tacitly pointed out the importance of research. According to IISD (2010b), Brazil argued for allowing scientific research on a small scale and within national jurisdiction, Japan noted potential benefits of some geoengineering activities for biodiversity and climate change, and Russia requested deleting the language on geoengineering.

The definition of geoengineering was also discussed. In particular, parties discussed whether to include carbon capture and storage (CCS). Bolivia requested to clarify that excluding CCS cannot be interpreted as an acceptance of geoengineering activities.

[11] ETC Group described scientific institutions such as the Royal Society as supportive of geoengineering (ETC Group 2010b), but this is misleading. It is true that it supports research on geoengineering, but it is very cautious about deployment. And the Royal Society clearly emphasizes the paramount importance of mitigation, and points out that geoengineering is not an alternative to mitigation.

Table 4. Positions of parties and stakeholders. Based on blog "Geoengineering Politics"[12], Earth Negotiations Bulletin (IISD 2010b), and an interview with an anonymous source. The asterisks indicate countries with a strong voice of each position.

Position	Parties	Other stakeholders
Oppose geoengineering	The Philippines (*), Tuvalu, Costa Rica, African Group, Switzerland, ALBA Group (Bolivarian Alliance for the Americas, led by Venezuela and including Bolivia), Grenada	Greenpeace, Ecosystems Climate Alliance, ETC Group
Middle ground	Brazil, European Union (EU), Norway	
Support research	China (*), Japan, Russia	Royal Society

Note that the United States is not a party to the CBD and took part in the conference as an observer. It signed but has not ratified the treaty.

The delegates negotiated on the text in a Friends of Chair group chaired by Horst Korn (Germany). The group discussed the definition of geoengineering, the language on geoengineering activities, and a possible exception for scientific research.

3.3. Decision

Based on the discussion at the Friends of the Chair group, the delegates reached a conclusion on the decision, as part of the deal package made in the COP10. The full text of the relevant parts of the decision is shown in Box 1.

There are many conditions and qualifiers attached. For the sake of simplicity (but with a fear of oversimplification), the main points of the decision are as follows:

(1) States are asked to ensure that no geoengineering activities that may affect biodiversity take place;
(2) But small scale scientific research that meets certain criteria is exempted;
(3) A tentative definition of geoengineering is given, distinguishing SRM and CDR and specifically excluding carbon capture and storage from fossil fuels;
(4) The Executive Secretariat will compile scientific information on geoengineering and viewpoints of stakeholders, and synthesize them for consideration by SBSTTA;
(5) The Executive Secretariat will conduct a study on the gaps in the regulatory and control mechanisms on geoengineering;
(6) States are invited to submit information on geoengineering for consideration by SBSTTA.

[12] <http://geoengineeringpolitics.blogspot.com/2010/10/update-on-cbd-cop10.html>, accessed 2010/11/04.

Box 1. The text of the adopted decision, UNEP/CBD/ COP/10/L.36 and UNEP/CBD/COP/10/L.26.

UNEP/CBD/COP/10/L.36 (Biodiversity and Climate Change)[13]

The Conference of the Parties …

8. *Invites* Parties and other Governments, according to national circumstance and priorities, as well as relevant organizations and processes, to consider the guidance below on ways to conserve, sustainably use and restore biodiversity and ecosystem services while contributing to climate change mitigation and adaptation: …

(w) Ensure, in line and consistent with decision IX/16 C, on ocean fertilization and biodiversity and climate change, in the absence of science based, global, transparent and effective control and regulatory mechanisms for geo-engineering, and in accordance with the precautionary approach and Article 14 of the Convention, that no climate-related geo-engineering activities[2] that may affect biodiversity take place, until there is an adequate scientific basis on which to justify such activities and appropriate consideration of the associated risks for the environment and biodiversity and associated social, economic and cultural impacts, with the exception of small scale scientific research studies that would be conducted in a controlled setting in accordance with Article 3 of the Convention, and only if they are justified by the need to gather specific scientific data and are subject to a thorough prior assessment of the potential impacts on the environment;

(footnote) 2: Without prejudice to future deliberations on the definition of geo-engineering activities, understanding that any technologies that deliberately reduce solar insolation or increase carbon sequestration from the atmosphere on a large scale that may affect biodiversity (excluding carbon capture and storage from fossil fuels when it captures carbon dioxide before it is released into the atmosphere) should be considered as forms of geo-engineering which are relevant to the Convention on Biological Diversity until a more precise definition can be developed. Noting that solar insolation is defined as a measure of solar radiation energy received on a given surface area in a given hour and that carbon sequestration is defined as the process of increasing the carbon content of a reservoir/pool other than the atmosphere.

…

9. *Requests* the Executive Secretary to: …

(o) Compile and synthesize available scientific information, and views and experiences of indigenous and local communities and other stakeholders, on the possible impacts of geo engineering techniques on biodiversity and associated social, economic and cultural considerations, and options on definitions and understandings of climate-related geo-engineering relevant to the Convention on Biological Diversity and make it available for consideration at a meeting of the Subsidiary Body on Scientific, Technical and Technological Advice prior to the eleventh meeting of the Conference of the Parties;

(p) Taking into account the possible need for science based global, transparent and effective control and regulatory mechanisms, subject to the availability of financial resources, undertake a study on gaps in such existing mechanisms for climate-related geo-engineering relevant to the Convention on Biological Diversity, bearing in mind that such mechanisms may not be best placed under the Convention on Biological Diversity, for consideration by the Subsidiary Body on Scientific Technical and Technological Advice prior to a future meeting of the Conference of the Parties and to communicate the results to relevant organizations;

…

UNEP/CBD/COP/10/L.26 (New and emerging issues)[14]

The Conference of the Parties …

4. *Invites* Parties, other Governments and relevant organizations to submit information on synthetic biology and geo-engineering, for the consideration by the Subsidiary Body on Scientific, Technical and Technological Advice, in accordance with the procedures of decision IX/29, while applying the precautionary approach to the field release of synthetic life, cell or genome into the environment;

[13] <http://www.cbd.int/doc/meetings/cop/cop-10/in-session/cop-10-l-36-en.doc>, accessed 2010/11/26.

[14] <http://www.cbd.int/doc/meetings/cop/cop-10/in-session/cop-10-l-26-en.doc>, accessed 2010/11/04.

Table 5. Comparison of the key parts of the draft and adopted decisions. The words that are boldface and underlined have been added during the negotiation. The lines were broken for the ease of comparison. The Article 3 refers to the principles, and the Article 14 of the CBD concerns with environmental assessment.

UNEP/CBD/COP/10/1/Add.2/Rev.1[15]	**UNEP/CBD/ COP/10/L.36**
[(w) Ensure, in line and consistent with decision IX/16 C, on ocean fertilization and biodiversity and climate change,	(w) Ensure, in line and consistent with decision IX/16 C, on ocean fertilization and biodiversity and climate change, **in the absence of science based, global, transparent and effective control and regulatory mechanisms for geo-engineering,**
and in accordance with the precautionary approach,	and in accordance with the precautionary approach **and Article 14 of the Convention,**
that no climate-related geo-engineering activities	that no climate-related geo-engineering activities[2] **that may affect biodiversity**
take place until there is an adequate scientific basis on which to justify such activities and appropriate consideration of the associated risks for the environment and biodiversity and associated social, economic and cultural impacts;]	take place, until there is an adequate scientific basis on which to justify such activities and appropriate consideration of the associated risks for the environment and biodiversity and associated social, economic and cultural impacts, **with the exception of small scale scientific research studies that would be conducted in a controlled setting in accordance with Article 3 of the Convention, and only if they are justified by the need to gather specific scientific data and are subject to a thorough prior assessment of the potential impacts on the environment;**
	(footnote) 2: Without prejudice to future deliberations on the definition of geo-engineering activities, understanding that any technologies that deliberately reduce solar insolation or increase carbon sequestration from the atmosphere on a large scale that may affect biodiversity (excluding carbon capture and storage from fossil fuels when it captures carbon dioxide before it is released into the atmosphere) should be considered as forms of geo-engineering which are relevant to the Convention on Biological Diversity until a more precise definition can be developed. Noting that solar insolation is defined as a measure of solar radiation energy received on a given surface area in a given hour and that carbon sequestration is defined as the process of increasing the carbon content of a reservoir/pool other than the atmosphere.

To appreciate the changes made during the negotiation, Table 5 makes a comparison on Section

[15] <http://www.cbd.int/doc/meetings/cop/cop-10/official/cop-10-01-add2-rev1-en.pdf>, accessed 2010/11/04.

(w) between the draft decision and the adopted one.

There are five changes made: (1) A qualifier that recognizes the absence of regulatory and control mechanisms has been added; (2) The reference to Article 14 has been included; (3) “geo-engineering activities” is now with a modifier “that may affect biodiversity”; (4) An exception is made for small-scale scientific research that satisfies certain criteria; (5) A tentative definition of geoengineering is added as a footnote.

The crucial problem with this language is that it leaves many terms undefined, and that even when given, the definition is not well thought out. For example, it is unclear what a “controlled setting” for small-scale scientific research means. There is even no mention of the method to determine the meaning of this term. Another problem is the exclusion of CCS based on fossil fuel combustion. Such definition would include part of CCS from the cement industry in the definition of geoengineering. Cement CO_2 emissions arise from heating the kiln by fuels and chemical reactions of the material, limestone. The latter clearly is not due to fossil fuel combustion.

The COP10 also touched on ocean fertilization. It reaffirmed the COP 9 Decision IX/16, and recognized the report (UNEP/CBD/SBSTTA/14/INF/7) [16] on ocean fertilization impacts on ecosystems by SBSTTA. It also recognized the progress made by the London Convention/Protocol (UNEP/CBD/COP/10/L.42)[17].

4. Conclusions

Delegates at the CBD COP10 discussed not only biodiversity conservation targets and access and benefit sharing of genetic resources, but also geoengineering. The draft language, though not binding, discourages any geoengineering activities, including research. The agreed decision made an exception for small scale research (under certain conditions), included a tentative definition of geoengineering, and added numerous qualifiers. The Executive Secretariat will synthesize scientific information and stakeholders’ viewpoints, and have a look into the gap in regulatory mechanisms on geoengineering.

The negotiation at the CBD COP10 demonstrated that geoengineering is now an important topic on the international stage. An article in *The Economist* posited that geoengineering made a coming of age (Anonymous 2010). In light of the emergence of geoengineering in the international arena, what implication does the decision hold for the future?

As a United Nations body, the CBD adopted a landmark decision that comprehensively covers geoengineering. Some points are worth repeating: (1) Comparison with London Convention/Protocol and CBD decisions shows that the adopted language is not as strong as to

[16] <http://www.cbd.int/doc/meetings/sbstta/sbstta-14/information/sbstta-14-inf-07-en.pdf>, accessed 2010/11/04.

[17] <http://www.cbd.int/doc/meetings/cop/cop-10/in-session/cop-10-l-42-en.doc>

constitute a "*de facto* moratorium on geoengineering," in contrast with a claim made by some (ETC Group 2010c); (2) Governments are discouraged to deploy geoengineering, and small-scale research can be conducted if sufficient assessments are made. No serious scientist is suggesting deploying this technology immediately, and many are genuinely concerned about the risks of this technology. The decision was a step forward in the right direction, despite the messy processes preceding it.

In the larger context of climate change, the CBD is probably not the appropriate platform for geoengineering governance. One of the major emitters, the United States, is not party to the CBD, and the COP10 geoengineering decision recognized that the CBD may not be the proper forum for governance (a subject of a study to be conducted by the Executive Secretariat). In the United Nations structure, the Framework Convention on Climate Change would be an obvious candidate, but various other governance arrangements are possible. For instance, some argue for bottom-up approaches to geoengineering governance, starting with international coordination of research programs (Keith et al. 2010).

The most precarious part of the negotiation was that parties were not well informed of the science of geoengineering. In the decision, geoengineering was treated as though a single, monolithic technology, which clearly is not. An observer noted that delegates were confused between geoengineering research and geoengineering deployment.

It is therefore essential for the scientific community to provide more policy-relevant information with policymakers and citizens. The IPCC expert meeting planned next year is timely and should be welcomed. More information from scientific bodies like IPCC is vitally needed, whether one supports or opposes geoengineering.

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