

# Planetary Boundaries and the Matching of International Treaty Regimes

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## 1 The Notion of Planetary Boundaries

International law is increasingly engaged with the notion of planetary boundaries. As social-ecological repercussions of human activities expand geographically, processes previously perceived as regional reveal global dimensions. This involves not only larger scales, but also increasingly complex and coupled social, technical and ecological processes and interactions. Yet, these developments have received only little attention in legal debate.<sup>1</sup>

In this article, I use two influential articles on planetary boundaries (hereafter *Planetary Boundaries*)<sup>2</sup> as starting-points when examining whether the described social-ecological processes, and related boundary themes, are matched by international treaty regimes. A core message of *Planetary Boundaries* is that the different boundary themes are coupled, so approaching – or indeed exceeding – one theme affects the boundaries also for the other processes. While aware of this complexity and the shortcomings in coordinating and integrating existing treaty regimes,<sup>3</sup> this article considers the even more elementary aspect, namely whether each boundary theme, considered separately, is somehow matched by international treaty arrangement(s).

The notion of planetary boundaries, affecting and affected by man, is not entirely new. We find it in concepts and metaphors in fiction and scientific works of the 1950s, -60s and -70s, where the Earth is described as a closed system with implied limits.<sup>4</sup> It is also evident in the title of the renowned report

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1 See however, R.E. Kim & K. Bosselmann, *International Environmental Law in the Anthropocene: Towards a Purposive System of Multilateral Environmental Management*, 2 *Transnational Environmental Law* (2013) 285-309. Also J. Ebbesson, *The Rule of Law in Governance of Complex Socio-ecological Changes*, 20 *Global Environmental Change* (2010) 414-422; A. Duit, V. Galaz, K. Eckerberg & J. Ebbesson, *Governance, Complexity, and Resilience*, 20 *Global Environmental Change* (2010) 363-386; and J. Ebbesson & C. Folke, *Matching Scales of Law with Social-Ecological Contexts to Promote Resilience*, in A.S. Garmestani and C.R. Allen (eds.), *Social-ecological Resilience and Law* (Columbia University Press, 2014).

2 J. Rockström et al., *A Safe Operating Space for Humanity*, 461 *Nature* (2009) 472-475; J. Rockström et al., *Planetary Boundaries: Exploring the Safe Operating Space for Humanity*, 14(2) *Ecology & Society* [2009] 32 [online], “[www.ecologyandsociety.org](http://www.ecologyandsociety.org)”. (visited 1 December 2013).

3 Some existing and possible attempts of “clustering” of international environmental regimes are provided by K. v. Moltke, *On Clustering International Environmental Agreements*, in G. Winter (ed.), *Multilevel Governance of Global Environmental Change* (Cambridge, 2006, p. 409-429. Also R.E. Kim, *The Emergent Network Structure of the Multilateral Environmental Agreement System*, 23 *Global Environmental Change* (2013) 980-991, examines the need to approach multilateral environmental agreements in the context of a complex networked system, and recommends against assuming that the overall institutional structure is fragmented.

4 In H. Martinson, *Aniara* (Stockholm, 1956), “Aniara” is a spaceship, but also a metaphor for the Earth. The Earth is described as a spaceship – and a closed economic system – also by K. Boulding, *The Economics of the Coming Space-ship Earth*, in H. Jarret (ed.), *Environmental Quality in a Growing Economy* (Baltimore, 1966). In the 1970s, James Lovelock introduced his hypothesis of “Gaia”, by which he did not only consider the Earth

*The Limits to Growth*, published in 1972, focusing on five global tendencies and problems: increasing industrialisation, rapid population growth, widespread under-nurturing, and environmental decline. Interestingly, long before the climate change debate took off, the report also included policy aspects of possible climate change due to increased CO<sub>2</sub> concentrations.

Yet, it was not until the report *Our Common Future* by the World Commission on Environment and Development, in 1987, that the notion of planetary boundaries really started to influence international environmental governance and law.<sup>5</sup> The concept of sustainable development runs through *Our Common Future*, and it has had a huge impact on the perception of international environmental politics and law. The World Commission on Environment and Development defines sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.<sup>6</sup> This reflects the notion of boundaries for the utilisation of the Earth's resources:

“But ultimate limits there are, and sustainability requires that long before these are reached, the world must ensure equitable access to the constrained resource and reorient technological efforts to relieve the pressure.”<sup>7</sup>

Boundaries and limits based on ecological considerations are not entirely new in environmental law scholarship either.<sup>8</sup> Yet, *Planetary Boundaries* differs from previous approaches to boundaries, including “critical loads”, by emphasising the dynamic and tightly coupled character of the suggested boundaries. Thus, *Planetary Boundaries* argues that a change with respect to one boundary theme may affect one or more boundaries. In addition to telling us that there are boundaries, *Planetary Boundaries* tries to define several of them.

A starting-point for *Planetary Boundaries* is the relatively stable environment of the current interglacial period that begun some 10,000 years ago – the Holocene – in which the key biogeochemical and atmospheric parameters have fluctuated within a relatively narrow range. This stability has allowed agriculture and complex societies to develop and flourish. According to the *Planetary Boundaries*, however, humans are now effectively pushing the planet outside the Holocene range of variability for many key Earth system processes. The Earth is thus entering into a new epoch – the Anthropocene –

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as a closed system, but also as a living super-organism; see J. Lovelock, *The Ages of Gaia: a Biography of Our Living Earth* (Oxford, 1995).

5 World Commission on Environment and Development, *Our Common Future* (Oxford University Press, Oxford, 1987).

6 *Ibid.*, p. 43.

7 *Ibid.*, 42-46, quotation at p. 45.

8 See in particular the writings of Staffan Westerlund e.g. *Where Would Mankind Stand Without Land*, in E.M. Basse, J. Ebbesson and G. Michanek (eds.), *Fågelperspektiv på rättsordningen: vänbok till Staffan Westerlund* (Iustus, Uppsala, 2001), p. 19-55; *En hållbar rättsordning: rättsvetenskapliga paradigmer och tankevändor* (Iustus, Uppsala, 1997); and *Miljörättsliga grundfrågor 2.0* (Iustus, Uppsala, 2003).

where humans are a dominant factor for the changes of the Earth system. Put together, human activities may push the Earth system out of the equilibrium which has prevailed for thousands of years. Human activities are already exceeding some boundaries for safe operational space, which may entail harmful and even disastrous effects for large parts of the world. With these starting-points, the *Planetary Boundaries* asks:

“What are the non-negotiable planetary preconditions that humanity needs to respect in order to avoid the risk of deleterious or even catastrophic environmental change at continental to global scales?”

The authors then move on to try to identify the planetary boundaries for key processes of the Earth system associated with dangerous thresholds, the crossing of which could push the planet out of the desired Holocene state. Important in this endeavour is the distinction made between *thresholds*, defined as the intrinsic features of the human-environmental systems, defined by a position along one or more control variables, and *boundaries*, which are human-determined values of the control variable set at a safe distance from a dangerous level or from its global threshold. It follows that “determining safe distance involves normative judgments of how societies choose to deal with risk and uncertainty.”

The nine boundary themes examined in *Planetary Boundaries* are:

1. climate change
2. ocean acidification
3. stratospheric ozone layer depletion
4. atmospheric aerosol loading
5. global phosphorus and nitrogen cycles
6. global freshwater use
7. rate of biodiversity loss
8. land-system change
9. chemical pollution

*Planetary boundaries* has been intensively debated and also criticised, not least for the way the boundaries are defined.<sup>9</sup> One can also question why certain boundaries are included, such as land system and land-use, while other themes, of significance for resource usage and the impact on ecosystems, such as the growth of the population, have been left out of the study. Despite these criticisms and the uncertainties acknowledged also by the authors themselves, I will use the conclusions of *Planetary Boundaries* as a starting point when

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9 For an early critique, see e.g. *Commentary: Planetary Boundaries*, in 3 Nature Reports Climate Change (2009:10) 112-119, at “[www.nature.com/nclimate/](http://www.nature.com/nclimate/)”.

examining whether international treaty regimes match the defined boundaries and related processes.

When describing the boundaries, I rely closely on the formulations of *Planetary Boundaries* (even when I use no quotation marks). Determining the planetary boundaries as well as the legal and political dealing with the problem involves risks and uncertainties. Each threshold is defined with some degree of uncertainty, and the underlying environmental objectives of international treaties are also defined with varying exactitude. Apparently, these margins and objectives of international agreements, although relevant scientific research is considered, depend on values, balances and compromises. Rather than examining whether the proposed planetary boundaries are in themselves correct or probable, I focus on the scales of the treaty regimes to examine whether they match the described key processes of the Earth system.

## 2 Planetary Boundaries, Governance and Law

### 2.1 *Boundary Themes, International Regimes and International Principles*

*Planetary Boundaries* focuses on the boundary themes associated with specific social-ecological processes of global dimensions. Yet, environmental law and governance comprise different levels and scales (planetary, continental, regional, local etc.) simultaneously. Regardless of geographical scope, the possible agreed measures, cooperation, policies and legal frameworks must be anchored and implemented locally, so as to influence the conduct of individuals, for instance with respect to the introduction of greenhouse gases, use of energy and food habits. Put together, national and local laws are therefore critical for the possibility of implementing global accords so as to avoid international environmental problems.<sup>10</sup> However, even if we agree that norms and actions on these different levels and scales should be integrated in order to provide optimal resilience and robustness of social-ecological systems,<sup>11</sup> crucial questions remain, for instance:

- How should policies, legal norms, institutions and network be designed and which measures should be taken on which level/scale?
- Who should (be able to) participate in the control of this development and implementation?
- How should environmental and resource concerns be managed; top-down, bottom-up, polycentrically or otherwise?

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10 J. Ebbesson, *Compatibility of International and National Environmental Law* (Kluwer Law International, London/The Hague/Boston 1996).

11 E.g. E. Ostrom, *A Polycentric Approach for Coping with Climate Change*, World Bank Policy Research Working Paper 5095 (World Bank, Washington DC, 2009).

While there are hardly any general answers to these questions, it is clear that the character and geographical scope of each issue are significant factors for the design of effective law and governance. Despite the significance of integrating law and politics of different levels and scales, I limit my examination to international law, in particular treaty regimes, in light of the nine planetary boundaries identified in *Planetary Boundaries*.

For some of these boundary themes international law and institutions appear rather well suited, but for most themes the legal and institutional structures matching is far from optimal. Although the international community tends to treat interconnected environmental matters on a sectoral basis rather than in a comprehensive manner,<sup>12</sup> international law develops not only through different sectors or with focus on a specific environmental problem. In addition, cross-sectoral legal developments matter for the identified planetary boundaries, for the protection of health and the environment and for the use of natural resources in general.

First, planetary environmental governance depends on customary international law and on general principles of international law, e.g. on state sovereignty and states' duty to consider environmental effects and to cooperate. These principles may promote or undermine sustainable development and the respect for the defined boundaries. Second, several international treaties set out trans-sectoral principles for the protection of the environment, e.g. on non-discrimination, environmental impact assessments in transboundary contexts, the prevention of industrial accidents, and on public participation in decision-making procedures. If effectively applied, these principles strengthen the protection of health and the environment. Third, the prospect for protecting health and the environment and for moving toward sustainable development is affected by international law and institutions which are not primarily addressing health or environment issues. One such example is the World Trade Organization, which restricts the use by its member states of trade and import restrictions. Another example is found in the numerous bilateral investment treaties, which may limit states' environmental policy space.<sup>13</sup> Yet another example is found in the international legal frameworks for the protection of human rights, which may promote the protection of the environment.

With this in mind, we may consider each boundary theme in a legal context.

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12 Kim & Bosselmann, above note 1, p. 286.

13 Å. Romson, *Environmental Policy Space and International Investment Law* (Stockholm University 2012).

## 2.2 Climate Change

Climate change is possibly the most complex of the identified social-ecological processes, politically and legally. While there is no doubt that the climate is changing and that human factors add to this change, plenty of uncertainties remain in terms of causal relationships and costs. In addition, climate politics engages complex dimensions of justice and fairness, including concerns for the distribution of burdens and benefits as well as for the structures of participation in decision- and policy-making of those concerned, globally, regionally and locally, within each country.<sup>14</sup>

*Planetary Boundaries* defines the planetary boundary for climate change in two ways, as the atmospheric concentration of carbon dioxide (350-550 ppm) and as energy imbalance at Earth's surface (1-1,5 W/m<sup>2</sup> above pre-industrial level).

Climate change is genuinely a global process, and so is the dominant legal framework for climate change: the 1992 United Nations Framework Convention on Climate Change (UNFCCC) with the 1997 Kyoto Protocol to the UNFCCC (KP).<sup>15</sup> More than 190 states are parties to the UNFCCC and KP, although some major contributors are not parties to the KP. The UNFCCC does not impose specific duties on reducing the introduction of greenhouse gases, but importantly, "developed country Parties" are obliged to communicate regularly their policies and measures "with the aim of returning individually or jointly to their 1990 levels these anthropogenic emissions of carbon dioxide and other greenhouse gases".<sup>16</sup> Moreover, the UNFCCC sets out the parties' "common but differentiated responsibilities", and obliges the developed country parties to take the lead in combating climate change and the adverse effects thereof.<sup>17</sup>

While cumbersome and bureaucratic, the genuinely global character of the UNFCCC warrants legitimacy for the measures and policies agreed to. The UNFCCC has also been criticised for being too vague and unspecific in defining the duties of the parties, yet it provides a flexible platform, which makes it possible for the parties to develop new concepts and instruments in order to stabilise the amount of greenhouses in the atmosphere.

Through the KP, developed country parties committed themselves to reduce jointly, but with differentiated levels, their overall emissions of greenhouse gases by at least 5 percent below 1990 levels in the commitment period 2008 to 2012.<sup>18</sup> KP also established the foundation for different flexible mechanisms to implement these reduction commitments. It was apparent already at the signing

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14 J. Brunnée, *Climate Change, Global Environmental Justice and International Environmental Law*, in J. Ebbesson & P. Okowa, *Environmental Law and Justice in Context* (Cambridge University Press, Cambridge, 2009), p316-332.

15 31 *International Legal Materials* (ILM) (1992) 849; 37 ILM (1998) 22.

16 UNFCCC, Art4(2b).

17 UNFCCC, Art3(1).

18 KP, Art3(1).

of the KP in 1997 that the agreed level of reduction was inadequate to stabilise the concentration of greenhouse gases, and this has become even more apparent since then. At the time of writing, the UNFCCC parties have not been able to agree on updated legally binding commitments for the post 2012 period, but several parties have made voluntary commitments, which are not legally binding, through the 2009 Copenhagen Accord and the 2010 Cancun Agreements.<sup>19</sup> A binding accord is intended for 2015.

The fact that neither the UNFCCC nor the KP has resulted in – or even come close to – stabilisation of the concentration of greenhouse gases, despite all meetings and decision-making at the global scale, makes it tempting to disapprove of the entire climate change regime. However, that conclusion would be too rash. The failures result rather from the lack of capacity to agree on measures and reduction levels. Despite all shortcomings, it is difficult to create a regime of global scope, which would lead to better and more comprehensive measures. For sure, it could be more effective if the, say, 20 states which represent the major emissions agreed on far-reaching reductions outside the scope of the UNFCCC. The UNFCCC could also be supplemented by regional efforts and agreements. Moreover, new forms of governance, legal commitments, measures and programmes should be promoted locally, through bottom-up initiatives. Legal norms affect our climate behaviour not only through bans and orders, but also through different encouraging initiatives from private persons, civil society associations and the private sector.

The greatest challenge in matching the legal and political design and outcomes to the features of climate change and the actual boundaries is the failure among the states concerned in agreeing on the level(s) of commitments and on the distribution of burdens within and between the two rather inadequate categories of developed and developing country parties. A major advantage of a global framework for the post 2012 period, with binding reduction levels, would be the creation of a common level field. This, in turn, could provide trust and predictability at a global scale, without unnecessary detailed regulations, for the development of technology, investments, planning and other efforts.

### 2.3 *Ocean Acidification*

Ocean acidification is a recently discovered environmental problem. It was previously thought that acidification would not occur in oceans because of the capacity of seawater to neutralise acidifying substances.<sup>20</sup> Now, it is shown that the increasing concentration of atmospheric carbon dioxide has quickly caused serious acidification of the surface ocean water (decrease by ca 0.1 Ph units). Acidification harms the marine ecosystems, in particular by decreasing

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19 Decision 2/CP.15, Copenhagen Accord, 18 December 2009, FCCC/CP/2009/11/Add.1; Decision 1/CP.16, The Cancun Agreements: Outcome of work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention, FCCC/CP/2010/7/Add.1.

20 J. Havenhand et al., *Havs försurning – nytt problem i klimatförändringens spår*, Havet (2008), p. 27-30.



the seawater saturation state for different types of calcium carbonate (aragonite and calcite). This may have serious impacts on coral reefs and associated ecosystems, since corals may stop growing and different shells may dissolve. Moreover, acidification in itself affects the ability of oceans to function as sinks for carbon dioxide (currently oceans are removing about 25 percent of human emissions).

The boundary value proposed by *Planetary Boundaries* is relative, and defined as the maintenance of at least 80 percent of the pre-industrial aragonite saturation state of mean surface seawater.

Since ocean acidification is caused by climate change, the UNFCCC, with the KP, is suitable also to address and mitigate this process. Moreover, more than 160 states are parties to the 1982 United Nations Convention on the Law of the Seas (UNCLOS).<sup>21</sup> The UNCLOS legal design and institutional feature differ significantly from that of the climate change regime. The UNCLOS parties are generally obliged to protect the marine environment, through the adoption of legislation and other measures so that activities under their jurisdiction and control do not cause harm to the environment of other states or cause pollution to sea areas outside their jurisdiction.<sup>22</sup> The UNCLOS general principles for the protection of the marine environments also apply to CO<sub>2</sub> emissions to the atmosphere, which cause oceanic acidification. Yet, UNCLOS does not set out specifically what to do in order to reduce marine pollution or to avoid acidification. Rather, UNCLOS is drafted in a way which presupposes that such rules exist elsewhere – which, alas, is not the case. No treaty or international regime of global or regional scope adequately addresses oceanic acidification. The International Maritime Organization administers several global legal frameworks designed to reduce marine pollution from maritime activities, but they are not intended to tackle oceanic acidification due to increased atmospheric CO<sub>2</sub> concentrations.

Since the 1970s, about a dozen of regional sea conventions have been adopted, e.g. for the North-east Atlantic, the Baltic Sea, the Mediterranean, the Caribbean and parts of the Pacific Ocean, the Atlantic and the Indian Ocean. Most of these conventions set stricter obligations than the UNCLOS. While not specifically focused on acidification, their general principles apply also to activities causing acidification. These regional regimes could provide platforms for joint action plans and decision on measures to limit acidification, but so far this issue has not been given top priority.<sup>23</sup>

The most ambitious, and partly successful, international legal framework to combat acidification is the 1979 UNECE Convention on Long-range Transboundary Air Pollution (Air Pollution Convention),<sup>24</sup> which applies to Europe, Central Asia and North America. While several protocols to the Air

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21 21 ILM (1982) 1261.

22 UNCLOS, Arts 192-194, 197-201, 207 and 212.

23 For instance, the rather comprehensive 2007 Baltic Sea Action Plan does not prioritise acidification of the sea; see Helsinki Commission “www.helcom.fi” (visited 1 December 2013).

24 18 ILM (1979) 1442.

Pollution Convention are intended to reduce emissions of acidifying substances, they focus on sulphur and nitrogen oxides – and the emissions of these substances have been significantly reduced. However, oceanic acidification due to increased concentration of carbon dioxide has not entailed any legal regulation within the Air Pollution Convention.

Rather, oceanic acidification shows that the changed character of the environmental problems significantly affects the relevance of the institutions created to solve a problem. Thus far, acidification policies have centred on sulphur and nitrogen oxides, and acidification has been considered a regional problem. Now we see that ocean acidification is a genuinely global process. Therefore, the acidification of, say, the Baltic Sea or the North-east Atlantic cannot be resolved only by the states in these regions.

This will instead be yet another issue to be considered and dealt with through norms and measures within the global legal frameworks, in particular the UNFCCC, but also within the UNCLOS and the 1992 Convention on Biological Diversity (CBD, further discussed in section 2.8). It has also been proposed that a new global treaty regime on ocean acidification be negotiated.<sup>25</sup> Neither the UNFCCC, UNCLOS nor the CBD define specific measures or actions concerning oceanic acidification, but in theory all three treaty regimes could provide the basis for more detailed rules and measures on the issue, through separate protocols or related agreements. UNCLOS has a more advanced system for dispute resolution than the UNFCCC, the CBD or any other international environmental treaty of global application. Even so, the diffuse character of oceanic acidification makes it difficult to hold one specific state responsible for a certain harm caused by acidification. A court procedure may well highlight important questions of principle concerning states' responsibilities for climate change, but it is hardly the most effective way to achieve stabilisation of climate and oceanic pH value. Rather, a global action programme to combat oceanic acidification could be adopted with any of these three global regimes – on climate change, the law of the sea or on biodiversity – as the basis. Since the measures would be so closely related to climate change, the UNFCCC appears to be the most appropriate, unless a new treaty regime is to be negotiated.

#### **2.4      *Stratospheric Ozone Layer Depletion***

The depletion of the stratospheric ozone layer is also a genuinely global process. It is caused by human introductions of ozone depleting substances, in particular CFCs, to the atmosphere. Depletion of the ozone layer results in increased – adverse – exposure of human beings, animals and plants to ultra violet radiation. Some ozone depleting substances also contribute to the added green house effects. In linking to climate change as well as to loss of

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25 R.E. Kim, *Is a New Multilateral Environmental Agreement on Ocean Acidification Necessary?*, 21 *Review of European Community & International Environmental Law* (2012) 243.

biodiversity, ozone layer depletion thus reveals how different environmental problems and means to solve them are interconnected.

According to *Planetary Boundaries*, in the case of global, extra-polar stratospheric ozone, there is no clear threshold around which to construct a boundary. Therefore, a boundary, defined as less than 5 percent decrease from pre-industrial levels (of 290 so called Dobson Units, measured as a total-column ozone, from the outer atmosphere, including the stratosphere, down to the earth's surface), is suggested.

Ozone depletion is the only proposed boundary theme for which the boundary is not yet passed. International cooperation on ozone layer depletion is commonly described as one of rather few success stories of global environmental politics and law. The 1985 Vienna Convention on the Protection of the Ozone Layer provides a platform for global cooperation, and through the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, which has been changed several times, the international community was able to agree relatively swiftly on the phase out of ozone depleting substances.<sup>26</sup> In many ways, the structure of the regime for ozone depletion resembles that of the UNFCCC and the KP; indeed it appeared as a model for the climate change negotiations. Even so, ozone layer depletion is considerably less complex – environmentally, politically and legally – than climate change.

The Montreal Protocol obliged first the industrialised countries and then the other countries to phase out and ban the new uses and production of a large number of ozone depleting substances. The phase-out and ban of these substances has had a positive effect, although it will take years until the ozone layer is restored. In addition, since many ozone depleting substances also have a negative effect on climate change, the phase-out and ban of these substances have the positive effect of preventing some green house gases from being introduced.

The successes should not only be credited to the regulations as such; it is a result of diplomatic skills and political will, but also of the development of alternative substances with no ozone depleting potential. Nevertheless, the concerted actions within the described global regime are a good case to show how efforts and institutional response can match the environmental problem.

## 2.5 *Aerosol Loading*

Aerosols are small particles (ranging from some nm to ca 100 µm) in the air, and appear as clouds, haze and pollution. Aerosols may affect the Earth's radiation balance, hydrological cycles and the creation of clouds, and may thus significantly influence regional temperature and climate. *Planetary Boundaries* describes atmospheric aerosol loading as an anthropogenic global change process for two reasons: (i) the influence of aerosols on the climatic system, and (ii) their adverse effects on human health at a regional and global scale. Yet, because of the complexity of aerosols, e.g. with different sources, impacts

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<sup>26</sup> 26 ILM (1987) 1529; 21 ILM (1987) 1550. The numerous changes of the Montreal Protocol can be found at “[www.ozone.unep.org](http://www.ozone.unep.org)” (visited 1 December 2013).

and spatial and temporal dynamics, it is still not possible to identify a safe boundary for aerosol loading.

The cooling impact of aerosols on climate makes them part of a global ecological process and global environmental problem. Aerosols are not a new theme for climate change research; and while aerosols may counter climate change, they can and should be considered globally within the UNFCCC (although not as a measure to stabilise the climate). The significant damage of aerosols on human health and the environment also makes regional regimes and efforts important for any future concerted actions.

While there is no international legal framework which directly regulates aerosols, aerosols are not only caused and introduced by different primary sources. Aerosols are also created through formations of different pollutants, such as sulphur dioxide, nitrogen oxides and volatile organic substances and compounds. Therefore, the mentioned regional Air Pollution Convention and its related protocols are important to reduce the amounts of aerosols. The Air Pollution Convention applies to Europe, Central Asia, Russia, Canada and the USA. The 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (last amended in 2012) sets emission standards for stationary sources and – more importantly – national caps, i.e. the total emission reductions, for each party. According to the Air Pollution Convention secretariat, the 1999 Protocol, when/if fully implemented, is expected to result in the following reduction levels in Europe compared to 1990 levels: sulphur cut by at least 63 percent; nitrogen oxides by 41 percent; volatile organic compounds by 40 percent, and ammonia by 17 percent.<sup>27</sup>

Although the 1999 Protocol to the Air Pollution Convention does not cover all sources of aerosols, it provides at least one international regime which matches the regional scale of the effects on health and the environment. Still, this regime is exceptional, and there is no corresponding legal framework applicable to other industrial regions, such as South America or South-east Asia.

## **2.6 *Interference with Global Phosphorous and Nitrogen Cycles***

Eutrophication due to human introduction of nitrogen and phosphorous can push the aquatic and marine systems to new stable states with abrupt ecological shifts. This is a serious and complex problem in aquatic and marine environments e.g. in northern Europe and other regions. According to *Planetary Boundaries*, in addition to causing undesired non-linear change in terrestrial, aquatic and marine systems, increase in nitrogen and phosphorous flows may function as a slow driver influencing anthropogenic climate change at the planetary level. Although nitrogen and phosphorous cycles could be considered two separate boundary themes, they are identified as one common theme because of the close interaction between the two substances as key biological nutrients in driving abrupt shifts in the Earth's sub-systems. Aware

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27 UNECE, Air Pollution, “[www.unece.org](http://www.unece.org)” (visited 1 December 2013).

of the great uncertainties and difficulties in quantifying the boundaries for these nutrients, *Planetary Boundaries* suggests the boundary for nitrogen flows initially at 25 percent of the total amount of nitrogen (molecular nitrogen, N<sub>2</sub>) fixed naturally by terrestrial systems. This means a limit of industrial and agricultural fixation of nitrogen to 35 mega tonnes nitrogen per year – but this is described as “a first guess only.” The proposed planetary boundary for anthropogenic phosphorous inflow to the oceans is set at less than 10 times the natural background weathering flux of phosphorous. Both these values refer to boundaries at the planetary level in order to create a global operating space, rather than boundaries to avoid eutrophication or lack of oxygen in specific local or regional marine environments.

While there is no international legal framework intended to deal with eutrophication only, UNCLOS as well as the mentioned regional seas conventions all apply to marine pollution through nitrogen and phosphorous. Moreover, eutrophication, as opposed to oceanic acidification, is explicitly a legal issue both in the 1992 Baltic Sea Convention and, although to a lesser extent, the 1992 North-east Atlantic Convention. Accordingly, the convention parties of these two regions shall take measures to prevent emissions of nitrogen and phosphorous.<sup>28</sup> For both these regimes, eutrophication has been given much attention also in the agreed measures and action plans.<sup>29</sup> UNCLOS as well as the regional seas conventions are applicable to atmospheric nitrogen, which may also add to eutrophication.

Eutrophication has been given priority within the regional Air Pollution Convention too. As indicated by its title, the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone also applies to nitrogen emission through the atmosphere. The Protocol sets out, inter alia, national emission caps for nitrogen oxides and ammonia,<sup>30</sup> which, if complied with, should result in a reduced introduction of nitrogen in near sea areas.

There is no global counterpart to the Air Pollution Convention, but UNCLOS becomes increasingly relevant as the flows of nitrogen and phosphorous entail global impacts – at that stage neither the regional seas conventions nor the regional air pollution regime suffice geographically. UNCLOS defines fundamental principles for states’ responsibility not to harm the marine environment, although it sets no specific obligation concerning eutrophication. It would for sure be possible to develop a specific legal framework concerning nitrogen and phosphorous flows through an agreement or protocol related to UNCLOS, but thus far there is no such development. This is not surprising, since not even the regional regimes which are

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28 Baltic Sea Convention, arts 3, 5 and 6 and annexes I(1.2) and III(I.1.2 and II); North-east Atlantic Convention, Art3, annex I and appendix 2.

29 A specific strategy has been adopted concerning eutrophication as part of the 2003 Strategies of the OSPAR Commission for the Protection of the Marine Environment of the North-east Atlantic; “www.ospar.org” (visited 1 december 2013). Eutrophication is a major “segment” of the 2007 HELCOM Baltic Sea Action Plan; “www.helcom.fi” (visited 1 December 2013).

30 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone, Art3(1 and 10) and annex II (tables 2 and 3).

geographically well designed to deal with eutrophication have been able to develop sufficient measures and actions regionally, to effectively limit the introduction of nutrients into the seas.

## 2.7 *Global Freshwater Use*

Access to fresh water differs significantly from one region to the other, so it is not obvious that the underlying social-ecological processes or problems should be considered genuinely global. Rather, they appear as similar problems around the world. Yet, *Planetary Boundaries* explains the inclusion of fresh water use by pointing at the dominance of humans as the driving force to alter global-scale river flow and the spatial patterns and temporal timing of vapour flows. It is estimated that the use of freshwater result in 25 percent of the world's rivers running dry before reaching the oceans. Changed freshwater cycle (“global manipulations of the freshwater cycle”) adversely affects various ecological functioning, such as providing habitats for fish recruitment and regulating climate, thus weakening the resilience of ecosystems. In all, these processes may thus challenge planetary boundaries.

In water studies, a difference is made between two types of water: “blue water”, i.e. continental water that runs off through lakes, rivers and ground water; and “green water”, which is the fraction of rainfall that infiltrates and remains in the soil, available to plants. While a planetary boundary for freshwater resources must sustain enough green water flows (for moisture feedback to generate rainfalls) and secure access to blue water, the proposed boundary refers to consumptive blue water. *Planetary Boundaries* estimates the total amount of accessible blue water resources at 12,500-15,000 km<sup>3</sup> per year, and sets the planetary boundary at 4,000 km<sup>3</sup> of consumptive blue water per year (with a considerable zone of uncertainty). It is argued that exceeding this boundary for water consumption may entail collapse of terrestrial and aquatic ecosystems, major shifts in moisture feedback, and freshwater/ocean water mixing at regional and continental scales.

Today, international treaty regimes apply to most of the larger transboundary watercourses and lakes.<sup>31</sup> Although these treaties may have some common elements and characteristics, they differ significantly depending on when they were established and on political, economic, hydrological and ecological circumstances. Their relevance for managing the water area also differs depending on the legal design as well as political circumstances. Many treaties on watercourses create some form of intergovernmental body, whether a commission, a secretariat or regular meetings of the parties. Many treaties also set out the parties' duties to protect the watercourse through fundamental, although general, principles. Some treaties define how the volume and use of

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31 31 S. C. McCaffrey, *The Law of International Watercourses: Non-Navigational Uses* (Oxford, 2001) analyses relevant principles of international law, which govern states' rights and obligations in the use of watercourses. For a comparative study on international legal frameworks and institutions for international watercourses, see K. Malla, *The Legal Regime of International Watercourses* (Stockholm, 2005).

the water is to be distributed among the parties, while in other contexts, the exact allocation may be decided jointly within the scope of the applicable legal framework. Obviously, the effectiveness, degree of cooperation and regulation within these frameworks also differ from one watercourse to another.

An attempt to globally define legal principles for the use of watercourses is found in the 1997 UN Convention on the Law of Non-navigational uses of International Watercourses.<sup>32</sup> Although the UN Convention, which is based on the work of the International Law Commission, has not yet entered into force, on certain issues it codifies international customary law. The obligation to utilise international watercourses in an equitable and reasonable manner, and with a view to attaining “optimal and sustainable utilization”,<sup>33</sup> should be construed in light of the increasing shortage of water, for instance when supplementing the 1997 Convention with regional agreements and arrangements for specific watercourses.<sup>34</sup>

The obligations of states to protect – and manage – international watercourses are defined more straightforwardly (and adequately) in the regional 1992 UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes,<sup>35</sup> applicable to some 40 states in Europe and Central Asia. Like the 1997 UN Convention, the 1992 Convention does not apply to a specific watercourse, but defines general principles and rules, e.g. on equitable uses of the water and on the protection of the aquatic environment.<sup>36</sup> It also obliges the parties to enter into bilateral or multilateral agreements or other arrangements where these do not yet exist.<sup>37</sup>

Without considering whether the proposed boundary is correct, reasonable or adequate for global freshwater uses, it is apparent that it cannot be used directly as a measure, starting-point or reference in the allocation of water for consumption in each and every watercourse and for each international regime. Still, if the boundary – or at least the thinking in terms of boundaries – gets accepted, it may contribute to focusing on the objectives of the different regimes and strengthen the legal arguments for why states are obliged to manage their water consumption. Specific legal frameworks will be instrumental for the allocation and long-term usage of water within specific watercourses, but that will not be sufficient. For some regions climate change is becoming a major threat for adequate access to freshwater, which brings us once again to... the UNFCCC.

Moreover, access to water in international contexts has moved from being an exclusive issue of states’ mutual rights and obligations to increasingly be conceived and confirmed as a fundamental human right, with the implied

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32 36 ILM (1997) 700.

33 Art5.

34 Art3.

35 31 ILM (1992) 1312.

36 Arts 2 and 3.

37 Art 9(1).

claims against states.<sup>38</sup> We can also see a certain shift in this direction in international law on water, from being mainly considered an issue of states' mutual rights and duties to considering states' duties concerning water governance and management more generally, including how states ensure and allocate water resources domestically.<sup>39</sup> This approach is reflected in the 1999 Protocol on Water and Health to the 1992 UNECE Convention, which sets obligations for states vis-à-vis each other, but also obligations concerning the public.<sup>40</sup> Possibly, the boundary set in *Planetary Boundaries* may be more relevant from a rights perspective, as a starting-point for a discussion on what quantity of water should be a minimum level of a human right to water.

## 2.8 *Rate of Biodiversity Loss*

*Planetary Boundaries* estimates that about 25 percent of species in well-studied taxonomic groups are threatened with extinction (ranging from 12 percent for birds to 52 percent for cycads). In the last 20 years, almost half of the recorded extinctions have occurred on land, primary due to land-use *change*, species introductions and increasingly climate change. This, it is submitted, indicates that biodiversity is broadly at risk throughout the planet. Biodiversity is necessary to maintain ecological functions and resilience as well as access to various ecosystem services. Loss of species weakens the capacity of ecosystems to withstand and adapt to changed physical and biological circumstances. This does not necessarily make biodiversity loss a genuinely global process with global repercussions. Including biodiversity as a planetary boundary is primarily, although not so clearly, motivated by its significance in providing ecological functions that support the Earth's sub-system, which in turn provide the underlying resilience of other planetary boundaries.

*Planetary Boundaries* admits that it is not scientifically possible to provide a boundary measure that captures, at an aggregate level, the regulating role of biodiversity. Nevertheless, as an interim indicator, the extinction rate, measured as the relative number of extinctions per year, is proposed as a substitute; the boundary is set at less than 10 extinctions per million species per year.

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38 In Resolution 64/292, *The human right to water and sanitation*, the UN General Assembly recognises "the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights; see UN Doc. A/RES/64/292 (28 July 2010). See also UN Committee on Economic, Social and Cultural Rights, *General Comment No. 15 (2002), The right to water (arts. 11 and 12 of the International Covenant on Economic, Social and Cultural Rights)*, (20 January 2003); see UN Doc. E/C.12/2002/11.

39 E. Hey, *Distributive Justice and Procedural Fairness in Global Water Law*, in J. Ebbesson & Ph. Okowa (red.), *Environmental Law and Justice in Context* (Cambridge, 2009), p. 351-370, perceives this as a development towards "global water law". See also 19 *Review of European Community and International Environmental Law* (2010), s 281-365, a thematic issue devoted to the right to access to water.

40 29 *Environmental Policy and Law* (1999) 200.



Such a generally defined boundary does not by itself imply specific duties for states and other actors, but, in the same vein as for freshwater, the recognition of some such boundary may add weight to biodiversity in policies, decision-making and legal balances of interests. Thus, it may be relevant when specifying international (and national) targets and means, and it also adds to the argument of avoiding at all levels measures which accelerate extinction of threatened species. In this respect, an established and acknowledged boundary matters for biodiversity loss.

The global legal framework which best matches this boundary theme is of course the 1992 Convention on Biological Diversity (CBD).<sup>41</sup> The CBD area of application is wide, but the convention sets out only very few concrete duties and measures to be taken or avoided by the convention parties in order to protect the diversity of species and ecosystems. Still, it matters for planetary concerns that the CBD confirms the applicability of the principle of no (significant) harm, reflected e.g. in the 1972 Stockholm Declaration and quoted below in the section on land-use change,<sup>42</sup> to activities that may threaten biodiversity.<sup>43</sup> The CBD is also a crucial basis for further measures and normative developments through related protocols and agreements, and highly relevant in the coordination of other global and regional conventions on the protection of species and different environments. In addition to developing the rights and duties concerning genetically modified organisms, the CBD parties have been active in adopting targets and action plans in order to avoid loss of biological diversity.<sup>44</sup> This is apparent in the 2010 Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (Nagoya Protocol),<sup>45</sup> which also shows the importance of justice and legitimacy considerations for effective preservation of biodiversity.

There is still no global agreement on the protection of forests,<sup>46</sup> despite the recognition of the significance of forests for sustainable development,

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41 31 ILM (1992) 818.

42 See below, note 55.

43 CBD, Art 3.

44 The 2010 CBD Conference of the Parties adopted a new strategy plan for the period of 2011-2020 (COP 10, Decision X/2, *Strategic Plan for Biodiversity 2011-2020*) with the “mission” to “take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet’s variety of life, and contributing to human well-being, and poverty eradication” A similar ambition, which was not realised, could be found in the 2002 strategic plan for biological diversity for the period up to 2010 (COP 6, Decision VI/26, *Strategic Plan for the Convention on Biological Diversity*), “to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth”. Both COP decisions available at “www.cbd.int” (visited 1 December 2013).

45 Text at “www.cbd.int” (visited 1 December 2013).

46 See, however, the 2006 International Tropical Timber Agreement, which is administered by the International Tropical Timber Organization, the stated objective of which is “to promote the expansion and diversification of international trade in tropical timber from sustainably managed and legally harvested forests and to promote the sustainable management of

biodiversity and climate stability at least since the early 1980s. In the run-up for the 1992 Rio Conference on Environment and Development, a third global convention, on forests, was discussed, alongside the UNFCCC and CBD, but it was never concluded. Instead, the Rio Conference adopted a set of “non-legally Binding Authoritative Statement” of forest principles.<sup>47</sup> These principles are clearly inadequate as a basis for a global regime. Rather than defining forests as a global concern, the forest principles emphasise that utilisation of forests is subject to state sovereignty.

In addition to the CBD, both the UNFCCC and UNCLOS matter globally for biological diversity, and they may be used as platforms for the development of more detailed rules and principles on measures, restrictions and cooperation. The link between climate change and biodiversity is apparent and of global scale. This is manifest in the measures taken to reduce deforestation (REDD: Reducing emissions from deforestation and forest degradation), intended to contribute to climate stabilisation and to promote biological diversity.<sup>48</sup> As for UNCLOS, although neither biological diversity nor ecosystems are core concepts, it can also be an adequate basis for more detailed provisions to protect biological diversity and ecosystems, e.g. with respect to rules on fishery and the exploitation of marine living resources.<sup>49</sup> So far, however, while the 1995 Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks may well serve that purpose,<sup>50</sup> no further agreement or protocol on these issues has been adopted within the framework of UNCLOS.

Several other global and regional treaties apply to the protection of species and/or certain environments, usually with far more detailed provision than the

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tropical timber producing forest” (article 1); *see* United Nations Conference on Trade and Development, *International Tropical Timber Agreement, 2006*, UN Doc. TD/TIMBER.3/12 (1 February 2006).

47 Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of all Types of Forests; *See* United Nations General Assembly, *Report of the United Nations Conference on Environment and Development, Rio de Janeiro 3–14 June 1992*, A/CONF.151/26 (Vol. III) (14 August 1992).

48 *See e.g.* H.v.Asselt, *Integrating Biodiversity in the Climate Regime’s Forest Rules: Options and Tradeoffs in Greening REDD Design*, 20 *Review of European Community and International Environmental Law* (2011) 139-149, who sees in REDD a new opportunity to exploit potential synergies between the climate and biodiversity regimes, while emphasising that the biodiversity impacts of any REDD mechanism will crucially depend on its design. Also C. Ituarte-Lima and S.M. Subramanian, *Retreading Negotiations on Equity in Environmental Governance: Case Studies Contrasting the Evolution of ABS and REDD+*. In F. Maes et al. (eds) *Climate Change and Biodiversity, Linkages at International and Local Levels* (Surrey and Northampton, 2013).

49 Support for such measures is found e.g. in UNCLOS, article 61-68 and 194(5).

50 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks; *see* United Nations General Assembly, 8 September 1995, UN Doc. A/CONF.164/37.

CBD, but also with a narrower scope of application.<sup>51</sup> While promoting the protection of these species and environments, few of them take an ecological or ecosystem approach.<sup>52</sup> Even if they did, to a considerable extent international cooperation and governance must take place locally and regionally, while taking into account the existence of global boundaries. Biological diversity is a lucid example of the need for multilevel and polycentric forms of law, measures and cooperation.<sup>53</sup>

## 2.9 *Land-system Change*

Closely related to biodiversity loss are changes in land-use and land-systems, primarily driven by agricultural expansion and intensification. According to *Planetary Boundaries*, such changes contribute to global environmental change, with the risk of undermining human well-being and long-term sustainability. In the past 40-50 years forests and other ecosystems have been converted to agricultural land at a rate of 0.8 percent per year, resulting in significant losses of ecosystem functioning and services. The suggested planetary boundary for this process is that no more than 15 percent of the global ice-free land surface should be converted to cropland.

Although land-use change is a global phenomenon, this is again an issue where it may not be obvious that the underlying social-ecological processes or problems should be considered as genuinely global. Like biodiversity loss and access to fresh water, the circumstances and effects of land-use change differ significantly between different regions. The motivation of *Planetary Boundaries* for suggesting a global boundary for land-use and land-system change is somewhat weaker than for the other boundary themes. Rather, it is emphasised that since this boundary is a complex global aggregate, “the special distribution and intensity of land-system change is critically important for the production of food, regulation of fresh water flows, and feedbacks to the functioning of the earth system.”

To a great extent, the legal dimension of this boundary resembles that of biodiversity loss; and with the exception of the CBD and UNFCCC there are no adequate agreements of global scope on land-use change or forestry. Principles of international law on the protection of the environment have also developed as part of customary law, outside the scope of treaties, primarily with respect to transboundary environmental effects. One such example of relevance for land-use change – and biodiversity<sup>54</sup> – is the principle of no

51 For analyses of the legal approaches of these conventions, see P. Birnie et al., *International law and the Environment* (Oxford, 3rd ed., 2009), p. 583-753.

52 An attempt to developing a method for analysing the ecological approach of treaties is found in J. Ebbesson, *Lex pernis apivorus: An Experiment of Environmental Law Methodology*, 15 *Journal of Environmental Law* (2003) 153-174. See also R.E. Kim & K. Bosselmann, above note 1.

53 See A. Duit et al., *Governance, Complexity, and Resilience*, 20 *Global Environmental Change* (2010) 363-386.

54 CBD, Art 3.

(significant) harm, reflected in the frequently quoted Principle 21 of the 1972 Stockholm Declaration on the Human Environment:

“States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.”<sup>55</sup>

While the principle of no harm, which is part of customary international law, entails a general responsibility for states to prevent transboundary significant effects from activities within their territories and control, states are also granted considerable leeway in deciding on the exploitation of natural resources and the use of land as long as the effects remain within their respective territory. For sure, several international treaties on the protection of the environment, but also on the protection of human rights, limit the leeway of states in deciding on what to do with natural resources and land areas. Even so, states retain considerable scope of freedom in using their territories as long as no effects occur outside the state borders. From this, it has been concluded that international law hardly regulates or controls forestry or land use at all.<sup>56</sup>

The principle of no harm is not limited to industrial activities, but applies also to other forms of activities and measures which may cause damage outside the state’s territory, such as constructions in water (dams, irrigation), deforestation, other forms of land-use, and measures that may harm biological diversity.<sup>57</sup> Depending on where and how it is carried out, land-use change may therefore not be allowed or at least subject to restrictions, if it entails transboundary effects. Moreover, states are obliged to have environmental impact assessments carried out in cases where activities within their jurisdiction may cause significant adverse effects in transboundary contexts.<sup>58</sup>

The transboundary effects of land-use change are often diffuse; the effect from each change may perhaps not even be measurable, while the aggregate effects of all changes of land-systems lead to significant environmental conversions and pressure on ecological systems. Hence, it remains difficult to

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55 UN Declaration on the Human Environment, Principle 21, 11 ILM (1972) 1416.

56 A. Nollkaemper, *Sovereignty and Environmental Justice in International Law*, in J. Ebbesson & Ph. Okowa, *Environmental Law and Justice in Context* (Cambridge, 2009), p. 253–269, 268, takes forest management as “one of the most obvious examples of a resource management issue that in many respects essentially is within domestic jurisdiction of states”. He also points to the fact that any attempts to prescribe in a meaningful way at the international level how states should strike a balance between environmental, developmental and social interests in forest management have come to nothing.

57 This is confirmed by CBD, Art3.

58 See International Court of Justice, *Pulp Mills on the River Uruguay (Argentina v Uruguay)* (20 April 2010), holding, in para 204, that “it may now be a requirement under general international law to undertake an environmental impact assessment where there is a risk that the proposed industrial activity may have a significant adverse impact in a transboundary context, in particular on a shared resource.”

effectively apply the principle on no harm to land-use change; at least it is not in itself sufficient to prevent such changes. Although it would be possible to provide more specific restrictions in a global treaty regime also on land-use change, the conclusions on the need for multilevel and polycentric forms of law, measures and cooperation, made with respect to biodiversity, applies here as well. To a considerable extent international cooperation as well as governance through international law must take place locally and regionally – while taking into account the existence of global boundaries.

## 2.10 *Chemical Pollution*

The geographical reach and impact of pollutants cover the entire planet, so it comes as no surprise to find chemical pollution as one of the boundary themes. The motivation of *Planetary Boundaries* why chemical pollution qualifies as a planetary boundary theme rests on two ways in which it can influence the Earth system functioning: “(i) through a global, ubiquitous impact on the physiological development and demography of humans and other organisms with ultimate impacts on ecosystem functioning and structure, and (ii) by acting as a slow variable that affects other planetary boundaries.” Given examples are the influence of chemicals on the biodiversity boundary and possible interaction with the climate-change boundary.

It is hardly possible to define one boundary based on the aggregate effect of all chemicals on the market – between 80,000 and 100,000 according to an estimate referred to – with highly diverse effects on health and the environment. Moreover, there is limited knowledge on the combined effects of the chemicals. Therefore, two complementary approaches are proposed to defining the planetary boundaries, by focusing on persistent pollutants with global reach, and by identifying unacceptable, long-term and large-scale effects of chemicals on living organisms. After some speculation on possible approaches, including setting a range of sub-boundaries, *Planetary Boundaries* concludes that “it is not possible at this time to define these nor is it clear how to aggregate them into a comprehensive single planetary boundary.”

Chemical pollution was early on one of the rationales for expanding environmental politics and law across state borders. Several conventions, e.g. the different regional seas conventions and the Air Pollution Convention, oblige the parties to control and limit and in some cases (DDT; PCB and mercury) even ban emissions of chemicals. Except for the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, it was not until the end of the 1990s that uses of chemicals became subject to global treaty regimes. Today, four such global legal frameworks are significant for chemicals governance:<sup>59</sup>

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59 In addition, some other conventions of global reach, e.g. on maritime activities (mainly within the International Maritime Organization) and biosafety (Cartagena Protocol to the CBD) also matter for the control of chemicals and distribution of pollutants. The means of control of the Rotterdam and Basel Conventions, and their impact on states’ possibilities to restrict trade in hazardous chemicals and wastes, are analysed by D. Langlet, *Prior*

- 1998 Rotterdam Convention on the Prior Informed Consent Procedure for Certain Chemicals and Pesticides in International Trade;<sup>60</sup>
- 2001 Stockholm Convention on Persistent Organic Compounds;<sup>61</sup>
- 2013 Minamata Convention on Mercury;<sup>62</sup>
- 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.<sup>63</sup>

The Rotterdam Convention, with more than 150 parties, establishes an international system for prior informed consent, which makes it possible for the parties to prohibit or strictly limit the use of certain hazardous chemicals and pesticides, and to decide approval or refusal of importing hazardous chemicals. It also helps countries to control imports of chemicals even when they are not capable to maintain sufficient border control or to effectively enforce their laws and decisions. When a convention party prohibits or restricts the import of hazardous substances, this must be respected by the other convention parties. The Rotterdam Convention is intended to help disseminating information on hazardous substances, not least to developing countries. On the other hand, the Convention does not, in itself, prohibit the use of these substances. Rather, the rationale is to push for reduced use of hazardous chemicals through the possibility of restricting imports of hazardous substances (and thus reducing trade) and through the distribution of adequate information.

The Stockholm Convention, with about 180 parties, is differently structured than the Rotterdam Convention and sets out more explicitly the purpose of prohibiting or restricting persistent pollutants. While focusing on a narrower range of substances, the Stockholm Convention sets out as a first step that the 12 most hazardous substances, including DDT, PCB and dioxins, shall be prohibited, eliminated or restricted. The parties may also agree to prohibit or restrict more substances.

Focusing on a yet narrower scope of hazardous substances, the Minamata Convention on Mercury, which was signed in October 2013, will require actions to reduce mercury emissions to the air from power plants and other sources, to reduce the use of mercury in products and industrial processes, and to tackle mercury supply and trade. It also addresses the severe and growing problem of mercury use in artisanal gold mining.

The Basel Convention, with about 180 parties, strengthens international control of transboundary movements of hazardous wastes, which usually

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*Informed Consent and Hazardous Trade* (Kluwer Law International, Alphen aan den Rijn, 2009).

60 38 ILM (1999) 1.

61 40 ILM (2001) 532.

62 Text available at “[www.mercuryconvention.org](http://www.mercuryconvention.org)” (visited 1 December 2013).

63 28 ILM (1989) 657.

contain hazardous chemicals. The Basel Convention does not ban such movements altogether. Rather, it can be said, somewhat idealistically, to aim at a reduction of the use of hazardous substances by making it more complicated to export these chemicals when they have become wastes.

Three of these four treaty regimes, all with great support in the numbers of parties, cooperate institutionally and may potentially create a joint and comprehensive platform for global governance, including regulations and measures, to reduce the use of chemicals. This possibility, of course, does not imply that such regulations or measures are realised; that depends on whether the parties are able to agree on a common strategy to manage hazardous chemicals. Although the Rotterdam and Stockholm Conventions do not have similar scope of application, they are supplementary to each other in the sense that the one treaty regime makes it possible for states to prevent the import of hazardous chemicals and pesticides, whereas the other treaty regime can be used to jointly decide on the prohibition or restrictive use of persistent pollutants. Having said that, one significant aspect for effective control of hazardous pollutants, left out here, is to what extent international principles on free trade, in particular through the World Trade Organization, hamper such control or whether they can be construed so as to align with the notions for more sustainable handling of chemicals in the mentioned treaty regimes.

As for the matching of international treaty regimes with planetary boundaries, the circumstances for agreeing on effective globally applicable norms is greater for hazardous chemicals than for land-use changes, access to fresh water and the protection of biodiversity – at least one can more easily demonstrate the global dimension and link of such global rules to the performance of individual actors.

### **3 Within and Beyond Planetary Boundaries**

Environmental law and politics – international and national – is predominantly goal-oriented. International environmental treaties and national legislations are usually justified by the need for legal rules to jointly realise more or less precise environmental objectives. Goal-focus is also the apparent message of *Planetary Boundaries*, where the set boundaries also imply normative objectives.

Yet, regardless of how these planetary boundaries are defined, law and governance cannot be limited to only avoiding the excess of the set boundaries. It must also take into account conflicts and the distributive effects within these boundaries. If not, legal frameworks, whether international treaties or national legislations, and action plans will not be legitimate or effective. Every context of environmental law includes justice dimensions.<sup>64</sup> Even if we can agree on boundaries concerning climate change, it remains difficult to agree on the distribution of burdens and benefits. Who is worst affected by climate change

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64 J. Ebbesson, *Introduction: Dimensions of Justice in Environmental law*, in J. Ebbesson & Ph. Okowa (eds.), *Environmental Law and Justice in Context* (Cambridge University Press, Cambridge, 2009), p. 1-36.

if we do nothing, and who – if anyone – benefits from climate change? Who causes the problem? Who is engaged in defining how burdens and benefits are distributed, and who can participate when such negotiations and decision-making take place? Should harm from climate change be compensated for? If so, by whom and according to which standards? Similar questions can be asked with respect to land-use change, aerosols, access to freshwater and all the other boundary themes.

As emphasised by *Planetary Boundaries* itself, boundaries are human-determined values, which involve normative judgments on how to deal with risks and uncertainty. I would add that it also involves judgments on priorities among different interests and objectives. Therefore, the acceptance of these kinds of boundaries depends on how those affected compare the benefits of keeping within the boundary compared to other societal concerns. If policies to keep within the boundaries appear unfair, the boundaries risk losing legitimacy.

As shown, for some of the boundary themes presented there *are* international treaty regimes in place which could, at least theoretically, provide adequate and matching platforms for more focused law and governance in order to avoid exceeding the relevant boundaries. That, of course, does not imply that the given legal framework or the legal means of control *are* sufficient or adequate to avoid exceeding the boundary. Climate change, again, is the most obvious example: the Kyoto Protocol to the UNFCCC obliges the industrialised countries to reduce their emissions at a level amounting to perhaps a tenth of what would be required to stabilise atmospheric concentrations of green house gases. Also in other areas, from a legal perspective, the requirements are either too lax to achieve the environmental or health objective, even if complied with, or too generally or vaguely defined to provide any real impetus for states' performance.

That brings us to another factor for effectiveness of environmental treaties: most treaty regimes have weak mechanisms for compliance control,<sup>65</sup> also compared to other areas of international law, and rarely is the performance examined effectively and impartially. The World Trade Organization has a rather advanced system for dispute settlement, which makes it possible to examine in detail whether a party complies with its international duties. Most international human rights regimes establish courts or impartial committees with the mandate to review states' performance on request by states, individuals or other non-state actors. No such court or mandatory dispute settlement body operates under any international environmental treaty. Some environmental treaties provide for compliance or implementation control through different forms of committees ("compliance committees", "implementation committees") with the mandate to consider the parties' compliance with and implementation of the treaty. The committees are given different degrees of independence and integrity vis-à-vis the governments of

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65 T. Treves et al (eds.), *Non-compliance Procedures and Mechanisms and the Effectiveness of International Environmental Agreements* (The Hague: TMC Asser Press, 2009).



the parties. Yet, only in a few regimes can other actors than states trigger reviews on whether the parties comply with their international duties.<sup>66</sup>

International environmental law and governance is still state-centred, although other actors – civil society organizations, individuals and corporations – have achieved considerably more attention in the international arenas. These non-state actors participate when the legal frameworks are being developed, and they contribute to effective review. They also bring dynamics and multilevel governance into the international regimes. Although states will retain their critical role in international environmental governance and law, they are likely to become more dependent on other actors and networks in order to achieve the set international objectives – and to stay within agreed boundaries.

This is also one of the most interesting and challenging conclusions from reading *Planetary Boundaries*: that cooperation, efforts, guidelines and legal norms must be developed and apply at several levels simultaneously. For sure, global environmental problems require global cooperation, global solutions and in many cases global legal frameworks, but this does not mean that everything should – or could – be governed only globally. There are boundaries (!) also for the amount and details of governance through common, global legal frameworks. While it is possible to agree globally on, say, the phasing out of certain hazardous substances (e.g. CFCs, DDT, PCB) and on the level of reduction of greenhouse gases, it is neither possible nor feasible to regulate globally the details of uses or distribution of freshwater in each watercourse or of land within each territory. In these respects, global law and governance may rather take the form of general principles and programs or set rather clear norms on what to achieve, while details on how to proceed will have to be negotiated, developed and decided regionally and locally. Also in other cases, to be effective global legal frameworks must be implemented and further developed through regional and local measures. Still, it would be naïve to try to manage global environmental and health problems only top-down, with all political and legal norms and guidelines designed globally, and then “only” implemented regionally or nationally. Multilevel governance, while requiring coordination to be effective, means that issues are indeed governed and initiated at different levels and in different ways simultaneously.

Finally, *Planetary Boundaries* emphasises how global environmental problems interfere with each other and how the defined boundaries are coupled. The underlying theories of *Planetary Boundaries* also suggest that the boundaries are connected so that approaching or exceeding one boundary also involves approaching or exceeding another, or as a result one boundary should be redefined when another is approached or exceeded.

While some such steps have been taken already (e.g. among regimes concerning chemicals, biodiversity and marine pollutants), coordination and cooperation will have to be further developed and intensified *between* international regimes of different scales; and in this process, international and

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66 J. Ebbesson, *Public Participation*, in D. Bodansky et al (eds.), *The Oxford Handbook of International Environmental Law*, Oxford, 2007, p. 681-703.

national environmental laws will also have to be further integrated.<sup>67</sup> Although the suggested boundary themes as well as the actual boundaries suggested are uncertain, increased attention to the *notion* of planetary boundaries may improve international cooperation, coordination of treaty regimes and normative integration, and thereby make international law more effective.

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<sup>67</sup> See K von Moltke, above note 3; and R.E. Kim, above note 3.