

# GEOENGINEERING: GAMBLING WITH GAIA

## BRIEFING AND RECOMMENDATIONS FOR CBD DELEGATES TO COP 10

Geoengineering is the intentional, large-scale manipulation of the Earth's systems by artificially changing oceans, soils and the atmosphere. More than a set of technologies, however, it is a political strategy. Rather than nurturing and protecting biodiversity, geoengineering aims to create conditions that will allow us to sustain the excesses that brought on the current ecological and social crisis. It also allows the governments responsible for almost all historic greenhouse gas emissions to sidestep compensating the global South, which is not culpable in climate change but suffering its effects. In other words, geoengineering offers a technological “fix” to the same governments and industries that both created the climate crisis and failed to adopt policies that would mitigate its damage.

The consequences of geoengineering activities, including real world experimentation, are global. Before any action can be countenanced, the world's peoples and governments must debate these consequences and determine limits. As the Ad-Hoc Technical Expert Group on Climate Change and Biodiversity noted in its recent report, the impact of geoengineering on ecosystems is unknown.<sup>1</sup> No unilateral initiative – or one by a “coalition of the willing” – can be considered legally, practically or morally acceptable. Until the international community has had time to be properly apprised of the issue, has debated its relevance to addressing the concurrent global crises we are facing, and has determined what further action, if any, is necessary, the 10th Conference of the Parties (COP 10) should adopt a moratorium on all geoengineering activities.

Currently, there are no laws overseeing geoengineering experiments. The UN Convention on Biological Diversity (CBD), which has already shown leadership on ocean fertilization (**COP 9's Decision IX/16C**), should urgently address this governance vacuum. In Nagoya, Parties to the CBD will decide whether or not the Precautionary Approach will be applied not only to ocean fertilization, but also to all other geoengineering activities that are currently being contemplated by a growing group of scientists and policymakers in the global North.

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<sup>1</sup> See Secretariat of the Convention on Biological Diversity, *Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Meeting of the Ad Hoc Technical Expert Group on Biodiversity and Climate Change*, CBD Technical Series No. 41, 2009.

*Copies of two new reports by ETC Group – Geopiracy: The Case Against Geoengineering and The New Biomasters: An assault on global biodiversity and livelihoods – will be available in Nagoya at COP 10 and on ETC Group's web site: [www.etcgroup.org](http://www.etcgroup.org)*

## Geoengineering: Definitions

Although multilateral bodies may define the term differently, according to their mandates and interests, geoengineering always includes the following elements:

Intent: Geoengineering is always deliberate (even if it may have unintended impacts). It is the engineering of Earth's ecosystems on purpose rather than accidentally.

Scale: Geoengineering technologies have a big enough impact to actually affect global systems. By definition, the impacts are trans-boundary.

Technology: Geoengineering is a technological approach. Simply changing consumption patterns would not be considered geoengineering, even though on a large scale such a change could have a noticeable impact on the climate.

The *New Oxford Dictionary of English* defined geoengineering this year as, "the deliberate large-scale manipulation of an environmental process that affects the earth's climate, in an attempt to counteract the effects of global warming."<sup>2</sup>

## What technologies are involved in Geoengineering?

There are different geoengineering technologies in research and development in Northern academic, public and private settings, broadly classified into three categories: (1) Solar Radiation Management (SRM); (2) Carbon Dioxide [CO<sub>2</sub>] Removal; and (3) Weather Modification. Within each category, the most prominent of these technologies are:

### 1. Solar Radiation Management

- Aerosol sulphates in the stratosphere: Pumping aerosol sulphates or aluminum nanoparticles into the stratosphere to block sunlight, thereby lowering the Earth's temperature without reducing the level of greenhouse gases (GHGs) in the atmosphere.
- Cloud whitening: Spraying seawater into the atmosphere to increase the reflectivity and condensation of clouds, thereby reflecting more of the sun's rays back into space.
- Space sunshades: Launching trillions of small free-flying spacecrafts, or space mirrors, a million miles above the Earth to prevent a portion of the sun's rays from hitting the planet, thereby reducing global warming.
- Albedo enhancement: Increasing the reflectivity of the Earth's surface by planting whiter or shinier crops, or covering desert regions or mountains with reflective white material.

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<sup>2</sup> ETC group does not define geoengineering exclusively in relation to the climate. While real, the climate crisis is also a convenient pretext for geoengineering. In another political context, geoengineering strategies could be applied to crises (e.g., water shortages and imbalances in the nitrogen cycle). James Fleming has pointed out the lack of logic in constraining the definition of a technology by its stated purpose. See James Rodger Fleming, *Fixing the Sky: the Checkered History of Weather and Climate Control*, New York: Columbia University Press, 2010, pp. 228-230.

**Implications:** The artificial manipulation of radiation could wreak havoc on the fragile balance of complex ecosystems that have taken millennia to evolve. Solar radiation management is a blunt instrument (often referred to as “Plan B”), an emergency measure theoretically used to cool the climate in catastrophic situations. Increasingly, however, it is being considered as part of a permanent planetary management, where different variables could be optimized to deliver a made-to-order climate.<sup>3</sup> It is well established that geoengineering’s impact on regional climates would be diverse and not sufficiently understood with current modeling techniques. The countries capable of deploying such technologies would effectively have one hand on the thermostat and the other on the water cycle.

## 2. Carbon Dioxide Removal

- Ocean fertilization: Promoting carbon sequestration deep at sea by using iron or nitrogen to artificially stimulate the growth of phytoplankton.
- Ocean upwelling or downwelling enhancement: Using giant pipes to bring nitrogen or phosphorous-enriched waters up from the deep ocean in order to cool surface waters and enhance ocean sequestration of CO<sub>2</sub>.
- Genetic engineering of algae: Using genetically engineered algae, often created through synthetic biology techniques, to cover urban buildings, open ponds, or the surface of the ocean in order to capture CO<sub>2</sub>.
- Carbon-sucking machines or synthetic trees (air capture): Extracting CO<sub>2</sub> from the air by using liquid sodium hydroxide (or other materials), which is converted to sodium carbonate; the “excess” solid carbon dioxide is then buried in the soil or dumped in the oceans.
- Biochar: Planting huge quantities of biomass and burning it by pyrolysis (low oxygen environment) and burying the concentrated carbon in the soil, a proposal backed by the corporate-driven International Biochar Initiative. The industrial production of biochar claims traditional Amazonian *terra preta* as its ancestor, but the practices differ both qualitatively and in scale.
- Carbon capture and storage: This umbrella heading most often refers to capturing CO<sub>2</sub> at source (before it enters the atmosphere) and storing it in the oceans or in terrestrial geologic formations. It is generally not considered a geoengineering technique as it aims to capture CO<sub>2</sub> before it is released to the atmosphere. Nonetheless, it is problematic from an environmental perspective as an accidental and/or sudden release of stored CO<sub>2</sub> could provoke climate disruptions.

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<sup>3</sup> See, for example, “Optimizing Climate Change Reduction,” Carnegie Institution, Department of Global Ecology, 2010, which reports on a study by Ken Caldeira and George Ban-Weiss that asked, “how, if people decided what kind of climate they want, they would go about determining the aerosol distribution pattern that would come closest to achieving their climate goals?” available at [http://carnegiescience.edu/news/optimizing\\_climate\\_change\\_reduction](http://carnegiescience.edu/news/optimizing_climate_change_reduction)

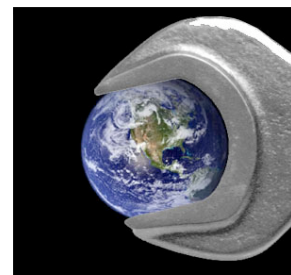
**Implications:** When used on a large scale, Carbon Dioxide Removal technologies that aim to capture carbon dioxide from the atmosphere after it has been emitted can destroy, unintentionally modify or trigger unpredictable side effects on complex ecosystems, such as our oceans. The duration, reliability and safety of carbon sequestration (by biological or mechanical means) on land or in the sea are mostly unknown. Moreover, a massive investment and scale-up would be required before there would be a noticeable impact on the climate. Many of these techniques require unsustainable inputs or land/ocean use changes that will negatively affect the marine food webs and the livelihood of thousands of peoples subsisting on artisanal fisheries.

### 3. Weather Modification

Weather modification has a long and checkered past, including hostile use in the Vietnam War and is today practiced in dozens of countries in some form or other – despite lack of scientific proof of its effectiveness. The impact of weather modification can be more local and short-term, but it is, nonetheless, historically and scientifically related to the geoengineering enterprise.

- Cloud seeding (for precipitation) has been around since the 19<sup>th</sup> century, promising rain to farmers whose crops are suffering from drought, and later as a military technique to hinder troop movements. While based on dubious science, alleged impacts on nearby fields can be serious, provoking conflicts between neighbouring communities that think the cloud seeders have stolen their rain.
- Hurricane suppression or redirection: Patent claims are already pending on unproven technologies to suppress or change the direction of hurricanes.

**Implications:** Weather modification techniques have already shown local impacts but we do not know what other changes in regional weather patterns have been created by their use. Diverting hurricanes and modifying storms could have potentially devastating global and regional impacts. For example, it is entirely conceivable that the path of a hurricane could be artificially deviated, either intentionally or accidentally, toward an unsuspecting population.



## Who is the Geoengineering Lobby and what are they doing?

The geoengineering lobby is a diverse group of entrepreneurs, scientists, think tanks and policy makers of varying political persuasions, including both alarmed environmentalists and former climate change skeptics. They may have different rationales for controlling the climate, but they are all calling for more research dollars and for authorization to experiment with these technologies. They have multiple plans, rationales and strategies for geoengineering:

Plan A (Action) – Geoengineering is faster and cheaper than carbon taxes and emission reductions. Let's get on with it! (e.g., Copenhagen Consensus Center's Bjorn Lomborg, Virgin Airline's CEO Richard Branson, and the American Enterprise Institute)

Plan B (Backup) – We must prepare an emergency Plan B because we are heading toward certain climate catastrophe (e.g., UK Royal Society, Carnegie Institution/Stanford University scientist Ken Caldeira, University of Calgary scientist David Keith).

Plan C (Commerce) – There is good money (and carbon credits) to be made from geoengineering (e.g., ocean fertilisation company Climos, the network and lobby group International Biochar Initiative).

Plan D (Defense) – Control of the climate, especially regional control, gives military advantage. It's a security issue (e.g., Star Wars architect Lowell Wood, U.S. Defense Advanced Research Projects Agency-DARPA).

Plan E (Environmentalists) – Ecological emergency means we need to look seriously at preparing for deployment (e.g., Frozen Isthmuses Protection Campaign; Environmental Defense Fund).

## How does Geoengineering threaten biodiversity?

Rather than protecting or restoring the Earth's ecosystems – already under severe strain from human activities – geoengineering's sole interest is to "enhance" or "correct" them in order to produce an effect on the global climate. This is akin to releasing one invasive species to destroy another: it only compounds the problem it was meant to solve. In the geoengineering paradigm, the climate crisis is perceived as separate from poverty, hunger and biodiversity loss. The political question of who is responsible for global warming is ignored. But aside from obvious (or yet unknown) side effects, any unilateral initiative to manipulate the Earth's systems will impact everyone, and it is widely acknowledged that there will be "winners and losers" in these schemes. Geoengineering poses tremendous risks to biodiversity and ecosystems depended upon for food, livelihood and survival by marginalized local and indigenous communities in developing countries. A table summarizing some of the potential impacts of different geoengineering techniques follows:

## LEADING GEOENGINEERING TECHNOLOGIES: A SUMMARY OF POTENTIAL IMPACTS

Stratospheric aerosols (SRM)	<ul style="list-style-type: none"> <li>• interruption of African and Asian monsoons, potentially affecting food supplies of up to 2 billion people<sup>4</sup></li> <li>• ozone depletion</li> <li>• irreversibility (sudden temperature rise if stopped)</li> <li>• worsening ocean acidification</li> <li>• reduced efficacy of solar energy generation</li> <li>• profiteering</li> <li>• militarization<sup>5</sup></li> </ul>
Cloud whitening (SRM)	<ul style="list-style-type: none"> <li>• altered precipitation patterns and storm tracks<sup>6</sup></li> <li>• unknown effects on marine life if executed on a vast scale</li> <li>• extremely energy intensive</li> <li>• is inherently trans-boundary</li> <li>• would take place over the oceans, a global commons</li> </ul>
Ocean Fertilization (CDR)	<ul style="list-style-type: none"> <li>• disturbance of marine food web<sup>7</sup></li> <li>• worsening ocean acidification<sup>8</sup></li> <li>• commercial exploitation already underway<sup>9</sup></li> <li>• production of toxic algal blooms<sup>10</sup></li> <li>• production of harmful gases such as dimethylsulphide (DMS)</li> </ul>
Biochar (CDR)	<ul style="list-style-type: none"> <li>• unsustainable land use requirements (hundreds of millions of hectares)<sup>11</sup></li> <li>• unproven claims regarding soil amendment properties<sup>12</sup></li> <li>• puts at risk those populations depending on forests and marginal lands</li> <li>• attempts underway to accredit biochar on carbon markets with oil and airline industry backing<sup>13</sup></li> </ul>

<sup>4</sup> Many of these impacts are discussed in Alan Robock, “20 reasons why geoengineering may be a bad idea,” *Bull. Atomic Scientists* 64, No. 2, 14-18, 59, doi:10.2968/064002006.

<sup>5</sup> *Ibid.* and Jeff Goodell, *How to Cool the Planet: Geoengineering and the Audacious Quest to Fix Earth’s Climate*, Boston and New York: Houghton Mifflin Harcourt, pp. 207-208, and James Fleming, *op.cit.* p. 168.

<sup>6</sup> See policy statement on geoengineering adopted by American Meteorological Society, available at [http://www.ametsoc.org/policy/2009geoengineeringclimate\\_amsstatement.html](http://www.ametsoc.org/policy/2009geoengineeringclimate_amsstatement.html)

<sup>7</sup> “Scientific Synthesis of the Impacts of Ocean Fertilization on Marine Biodiversity,” Convention on Biological Diversity, Technical Series 45, 2009, available at <http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf>

<sup>8</sup> Denman, K., “Climate change, ocean processes, and ocean iron fertilization,” *Marine Ecology Progress Series* 234, 2008, pp. 219–225.

<sup>9</sup> Private companies have already sold carbon offsets on the voluntary market for sponsoring ocean fertilization activities. See, for example, ETC Group and ICTA news release, “Dumping on Gaia,” 19 June 2007; available at <http://www.etcgroup.org/en/node/637>

<sup>10</sup> C. G. Trick et al., “Iron enrichment stimulates toxic diatom production in high nitrate low chlorophyll areas,” *Proceedings of the National Academy of Sciences*, 1 February 2010 (10.1073/pnas.0910579107), available at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2851856>

<sup>11</sup> Dominic Woolf et al., “Sustainable Biochar to Mitigate Global Climate Change,” *Nature Communications*, 10th August 2010, available at <http://www.nature.com/ncomms/journal/v1/n5/full/ncomms1053.html> See also NGO press release challenging these findings: “*Nature Communications* article shows ‘true colours’ of biochar advocates: Groups condemn implied land-grab for biochar,” 30 August 2010, available at <http://www.etcgroup.org/en/node/5198>

## Why else is Geoengineering unacceptable?

- **It can't be tested:** No experimental phase is possible – in order to have a noticeable impact on the climate, geoengineering must be deployed on a massive scale. “Experiments” or “field trials” are actually equivalent to deployment in the real world because small-scale tests do not deliver the data on climate effects. For people and biodiversity, impacts would likely be massive as well, and immediate and possibly irreversible.
- **It is unequal:** OECD governments and powerful corporations (who have denied or ignored climate change and its impact on biodiversity for decades but are responsible for most of historic GHG emissions) are the ones with the budgets and the technology to execute this gamble with Gaia. There is no reason to trust that they will have the interests of more vulnerable states or peoples in mind.
- **It is unilateral:** Although all geoengineering proposals run into the tens of billions of dollars, for rich nations and billionaires, they could be considered relatively cheap (and simple) to deploy. The capacity to act will be within the hands of those who possess the technology (individuals, corporations, states) in the next few years. It is urgent that multilateral measures are taken to ban any unilateral attempts to manipulate Earth ecosystems.
- **It is risky and unpredictable:** The side effects of geoengineered interventions are unknown. Geoengineering could easily have unintended consequences due to any number of factors: mechanical failure, human error, inadequate understanding of ecosystems and biodiversity and the Earth's climate, unforeseen natural phenomena, irreversibility, or funding interruptions.
- **It violates treaties:** Many geoengineering techniques have latent military purposes and their deployment would violate the UN Environmental Modification Treaty (ENMOD), which prohibits the hostile use of environmental modification.
- **It is the perfect excuse:** Geoengineering offers governments an option other than reducing emissions and protecting biodiversity. Geoengineering research is often seen as a way to “buy time,” but it also gives governments justification to delay compensation for damage caused by climate change and to avoid taking action on emissions reduction.
- **It commodifies our climate and raises the spectre of climate profiteering:** Those who think they have a planetary fix for the climate crisis are already flooding patent offices with patent applications. Should a “Plan B” ever be agreed upon, the prospect of it being privately held is terrifying. Serious planet-altering technologies should never be undertaken for commercial profit. If geoengineering is actually a climate emergency back-up plan, then it should not be eligible for carbon credits under the Clean Development Mechanism or any other offset system.

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<sup>12</sup> See A. Ernstring and R. Smolker, *Biochar for Climate Change Mitigation: Fact or Fiction?* February 2009 available at <http://www.biofuelwatch.org.uk/docs/biocharbriefing.pdf>

<sup>13</sup> K. Driver and J. Gaunt, “Bringing Biochar Projects into the Carbon Market Place,” Carbon Consulting, Blue Source, Carbon War Room, Conoco Phillips Canada, May 2010.

## Why should COP 10 establish a moratorium on Geoengineering?

Because without a moratorium, a few powerful governments, companies or industries who have the means to deploy geoengineering could subject the rest of the planet, its biodiversity and peoples to geoengineering's unknown and potentially devastating effects. Real-world experiments/deployment using geoengineering technologies cannot be allowed, even less in the absence of global international debate and rules. Moratoria are a stopgap measure until the UN system gains capacity to monitor and assess new technologies.<sup>14</sup> A moratorium on geoengineering is essential because the risks of not having a moratorium in place are too high: Both biological and cultural diversity are already under intense pressure and climate change is making things worse. We simply cannot afford to gamble with geoengineering technologies – large-scale, dangerous, speculative – proposed by scientists, industries and governments from the countries that have the heaviest ecological footprint on Earth.

### Decisions on Geoengineering at COP 10 in Nagoya

- **The draft decision pertaining to geoengineering put forward by SBSTTA 14 is found on pp. 145 – 147 of UNEP/CBD/COP/10/1/Add.2/Rev.1**
- **“Biodiversity and Climate Change” (agenda item 5.6 in the draft Work Programme) is scheduled for discussion in Nagoya, Wednesday October 20, 10:00 – 13:00 WG 1**

The 14th session of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA-14) has put forward to COP 10 a **draft decision pertaining to geoengineering** (see UNEP/CBD/COP/10/1/Add.2/Rev.1, pp. 145-147) under **“Climate Change and Biodiversity”** (Agenda item 5.6), which contains the following passages:

1 (d) The Conference of the Parties... Implement activities to increase the adaptive capacity of species and the resilience of ecosystems in the face of climate change, including, *inter alia*...

[(w) Ensure, in line and consistent with decision IX/16 C, on ocean fertilization and biodiversity and climate change, and in accordance with the precautionary approach, that no climate-related geoengineering activities 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;]<sup>15</sup>

<sup>14</sup> It is incumbent upon the United Nations to establish something like an International Convention for the Evaluation of New Technologies (ICENT), which would allow governments to properly track emerging technological developments from the laboratory all the way through to commercialization. Regulatory mechanisms could evolve, as appropriate, in a more predictable manner, and reliable information on benefits and risks of technologies would be made available to the public before being confronted with impacts. For a fuller discussion of ETC Group's proposal for ICENT, see ETC Group, *Geopiracy: the Case Against Geoengineering*, October 2010, available at [www.etcgroup.org](http://www.etcgroup.org)

<sup>15</sup> Convention on Biological Diversity, *Draft Decisions for the Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity*, UNEP/CBD/COP/10/1/Add.2/Rev.1, 1 October 2010, p. 145.

9. Requests the Executive Secretary to: ...

(n) Compile and synthesize available scientific information on the possible impacts of geoengineering techniques on biodiversity 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;<sup>16</sup>

### **ETC Group Recommendations to the COP 10**

- **ETC group supports the adoption of a moratorium on geoengineering following the draft decisions recommended by SBSTTA 14, and emphasizes that if any exception is made for research, it must be clearly confined to laboratory research and computer modelling and that all *in situ* (real world) experiments fall under the moratorium. Further:**
- **The application of the precautionary principle via a moratorium on geoengineering deployment and experiments in the field is the most fundamental step that the Parties to the CBD should take in order to ensure the protection of biological diversity from the potential dangers posed by these technologies**
- **The compilation and synthesis of available scientific information on the possible impacts of geoengineering technologies must include the active participation of those who will be most affected by adverse impacts of these technologies: the local and indigenous communities of the global South.**
- **To avoid potential conflicts of interest, such compilations must give particular weight to assessments written by *bona fide* independent experts as well as to institutions and civil society organizations that are not involved in the conduct and promotion of geoengineering research and development**

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<sup>16</sup> *Ibid.*, p. 147.

## **ETC GROUP**

### **SIDE EVENTS AT COP 10, NAGOYA:**

#### **SYNTHETIC BIOLOGY AND NEXT GENERATION BIOFUELS**

Monday Oct. 18th, 13:15-14:45, Room 212A - Bldg 2, 1st Floor

#### **GEOENGINEERING: CHALLENGES FACING THE CBD**

Tuesday Oct. 19th, 13:15-14:45, Room 234C - Bldg 2 - 3rd Floor

#### **TERMINATOR TECHNOLOGY... THE BAD IDEA THAT WON'T GO AWAY**

Monday Oct 25, 16:30 - 18:00, Room 236 - Bldg 2 - 3rd Floor

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#### *ETC Group or Action Group on Erosion, Technology and Concentration*

*ETC Group is an international civil society organization. We address the global socioeconomic and ecological issues surrounding new technologies with special concern for their impact on indigenous peoples, rural communities and bio-diversity. We investigate ecological erosion (including the erosion of cultures and human rights); the development of new technologies; and we monitor global governance issues including corporate concentration and trade in technologies. We operate at the global political level and have consultative status with several UN agencies and treaties. We work closely with other civil society organizations (CSOs) and social movements, especially in Africa, Asia and Latin America. We have offices in Canada; USA, Mexico and Philippines.*