

Climate Change Mitigation Techniques: Assessing the Externalities of Reforestation and Geo-Engineering in Light of International Law

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A compelling moral case has been made that outsiders have duties of justice to share in the costs of rainforest protection, and thus that inhabitants of the states on whose territory these rainforests are found should not bear the burden of protection alone.¹ The idea is that the international community, and developed states in particular, compensate rainforest states for preserving their rainforests, as rainforests have the capacity to sequester carbon in ways that other resources or mechanisms do not. This capacity for carbon sequestration thus makes an important contribution to reducing greenhouse gas emissions and combating climate change.

This is an attractive argument, but for a lawyer, including an international lawyer as the present author, the proof of the pudding is in the eating. A solution may appear just, but for it to rise to the level of an international law rule – at least for those who embrace a formal sources theory of international law – states should also act upon it, and/or believe that the law requires them to behave in the prescribed way. Thus, the legal question is whether international law obliges developed states to transfer financial resources to developing states with a view to compensating them for not cutting down their rainforests. Methodologically, this question will be answered by examining international conventions and relevant state practice (with a view to identifying customary international law) in the field of international environmental law.

The analysis will not stop there, however. Assuming that compensatory financial transfers are a moral imperative, and an actual – although probably non-obligatory – practice, the contribution goes on to inquire whether a focus on such transfers as a leading climate mitigation strategy may not result in a tunnel vision that overlooks possible negative effects,

¹ See in particular the Ecuadorian Yasuní-ITT Initiative, which has also triggered Oliviero Angeli's contribution on 'Self-Determination and Sovereignty over Natural Resources', also in this issue.

as well as the potential (or risks) of other – complementary or rival – mitigation strategies. This danger should not be underestimated: the Conference of the Parties to the UN Framework Convention on Climate Change saw the international community enthusiastically throwing its weight behind financial transfers for climate change mitigation actions in developing countries' forest sector (although stopping short of couching this enthusiasm in binding legal terms),² without making much notable progress on other strategies.

One of such other strategies, and probably the most radical one, consists of using geo-engineering techniques, aside from, or even instead of financial transfers and capacity-building, to avert climate change. Such techniques aim, in the words of the Royal Society, 'to intervene in the climate system by deliberately modifying the Earth's energy balance to reduce increases of temperature and eventually stabilise temperature at a lower level than would otherwise be attained'.³ There are many techniques of climate geo-engineering, but the emphasis will be placed upon ocean iron fertilization,⁴ as this is the only geo-engineering technique which has so far been subjected to some international regulation.

As the perspective of this contribution is *legal*, it will *not* be examined whether one strategy is more effective than another in tackling climate change. The strategies have been selected as they begin to become implemented on the basis of regulatory fiat (financial transfers), or through technological experimentation (geo-engineering). They will be viewed as given. However, it is the aim of this contribution to review their design, implementation, and possible side-effects in light of international legal norms that protect individuals and the environment from the negative externalities of state and institutional action. Both the protection of rainforests and geo-engineering, in spite of their intuitive appeal, come with risks, which may produce violations of international human rights law and international environmental law. The further aim of the analysis is to – preliminarily – design a regulatory framework which sets out (a) the obligations of states in the context of the selected methods of climate change mitigation; (b) the methods, or modes of implementation, that are prohibited; and (c) the methods, or modes of implementation, that are authorized when specific conditions are satisfied.

² The decisions of UNFCCC COP19 (Warsaw 2013) are available at <http://unfccc.int/2860.php#decisions>.

³ Royal Society, *Geo-engineering the Climate*, London, 2009, 11.

⁴ Ocean iron fertilization is a technique that, by means of introducing iron into the surface waters of the oceans, boosts the growth of phytoplankton, which may in turn remove carbon from the atmosphere. *Id.*, 16.

1. On developed states' legal obligations to compensate developing states for not logging their forests

This first section attempts to answer the question of whether the proclaimed moral duty for developed states to compensate developing states for not logging their forests, also rises to the level of an international legal obligation.

Developed states' permanent sovereignty over their natural resources

There is an assumption in the aforementioned question which requires some justification up front, namely, that developing states are in principle free to log their forests on the basis of their permanent sovereignty over their natural resources.

Developed states can decide to log their forests, or they can decide not to. In the latter case, the argument goes that global justice may require compensation for developed states for the opportunity costs associated with preserving the forests. If developing states are *not* allowed to log their forests in the first place, one could perhaps still argue on moral grounds that third states are required to compensate, since refraining from logging has the same opportunity costs in this situation. In his parallel contribution to this issue, Angeli develops a cautious argument in this respect. In his view, rainforest states have the moral right to exploit their natural resources given the current structure of the international system, although countervailing considerations, such as being sensitive to the consequences of exercising these rights both for outsiders and future generations, may have to be taken into account. Whether this means that non-rainforest states have a corresponding moral duty to compensate rainforest states for not exercising their moral right, or at least for forgoing the exploitation of rainforests, remains rather implicit in his analysis. I am inclined to believe that Angeli takes the view that they have no such duty, where he points out that income rights - rights to gain income or benefits from the use or transfer of natural resources - are not as closely related to the ideal of collective self-determination in democratic states as control rights. This arguably means that rainforest states do not have a moral right to claim compensation from non-rainforest states, as a right to compensation is an income right and not a control right.

From a *legal* perspective, the argument that third states are required to compensate rainforest states for not committing an internationally wrongful act, is equally difficult to maintain. Once it is established that an internationally wrongful act has been, or is about to be committed, there is no 'financial costs'-based escape rule which states can rely on to justify

their behavior,⁵ or to condition compliance on financial assistance of other states, unless states have mutually agreed to such a rule in relation to a specific subject-matter. Accordingly, the further development of the legal argument as to whether developed states are required to compensate developing states, hinges on the existence of a principle allowing the latter to cut down their forests.

Such a principle does indeed exist, and is known as states' 'permanent sovereignty over natural resources' found on their territory. This principle came into being in a decolonization context, where, in essence, it meant that newly independent states were free to dispose of the natural resources found on their territory, without any interference from, or rights for, former colonial powers or their economic operators. This idea was famously laid down in the UN Natural Resources Declaration (1962),⁶ and the 1974 Declaration on the Establishment of a New International Legal Order.⁷ To be true, since the 1970s, international instruments have nuanced states' permanent sovereignty of their natural resources by drawing attention to the interests of the environment.⁸ Yet these instruments have no formal legal status, and, moreover, recent ones have highlighted the *balance* to be struck between environmental and developmental instruments.⁹ The principle of sustainable development enshrined in these instruments means that states could legitimately forego environmental protection options if such would further their socio-economic development. On the basis of this principle, a rainforest state's decision to cut down its trees could be justified should this serve its development purposes, at least insofar as specific tree species are not internationally protected by such international law instruments as the Convention on Biological Diversity to which the state concerned is also a party.¹⁰

The principle of permanent sovereignty over natural resources has also been restricted by states' becoming parties to the relevant agreements of the World Trade Organization, the General Agreement on Tariffs and Trade (GATT) in particular. By agreeing to GATT, states

⁵ See for the general circumstances precluding international wrongfulness: International Law Commission, *Draft Articles on Responsibility of States for Internationally Wrongful Acts*, November 2001, Supplement No. 10 (A/56/10), chp.IV.E.1, Article 20 *et seq.*

⁶ Declaration on Permanent Sovereignty over Natural Resources, UNGA Resolution 1803 (XVII) of 14 December 1962.

⁷ Declaration on the Establishment of the New International Economic Order, UNGA Resolution 3201(S-VI) of 1 May 1974, para. 4.

⁸ See notably Principle 21 of the 1972 Stockholm Declaration of the United Nations Conference on the Human Environment, and Principle 3(1) of the UNEP Draft Principles of Conduct in the Field of the Environment for the Guidance of States in the Conservation and Harmonious Utilization of Natural Resources Shared by Two or More States.

⁹ Principle 2 of the Rio Declaration on Environment and Development (1992).

¹⁰ Convention on Biological Diversity (adopted in Rio de Janeiro), 1760 UNTS 79; 31 ILM 818 (1992).

commit to the principles of free trade laid down in this treaty, and are precluded from justifying export restrictions with respect to their (supposedly valuable) natural resources, on the basis of the principle of permanent sovereignty. This was confirmed by a WTO Panel in the case of *China-Raw Materials* (2011).¹¹ We need not pause too long here, however, as the question is not whether a rainforest state has to share its natural resources with, and allow exportation of them to, other states. Rather, the question is whether non-rainforest states have an international duty to financially assist rainforest states in preserving rainforests with a view to carbon sequestration.

This legal question can best be answered by (1) ascertaining whether states have entered into treaties setting out a regulatory framework governing compulsory financial transfers; (2) whether in the absence of such treaties, customary international law regarding such a framework has come into being through state practice, and a conviction that such practice is compulsory (*opinio juris*).

Treaty law and financial transfers to protect rainforests

As far as treaty law is concerned, it is not disputed that there is no international agreement which has put in place a financial transfer system specifically aimed at protecting rainforests. That being said, a considerable number of multilateral environmental agreements (MEAs) require specific states – *developed states* and states in economic transition – to take the lead in contributing to the realization of a global public good. In contrast, obligations which *developing states* may have depend on the financial or technological assistance they receive from richer states. Let us concentrate specifically on the MEAs relevant to climate change: the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. Article 3 of the Kyoto Protocol makes it clear that only states listed in Annex I – these are the more developed states – ‘shall, individually or jointly, ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts, ... with a view to reducing their overall emissions of such gases by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012’. In accordance with Article 4(7) UNFCCC, developing countries’ implementation of the limited commitments they have under the Convention (laid down in Article 4(1) UNFCCC) depends ‘on the effective implementation by developed country Parties of their commitments under

¹¹ China – Measures Related to the Exportation of Various Raw Materials (5 July 2011), *WT/DS394/R*, Panel Report, paras. 7.157, 7.381-7.383, 7.407.

the Convention related to financial resources and transfer of technology'. Moreover, pursuant to the same provision, the extent to which developing countries will implement their commitments to combat climate change 'will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties'. Accordingly, one of the cornerstones of the international legal framework to tackle climate change is that states have *common but differentiated responsibilities* (CBDR) to protect the climate as a global public good. This concept of CBDR in the context of climate change action has been characterized as a *legally binding principle* (Hey 2011, 18; Stone 2004, 276; Cullet 2010, 161-181).

It is of course one thing to state that developed states have to take the lead in combating climate change, or that developing countries are under no obligation to reduce their emissions. But it is quite another to state that developed states have the specific obligation to reward (some) developing countries for not cutting down their rainforests with a view to reducing overall emissions. Such an obligation may have its normative roots in the CBDR principle, but it does not flow automatically from it – or as Ellen Hey has argued, CBDR 'cannot apply in an all or nothing fashion'.¹² CBDR only prescribes that economic disparities between states be taken into account when fashioning obligations under international environmental law, and thus steers solutions to environmental problems of global relevance, such as climate change, into a certain direction, whilst leaving open the question of *how* obligations should exactly be fashioned.

State practice and financial transfers to protect rainforests

Having established that treaty law does not require developed states to compensate developing states for protecting their rainforests, we proceed to address the question of whether developed states, in spite of not having specific treaty obligations in this respect, nevertheless, in actual practice, do reward developing states for not cutting down their forests, and if so whether such a practice is informed by a conviction of international legal compulsion (*opinio juris sive necessitatis*). This potentially allows us to discern (nascent) customary international law duties for developed states to transfer funds to developing states.

There is no denying that an impressive legal-institutional and financial machinery is currently being put in place to compensate developing states for sequestering carbon in their forests, while allowing developed states – and their corporations – to meet their targets of emissions

¹² *Id.*

reduction. This compensation may be either public or market-based: either a developed state or a climate fund simply grants money to a developing state in return for a commitment not to log forests, or a state/corporation transfers funds in return for an emissions allowance (under a market-based emissions trading scheme).

The Kyoto Protocol itself contemplates such North-South transfers in Article 12, which introduces ‘the clean development mechanism’ (CDM), the purpose of which is to ‘to assist Parties not included in Annex I [these are the developing countries] in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I [the developed countries] in achieving compliance with their quantified emission limitation and reduction commitments under Article 3’. This CDM is a mechanism that enables the execution of projects in developing countries through funding by actors based in developed countries. CDM projects have been rather successful (especially in Asia), notably because it is often cheaper for economic operators from developed countries to cut emissions in developing countries than at home (Sands, Millar 2011, paras. 4 and 7). Importantly for us, participation in CDM projects is *voluntary*: what matters is *that* emissions are reduced, not *how*. Thus, the existence of CDM cannot be seen as evidence of an obligation for developed nations to transfer funds to developing states for purposes of carbon sequestration in forests.

CDM has hardly been used in the forestry sector, for that matter, mainly so because the credits - Certified Emission Reductions or CERs - issued to CDM investors in forestry (temporary or long-term CERs) are valued less than the credits issued in other sectors.¹³ This choice is informed by concerns that carbon sequestration is potentially reversible,¹⁴ and by outstanding monitoring, reporting, verification and liability questions.¹⁵ Only by 2012 were CDM credits for a forestry project issued for the first time, for a Brazilian project.¹⁶ The European Union, for its part, has outright excluded forests from its EU Emissions Trading System in a 2009 Directive, although it may include them at a later date, depending on

¹³ According to para. 9.6.6.2 of the IPCC’s Fourth Assessment Report (2007), ‘the price for a temporary CER during the first commitment period is estimated to range between 14 and 35 % of that of a permanent CER from any other mitigation activity’.

¹⁴ *Id.*

¹⁵ Monitoring, reporting and verification was considerably strengthened by UNFCCC COP, Decision -/CP.19 - Modalities for measuring, reporting and verifying (2013), which provided in para. 1 that ‘measuring, reporting and verifying anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks... is to be consistent with the methodological guidance provided in [an earlier COP decision]’.

¹⁶ Point Carbon, ‘Brazil forest projects issued first temporary CERs’, 14 April 2012.

whether an international agreement will be reached on the establishment of an internationally recognized system for reducing deforestation.¹⁷

Such a binding international agreement has not yet been reached, but there is a growing number of – voluntary – initiatives aiming at carbon sequestration in forests through financial incentives, the REDD+ initiative being the most important one. REDD+, which stands for ‘reducing emissions from deforestation and forest degradation’, is specifically established as a mechanism through which the North channels money to the South in return for the South preserving its forests. This initiative seems to be confident that adequate measuring, reporting and verification systems could be set up in relation to carbon sequestration.

UN REDD, an initiative launched in 2008 by the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP), gives this fine description of the goal and functioning of REDD:

‘REDD is a mechanism to create an incentive for developing countries to protect, better manage and wisely use their forest resources, contributing to the global fight against climate change. REDD strategies aim to make forests more valuable standing than they would be cut down, by creating a financial value for the carbon stored in trees. Once this carbon is assessed and quantified, the final phase of REDD involves *developed* countries paying *developing* countries carbon offsets for their standing forests. REDD is a cutting-edge forestry initiative that aims at tipping the economic balance in favour of sustainable management of forests.’

Participation in REDD is voluntary; thus, its existence cannot serve as evidence of a nascent international law obligation to financially offset developing states’ choice *not* to cut their rainforests. Currently, only five states - Norway (by far the largest donor), Denmark, Spain, Japan, and Luxembourg - and the EU contribute to REDD.¹⁸ If the REDD projects prove to be successful, mainly in terms of monitoring/reporting/verification, and taking account of local populations’ interests, it is possible that a REDD+ mechanism will be included in a future binding post-Kyoto agreement.

For the time being, the UNFCCC has limited itself to stating at the 19th Conference of the Parties in Warsaw (2013) that ‘in the context of the provision of adequate and predictable support to developing country Parties, Parties should collectively aim to slow, halt and reverse

¹⁷ Article 28(1)(g) of Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community, *Official Journal L 140*, 05/06/2009, paras. 0063 – 0087.

¹⁸ UNDP, Multi-Partner Trust Fund Office, Trust Fund Factsheet, UN-REDD Programme Fund.

forest cover and carbon loss, in accordance with national circumstances'.¹⁹ To be true, at first sight, such a statement is encouraging from a global justice perspective, as it points to a collective responsibility of all UNFCCC Parties to compensate developing countries for not cutting down their forests. From a legal perspective, caution is in order, however, as the relevant document uses the non-legal term 'should' as opposed to the legal term 'shall', and drawing attention to 'national circumstances', it allows Parties to evade their responsibilities on grounds that are not further defined.

That said, these – for the time being 'soft' – obligations may, at a later stage, be enshrined in a legally binding agreement which could stipulate that developed states are *legally required* to financially assist developing states with carbon sequestration in forests. This could technically be done by making 'CDM forests' a compulsory component of states' mitigation mechanisms, and by strengthening the Green Climate Fund as the main gateway to transfer funds from developed to developing states as regards forestry carbon sequestration.²⁰

Side-effects of implementing financial transfers

The global justice-based principle, that developed countries should compensate developing countries for not cutting down their forests, is convincing, and deserves to be codified in treaties or other legal documents. Nevertheless, one should not turn a blind eye to the adverse effects of implementing this principle in practice. If such adverse effects are found, this need not detract from the validity of the principle in itself, but at least it calls for the taking of remedial measures or safeguards that limit the fall-out of the principle's implementation.

Existing practice with respect to REDD projects may be particularly instructive in identifying shortcomings or harmful consequences of North-South financial transfers to sequester carbon in forests. In truth, REDD has come in for a fair share of criticism. At the most fundamental level, it has been submitted that REDD may create a moral hazard in that it could serve as an excuse for developing countries not to cut their emissions at home.²¹ But even if one agrees

¹⁹ UNFCCC COP19 Warsaw (2013) Decision -/CP.19 - Guidelines and procedures for the technical assessment of submissions from Parties on proposed forest reference emission levels and/or forest reference levels.

²⁰ UNFCCC COP 19 in Warsaw (2013) has already recognized the 'key role that the Green Climate Fund will play in channelling financial resources to developing countries and catalysing climate finance'. Decision -/CP.19 Work programme on results-based finance to progress the full implementation of the activities referred to in decision 1/CP.16, para. 70. It remains to be seen now whether developed States will effectively place financial resources at the disposal of this Fund. It is not fully clear, for that matter, why the Green Climate Fund was recognized as the main gateway, as the Global Environmental Facility already serves as the financial mechanism for the UNFCCC.

²¹ See the leading critic of REDD, the website www.redd-monitor.org, run by Chris Lang. ('If we are to stand a chance of preventing runaway climate change we need to stop burning fossil fuels. We also need to protect

with the necessity of putting in place REDD-style projects to save the climate, one cannot dispense with giving some thought to major implementation problems which such projects run, and could run, into. For one thing, REDD risks abuse by unscrupulous investors reconverting rainforests into profitable plantations in the absence of an unambiguous legal definition of the notion ‘forest’.²² For another, it may become prone to corruption, as local firms may bribe local officials so as to start logging protected forests in spite of legally not being allowed to. Strong monitoring, verification, and reporting will be required to tackle these concerns. Furthermore, REDD may fail to tackle the real drivers of deforestation and forest degradation.²³ After all, REDD is limited to the transfer of money from developed States to developing States in return for the latter’s efforts to protect forests. In the absence of direct and adequate compensation of local economic operators’ losses, such operators will continue to log tropical hardwood, all the more so as long as there is an (international) market for it.²⁴ Accordingly, the international community may, as a complementary measure, also want to address the demand-side by regulating international commerce. Below, the EU’s measures in this regard will be briefly discussed.

Finally, REDD projects may insufficiently take into account the interests and rights of the local population who may agree to ‘forest protection’ without having given their free and informed consent.²⁵ A fine example is offered by the fierce opposition to the REDD agreement between Norway and Indonesia in respect of forests in Kalimantan inhabited by indigenous people, whose representatives called for an immediate moratorium on the REDD agreement in Central Kalimantan in 2011.²⁶ REDD projects are nevertheless supposed to take

forests, but trading REDD carbon credits would allow continued burning of fossil fuels, thus locking in polluting technology and postponing meaningful action.’).

²² See for civil society action against including forestry in emissions trading, e.g., FERN, ‘Keep Forests out of the ETS’, *EU Forest Watch*, Issue 133, December 2008.

²³ But see UNFCCC COP 19 Warsaw, Decision -/CP.19.

Addressing the drivers of deforestation and forest degradation (calling on parties, organizations and the private sector to take action to reduce the drivers of deforestation and forest degradation).

²⁴ Note even that, as the Indigenous Peoples’ Biocultural Climate Change Assessment Initiative has observed with respect to the REDD principles agreed on at UNFCCC COP19 in Warsaw (2013), that the very ‘Governments that are elaborating REDD+ policies are also promoting economic sectors such as cattle ranching, bio-energy, mining, oil exploration and agro-industrial monocultures that, ironically, are the main drivers of forest loss.’ IPCC, ‘REDD+ Agreement in Warsaw Threatens Indigenous Livelihoods’, 3 December 2013.

²⁵ See notably Michael Brown, *Redeeming REDD: Policies, Incentives and Social Feasibility*, EarthScan, 2013 (emphasizing the creation of ‘negotiation spaces’ and ‘new social contracts’ by the stakeholders involved). Note that Article 19 of the UN Declaration on the Rights of Indigenous Peoples, UN Doc. A/61/295 (2007) stipulates that ‘States shall consult and cooperate in good faith with the indigenous peoples concerned through their own representative institutions in order to obtain their free, prior and informed consent before adopting and implementing legislative or administrative measures that may affect them.’

²⁶ Statement of secretary general Abdon Nababan of AMAN, the Indigenous Peoples’ Alliance of the Archipelago, quoted in Chris Lang, ‘Kalimantan Forests and Climate Partnership faces yet more Criticism’, *REDD Monitor* 23 June 2011.

into account indigenous rights on the basis of UNFCCC REDD safeguards.²⁷ Yet these safeguards are not binding. Moreover, they may not exactly be in accordance with international human rights law (Conway: 2014). Ideally, given their expertise, international human rights bodies should be involved in further refining the UNFCCC safeguards.²⁸ At the same time, one should ensure that the safeguards are not designed so strictly as to become an obstacle to capital transfers to developing countries. In fact, the UNFCCC requirements of results-based finance may have already become so strict,²⁹ that the least developed countries face difficulties in satisfying them.

Arguably, international law on the REDD concept will only crystallize once these concerns are out of the way, and an international consensus on exact rules of implementation will emerge. The REDD principles agreed upon at the UNFCCC COP19 in Warsaw (2013) are a major step forward in this respect. While non-binding, they consolidate the basic rules of REDD financing, reference levels, safeguards, measuring, reporting, and verification, and institutional arrangements, for *all* REDD projects. In doing so, they should make support for developing countries both more adequate and more predictable.³⁰ But designers of REDD should continue to ensure that the ‘commodification’ of forests does not create perverse incentives for nontransparent State-to-State deals, and for Western investors to have their cake and eat it too, through receiving valuable carbon emissions certifications, whilst simultaneously exploiting Southern states’ natural resources in violation of indigenous peoples’ rights and these states’ sovereignty over their own natural resources.

2. Geo-engineering

There is a clear moral – although not yet a legal – case for an international obligation to support such ‘natural intervention’ as reforestation and afforestation as a climate change mitigation strategy. Admittedly, such intervention may produce some undesirable side-effects, in the sense that forestry commodification may at times prevail over local forest dwellers’ rights and interests. Increased stakeholder participation and rigorous monitoring could ensure,

²⁷ UNFCCC, Decision 1/CP.16 (2010), appendix I, para. 2(c) and (d).

²⁸ *Id.*

²⁹ See notably para. 3 of Decision -/CP.19 (2013), Work programme on results-based finance to progress the full implementation of the activities referred to in decision 1/CP.16, para. 70.

³⁰ UNFCCC, Decision -/CP.19 - Modalities for national forest monitoring systems (2013), para. 1.

however, that such side-effects be reduced. Accordingly, enhanced REDD-style programmes, combined with trade bans for illegally logged wood, are the road to take.

Still, even if such measures turn out to be successful, afforestation, reforestation, and deforestation avoidance may only contribute to at most 25 pct. of atmospheric CO₂ reduction by 2050 (Reyer, Guericke, Ibisch 2009, 15-34; Niles, Brown, Pretty et al 2002, 1621-1639). This may not suffice to bring a halt to global warming. To reduce more drastically CO₂ emissions in the atmosphere, more radical, technological solutions may have to be contemplated. Such technological solutions are denoted as ‘geo-engineering’.³¹ They are mainly comprised of carbon dioxide removal (CDR, e.g., carbon capture and storage in deep geological formations,³² or ocean fertilization³³) and – possibly more futuristic – solar radiation management (SRM, e.g., through space mirrors or stratospheric aerosol injection (Lane and Bickel 2013)).

One may argue that global justice principles in respect of forestry – developed nations compensating developing nations for preserving their forests – may provide guidance for geo-engineering projects, where some actors incur costs developing technologies from which others as a matter of course benefit. From a fairness perspective, indeed, one tends to agree, and legal solutions should be thus designed to reduce free-riding. As we write, however, the risk of some agents free-riding on the efforts of others is *not* at the center of the regulatory debate regarding geo-engineering. This debate is focused on whether such projects are lawful in the first place, rather than on spreading the costs of investments in geo-engineering projects. Unlike afforestation and reforestation, geo-engineering risks creating serious environmental harm, although ironically it is aimed at mitigating climate change through reducing harmful CO₂ emissions. Given the risks associated with (certain) geo-engineering techniques, the question arises whether such techniques should not be banned, or at least be subjected to stringent regulation. One is faced with a moral dilemma here, as by taking such measures, one would forfeit, or seriously circumscribe the climate mitigation opportunities offered by geo-engineering. At the same time, swooning for geo-engineering may create a moral hazard in that it risks diverting resources and interest away from other climate

³¹ See for a discussion: The Royal Society, *Geoengineering the Climate*, London, 2009.

³² See for an overview of relevant technologies, the London-based Carbon Capture & Storage Association, an association ‘promoting the business of capture and geological storage of carbon dioxide as a means of abating atmospheric emissions of carbon dioxide and tackling climate change’, <http://www.ccsassociation.org/>.

³³ This technique is further discussed below.

mitigation strategies, which are proven to be effective but require a radical lifestyle transformation (e.g., reduction of meat consumption and international travel).

Given this dilemma, it is unsurprising that the international community is rather ambivalent about geo-engineering. The IPCC's Fifth Assessment Report (2013) is illustrative in this regard. While stating that '[m]odelling indicates that SRM methods, if realizable, have the potential to substantially offset a global temperature rise', it highlights that '[t]here is insufficient knowledge to quantify how much CO₂ emissions could be partially offset' by geo-engineering, which, moreover, 'carry side effects and long-term consequences on a global scale'.³⁴ International regulators for their part have remained largely silent on geo-engineering, apparently awaiting the emergence of more scientific evidence as to its effective contribution to climate change mitigation, as well as its harmful effects.

Many geo-engineering techniques are still in their infancy, but one specific technique of geo-engineering is rapidly developing and actually being experimented with:³⁵ *marine* geo-engineering, and ocean fertilization in particular. Ocean fertilization is defined as 'any activity undertaken by humans with the principal intention of stimulating primary productivity in the oceans'.³⁶ It typically involves the introduction of iron into the ocean with a view to stimulating phytoplankton bloom, which in turn, through a biochemical process, removes carbon dioxide from the atmosphere. If practiced on a large scale it could prove to be a significant climate change mitigation technique.³⁷ At the same time, however, its potentially harmful effects remain largely unknown.³⁸ This explains why, as a precautionary measure, ocean fertilization has recently been subjected to some form of binding international regulation via a 2013 amendment to the London Dumping Protocol,³⁹ after recommendations

³⁴ IPCC, Fifth Assessment Report, Climate Change 2013: the Physical Science Basis. Summary for Policy Makers, 27, last paragraph.

³⁵ In the most eye-catching incident to date, Canadian First-Nation owned Haida Salmon Restoration Corporation, backed by U.S. businessman Russ George, dispersed 100 ton of iron west of the Canadian islands of Haida Gwaii in 2012, with a view to boosting salmon stocks through increased phytoplankton growth. Such phytoplankton growth could at the same time also contribute to carbon removal (see Russ George's subwebsite regarding geo-engineering: <http://russgeorge.net/category/geoengineering/>). See for the international outcry which followed: H. Fountain, 'Rogue Climate Experiment Outrages Scientist', *New York Times*, 18 October 2012.

³⁶ Annex 4, para. 1, Resolution LP.4(8) on the amendment to the London Protocol to regulate the placement of matter for ocean fertilization and other marine geoengineering activities, 18 October 2013.

³⁷ Boyd, Jickells, Law, Blain, Boyle, Buesseler, Coale, Cullen 2007, 612; Buesseler, Doney, Karl, Boyd, Caldeira, Chai, Coale, De Baar 2008, 162.

³⁸ See on the potential impact on biodiversity: Convention on Biological Diversity, Scientific Synthesis of the Impacts of Ocean Fertilization on Marine Biodiversity, CBD Technical Series No. 45, 2009.

³⁹ 1996 Protocol to the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972.

in the literature to this effect (see notably Scott 2013, 333-335; Rayfuse 2008, 324-325; Verlaan 2011, 186; Ginzky 2010, 57).

In essence, the London Protocol *outlaws* ocean fertilization,⁴⁰ and only allows it if a permit is issued in accordance with a specific assessment framework.⁴¹ In embracing this solution, States tried to wed the precautionary approach – pursuant to which scientific uncertainty should not be used as an excuse not to regulate, especially if the environmental risks are high – to the freedom of marine scientific research, and the latter’s potential to contribute to climate change mitigation.⁴² They contemplated the possibility of subjecting other marine geo-engineering techniques to the ocean fertilization regime,⁴³ while at the same time allowing such techniques, including ocean fertilization, to progress should they meet specific conditions relating to consultation, risk-management, monitoring, and effects-assessment.⁴⁴

The extensive technical regulation of the permit conditions cannot hide, however, that hard moral choices will have to be made, notably by balancing the adverse environmental effects of ocean fertilization with the climate change mitigation benefits accruing to it, or prioritizing one over the other. Indeed, how otherwise to interpret as vague a guiding rule as ‘[a] decision to issue a permit shall only be made if ... conditions are in place to ensure that, as far as practicable, environmental disturbance and detriment would be minimized and the benefits maximized’⁴⁵? It is of note that, under the London Convention and Protocol, permits are not issued *centrally* but by the States Parties themselves. These States may well decide to put a higher premium on the potential for climate change mitigation, and issue a permit even in the face of serious environmental risks. Such a decision may well be in compliance with the international assessment framework. And even if it was not, the issuing State may not risk any sanctions, since – as is the case with many multilateral environmental agreements – the relevant international compliance-monitoring body can only give advice and

⁴⁰ Article 6*bis*(1) London Protocol (‘Contracting Parties shall not allow the placement of matter into the sea from vessels, aircraft, platforms or other man-made structures at sea for marine geoengineering activities listed in annex 4, unless the listing provides that the activity or the subcategory of an activity may be authorized under a permit.’).

⁴¹ Article 6*bis*(2) London Protocol. The assessment framework is elaborated on in Annex 5 of the London Protocol.

⁴² Resolution LP.4(8) (2013), preambular paras. 5,7, 9 and 10.

⁴³ Draft guidance on a procedure for considering the inclusion of new activities in Annex 4 to the London Protocol [consideration of potential marine geo-engineering activities and procedure for considering their inclusion in Annex 4 to the London Protocol], LC 35/15 Annex 5.

⁴⁴ Annex 5 London Protocol.

⁴⁵ Annex 5 London Protocol, para. 26.5.

recommendations, or issue a formal statement of concern.⁴⁶ Nevertheless, since the adoption of the amendment to the London Convention and Protocol, States – at least those who will accept the amendment –⁴⁷ will have to justify their permit decisions before a world court of public opinion, even if they do not face harsh legal sanctions in case of non-compliance.

In the absence of a more rigorous assessment framework that gives more detailed instructions as to how to balance climate change mitigation benefits with the risk of environmental harm, at the end of the day, it remains difficult to judge States' conduct. While the assessment framework contains a large number of procedural obligations, there is no clear standard of substantive wrongfulness, and responsibility and liability issues have not been addressed. When amending the London Protocol for purposes of regulating ocean fertilization, one can ultimately not escape the conclusion that the Contracting Parties have eschewed making hard moral choices regarding the use of geo-engineering as a means to solve the global climate crisis. This reluctance is understandable, as ocean fertilization and other marine geo-engineering techniques are just a subset of a larger category of geo-engineering techniques that raise similar moral and regulatory issues. In fact, for the negotiators of the amendments to the London Protocol, it had already proved a challenge to subsume *fertilization* under *dumping*, which the London Convention and Protocol were originally designed to regulate (in the end, 'placement of matter' was placed alongside 'dumping of waste and other matter' to extend the scope of the Convention and the Protocol to include fertilization).⁴⁸ Such need for legal creativity more generally epitomizes the shortcomings of the current international legal framework when it comes to regulating geo-engineering. Therefore, the international community may want to develop a technology-neutral framework convention on the permissibility, or not, of geo-engineering, in which stark moral choices are made.⁴⁹ Such a convention should address (a) whether or not we are ready to countenance serious environmental harm in order to avert possibly more serious harm resulting from climate

⁴⁶ Compliance procedure and mechanisms pursuant to Article 11 of the 1996 Protocol to the London Convention 1972, adopted in 2007: LC 29/17, annex 7, para. 5.1.

⁴⁷ The London Protocol has only 42 Contracting Parties. However, the measures enshrined in the London Protocol could, via Article 194(3)(a) of the widely-ratified UN Convention on the Law of the Sea, indirectly become binding on all States Parties to the latter Convention. Said provision provides that States Parties shall adopt measures 'to minimize to the fullest possible extent ... the release of toxic, harmful or noxious substances, especially those which are persistent, from land-based sources, from or through the atmosphere or by *dumping*' (emphasis added).

⁴⁸ But note that as early as Resolution LC-LP.1(2008), the States Parties had already stated that ocean fertilization activities fall within the scope of the London Convention and the London Protocol.

⁴⁹ Compare Scott 2013, 353 (submitting that 'states need to address the ethical and moral issues associated with climate change mitigation in the Anthropocene *before* attempting to devise detailed regulations authorizing specific activities such as ocean fertilization research').

change; (b) moral hazard concerns, and, if geo-engineering is given a cautious go-ahead; (c) whether investing in geo-engineering could give rise to tradable carbon credit permits;⁵⁰ and, last but not least, (d) global justice-based financial transfers to those investing in geo-engineering solutions.

3. Concluding observations

This contribution started out with engaging, from an international law perspective, with the global justice-based premise that developed states have obligations to transfer financial resources to developing states so as to compensate them for preserving their rainforests. Such obligations have not yet risen to the level of legal obligations. However, States are increasingly aware of the fact that the protection, enhancement or extension of rainforests is one of the most serious options available for curtailing rises in greenhouse gas levels in the world's atmosphere, and that the legal principle of common but differentiated responsibilities requires developed states to help developing states tackle the tragedy of the commons. Dynamics at recent UNFCCC Conferences of the Parties have further added to this momentum. It is not excluded, therefore, that in the near future, obligations to transfer financial resources for purposes of rainforest preservation will be inserted into a binding international legal document pertaining to climate change mitigation. Practical challenges remain, however. How exactly to assess the amount of carbon stored in forests? Are investors' tradable Certified Emissions Reductions in respect of forests durable? Can implementation be adequately monitored? How should the opportunity cost of avoided deforestation precisely be calculated?⁵¹ Will the international community be willing to disburse the 30 billion dollars that are estimated to be annually needed to compensate rainforest countries for not cutting down their forests? From the legal norm-conflict perspective espoused in this contribution, the main challenge concerns the reconciliation of the REDD system with international human rights law in a way that does justice to the rights of forest-dwelling (indigenous) communities while not making REDD implementation so cumbersome that its supporters would consider abandoning it.

⁵⁰ Planktos, one of the corporations involved in ocean iron fertilization (and owned by Russ George, see above n 49), hopes one day to issue carbon credit certificates to recoup its investment in climate change mitigation. See <http://nancho.net/planktos/model.htm>. Such credits have not yet been officially approved.

⁵¹ See, e.g., statements of Brice Lalonde of the French delegation, EU Press conference, UNFCCC Poznan, 5 December 2008.

REDD programmes, however, may not sufficiently address the drivers of deforestation, nor may they suffice to mitigate overall climate change, especially if the world's consumption and production patterns do not change. Then, a more radical solution may have to be contemplated: geo-engineering aimed at removing carbon from the atmosphere or reflecting solar radiation. Climate change mitigation techniques raise legal concerns, however, and much more so than the others. Given their as yet unknown but potentially extensive environmentally harmful effects, application of the precautionary principle may call for rigorous regulation, which should nonetheless leave some room for legitimate scientific, including experimental, research that could shed further light on the benefits of geo-engineering. Regulators may find themselves between a rock and hard place here, though, as overly strict regulation of geo-engineering may come down to forfeiting a golden opportunity to drastically reduce carbon in a cost-effective manner.

Ultimately, states have no specific international obligations (yet) to implement, or assist others in implementing a specific climate change mitigation technique. They only have general obligations to reduce their carbon emissions on the basis of the Kyoto Protocol. This instrument leaves it largely open how exactly such reductions should be brought about. Thus, the various climate change mitigation techniques used, including those discussed in this contribution, are essentially voluntary in nature. The fact that they are voluntary does not mean that they are no longer relevant to international law, however: the very design and implementation of such techniques may produce undesirable side-effects that run afoul of specific international legal norms that protect a variety of (global) interests, such as human rights, national sovereignty, free trade, and biodiversity. When such side-effects are substantial, or unknown (though potentially substantial), climate change mitigation techniques may have to be strictly regulated, or even banned altogether.

Nonetheless, the question remains whether the classic rules of international law should not be interpreted somewhat more loosely, or even take a back seat, in the face of the global climate catastrophe which awaits us when we fail to sufficiently curb emissions. It is noted that, in extreme situations, international law allows states to invoke the – moral – defense of necessity as a ground for precluding the wrongfulness of an act, when this is the only way for the state to safeguard an essential interest against a grave and imminent peril.⁵² On this basis, a

⁵² Article 25(1) of the ILC Articles on the Responsibility of States for Internationally Wrongful Acts, above n 5. Note that this provision also requires that this act 'not seriously impair an essential interest of the State or States towards which the obligation exists, or of the international community as a whole'.

decision that failing to adequately address climate change is a greater evil than non-compliance with international norms, can be legally justified. It is nevertheless advisable, on legitimacy and transparency grounds, that if the international community is indeed of the view that necessity trumps compliance with the law when it comes to combating climate change, it takes such a decision *explicitly* and lays it down in an international instrument. Notably, in respect of geo-engineering techniques, such an instrument could be called for.

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