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# CLIMATE CHANGE: NEW DIMENSIONS OF ENVIRONMENTAL SECURITY

SIMON DALBY

**Climate change has added new impetus and urgency to the long-running discussion of environmental security, leading to an emphasis on the overall transformation of planetary systems. In this article, Simon Dalby argues that this requires consideration of three themes in particular: urban vulnerabilities to extreme events; the unforeseen social and political consequences of adaptation and mitigation efforts; and the possibilities of geo-engineering. Furthermore, given the increasingly artificial circumstances that the global economy is creating, security planners should now focus on the consequences of further expansion of the carbon-fuelled global economy, rather than on concerns about political instabilities in the rural peripheries caused by resource conflicts.**

Scholars and policy-makers have engaged in a long-running discussion about the relationships between environmental matters and various forms of conflict and security during the past two decades.<sup>1</sup> While fears of resource shortages and related conflicts go back at least as far as Thomas Malthus and his theories on population change, formulated towards the end of the eighteenth century, the links between conflict and environmental change – and the prospect of scarcity-driven conflicts and possible water wars in particular – gained prominence in international security discussions in the late 1980s.<sup>2</sup> Forest fires in the Amazon, the Chernobyl disaster and the hot summer of 1988 in the United States drew attention to global environmental issues as the Cold War wound down. All of these themes coalesced into a discussion of ‘environmental security’ in the late 1980s. Sometimes the term was simply used as a synonym for environmental protection in the sense of preventing damage to ecosystems and hence to humans: the American military in particular has used the language of environmental security to run programmes of waste clean-up and environmental remediation. However,

the phrase encompasses much more than this.<sup>3</sup>

‘Environmental security’ also refers to environmentally induced conflicts and insecurity caused by social and political disruption related to resource shortages and degraded landscapes. While assumptions of scarcity as a cause of conflict were widespread, what was notable in the early 1990s was the lack of clear social-scientific evidence that this was the case.<sup>4</sup> Neither was it obvious that environmental changes would necessarily lead to forms of conflict that could be easily understood in terms of threats to either national or global security. Field studies conducted in the 1990s suggested that widespread fears of poverty-induced rural conflict were usually seriously exaggerated. As this research progressed, it became apparent that while the processes of contemporary rural transformation were frequently conflict-ridden, the transformation itself was not a simple matter of environmental-change-induced violence.<sup>5</sup> The attendant debate was mostly about conflict in the global South and potential political instabilities that might spill over into international disputes, and hence become a matter of international security.

Linked to the discussion of the potential environmental causes of conflict has been a debate about what kind of security policy is appropriate if global environmental change is taken seriously. While in some senses environmental matters might be a national-security concern – for instance, when storms cause disruptions or major migrations cause political difficulties in particular states<sup>6</sup> – major environmental issues are matters that require international co-operation to be dealt with effectively. This has been clear in discussions of such matters as stratospheric ozone depletion and, most recently, climate change.<sup>7</sup> Despite some discussion in the United Nations Security Council in recent years,<sup>8</sup> international institutions have been slow formally to designate climate change as a matter of security; and this despite the clear consequences for many states, not least the potential obliteration of low-lying island states by rising ocean levels. In part, this has been because of the diffuse responsibilities for the causes of climate change, and the simple fact that the major emitters of greenhouse gases are permanent members of the Security Council.<sup>9</sup>

Driving this change in focus is the growing recognition that climate change



A four-wheel-drive truck slows as it approaches a stretch of coastal road damaged by Hurricane Sandy, Hatteras Island, October 2012. *Courtesy of AP Photo/Steve Earley.*

is happening now, is caused by human activity, and is unlikely to be solved by unilateral action or traditional security measures. Industrial humanity is shaping the configuration of the planetary systems that will provide the context for human security in the coming decades and the need to act is increasingly urgent.<sup>10</sup> Co-operative measures are essential to planning for how to deal with the new circumstances humans collectively face. This new recognition that future environmental conditions are being shaped by economic, urban, forestry and energy planning decisions changes the parameters of environmental security. The sheer scale of land-use changes, loss of biodiversity, decline in fish stocks, growing greenhouse gas concentrations, the re-routing of rivers, mining of numerous minerals, covering over of land by concrete and asphalt, and many other transformations have changed the planet's surface so drastically that humanity has in effect become a new force shaping the planet's basic physical systems.<sup>11</sup> What matters now with regard to the long-term discussion of environmental security is not whether rural squabbles over supposedly scarce resources spill over into larger conflicts, but rather how these new circumstances

emerging as a consequence of human activity impact upon both populations and states.

This requires thinking about security in new ways. Planning for the future must take into consideration an environment that is being changed by human activity, rather than one in which human society reacts to external disruptions to a given context. Shaping the future in order to prevent conflict is now key to environmental security, but this has to be done while rapidly reducing the use of carbon-based fuels, as well as ensuring that adaptive measures are thought through carefully so that they do not generate conflict. This has numerous implications. The rest of this article focuses on three themes that together illustrate the implications of the new context of environmental security: first, rising concerns about urban vulnerabilities; second, the need to think through adaptive measures that tackle environmental change without causing conflict; and third, the possibilities of geo-engineering and potential conflicts over the use of such technologies. These all pose difficult but now unavoidable questions in relation to both contemporary geopolitics and to the issues on which security agencies

now need to focus as a result of the new circumstances that industrial humanity is creating – of which climate change is but the most obvious facet.

### Climate and Security

While discussions of environmental security that started in the early 1990s never truly abated, 2007 marked the re-emergence of environmental security as a high-profile issue, made both more urgent and more complicated by renewed attention to global climate change.<sup>12</sup> In part this new emphasis was because ongoing studies on climate change, summarised in the fourth assessment report of the Intergovernmental Panel on Climate Change in 2007, highlighted the seriousness of the issue.<sup>13</sup> In addition, the receding emphasis on the War on Terror in Washington allowed other security agendas to come to the fore. New field research in potential conflict zones in the 2000s has again demonstrated that droughts and other climate disruptions are, at least so far, minor contributors to contemporary conflict.<sup>14</sup> Fears of environmental refugees with their potentially destabilising impact on host societies – a frequent theme in the earlier discussion – continue to attract attention, now linked to the more

alarming projections of environmental changes generated by scientific models of climate change. It should be noted that human migration is part of the broader contemporary processes of economic change and urbanisation, and that it is difficult to distinguish a climate migrant from one driven by economic factors to try their luck in the rapidly growing cities of a globalised world. Nonetheless, most migration that can be plausibly related to climate change occurs, at least so far, mostly within states.<sup>15</sup>

Environmental matters have also been connected directly with the human-security discussion in recent years, as vulnerability to extreme events has shifted the focus to natural disasters and lack of preparedness in the face of storms, floods and droughts.<sup>16</sup> This relates more to human-security concerns linked to the fate of poor and vulnerable citizens than to traditional security concerns such as interstate warfare. Yet the focus on hazards and vulnerabilities in the context of globalisation has undeniably added an extensive discussion to security preparations and has heightened the perceived need for international co-operation in preparing to cope with changing environments in the coming decades.<sup>17</sup> Indeed, vulnerabilities to climate change are not only a matter for rural populations in the global South. Severe storms, droughts and floods have demonstrated that Northern populations are also vulnerable to climate-change-enhanced weather events.

Fears about resource shortages have also been part of the environmental-security discussion. Investigations into conflict minerals and resource wars have added complications to environmental-security discussions, not least because many resources are fought over in places where effective state rule is absent. Furthermore, the literature on resource wars suggests that the relative abundance of resources in particular places is likely to be a source of conflict.<sup>18</sup> The way in which resources are traded in the international economy is also an increasingly important part of the discussion; boycotts of conflict diamonds, for example, link the global economy to particular episodes of violence in ways that clearly show that disruptions

caused by the expanding global economy are often a key cause of conflict in rural peripheries.

Recent research has also emphasised that, given the interconnections between social and environmental issues, environmental difficulties frequently facilitate co-operation rather than conflict, as dealing with stratospheric ozone depletion made especially clear.<sup>19</sup> Indeed, collaboration has frequently proven much more effective than conflict in managing scarce resources. Insofar as climate change might cause shortages and scarcities, this finding provides considerable cause for optimism in terms of security planning.

The other key factor to have changed since the emergence of the initial formulations of environmental security in the early 1990s is the rapid advance in earth-system science and the dawning realisation of just how dramatically human actions have transformed the biosphere. Geologists now regularly discuss matters in terms of the Anthropocene – the new geological era caused by humanity's transformation of so many facets of natural processes – while the earth system is in transition to some new phase, the parameters of which are still unclear.<sup>20</sup> These insights demonstrate that the environmental context for security is increasingly one of human manufacture; dealing with a given, permanent environmental backdrop for human affairs in the future is no longer a valid assumption for serious analyses of security.

Overarching this is the sheer scale of the likely environmental transformations should policies to prevent global warming not be implemented quickly; the evidence of rapid change in many dimensions of the earth system is now compelling.<sup>21</sup> Even if measures to reduce carbon emissions are taken promptly, some further changes in climate are inevitable and, as such, adaptation strategies are now part of the policy agenda in many places, in terms of infrastructure planning in particular. The social changes necessary to deal effectively with vulnerabilities are often not thought through in much detail,<sup>22</sup> but consideration of ways of adapting without inducing conflict is

now part of the environmental-security agenda. The nightmare scenarios of potentially dramatic disruptions in the coming decades have once again linked environmental change to discussions of security, although the way in which this might play out is a speculative matter dependent on which scenarios are used to depict future possibilities and which policies are adopted to curb greenhouse gas emissions in the near future.<sup>23</sup>

Although greenhouse gas concentrations might have increased even faster than they are currently without the efforts of numerous agencies and the arrangements agreed under the Kyoto Protocol, it is nonetheless clear that the mitigation measures adopted so far have failed to stop the increase in levels of greenhouse gases, with the levels of carbon dioxide in the atmosphere having approached 400 parts per million in early 2013. Rates of increase of close to 2 parts per million per annum, if they continue for much longer, will mean that rapid climate change is looming. Failure to keep the planetary system below the widely accepted 2°C 'guardrail' of the safe range of climate change – formally adopted at the Copenhagen climate summit in 2009 – means that humanity is entering a period of what is described by climate scientists simply as 'very dangerous climate change'.<sup>24</sup>

In recent years, such concerns have finally become mainstream considerations among policy-makers internationally. A high-profile World Bank-sponsored report published in late 2012 warns that, unless serious attention is paid to mitigation soon, the world is heading for a global increase in temperature of at least 4°C.<sup>25</sup> Such a set of circumstances would be so disruptive to human civilisation, not to mention to the remnants of the natural planetary system upon which humanity depends, that allowing such a scenario to unfold simply should not be contemplated. Facing this future requires careful thinking about what 'security' has now come to mean and, in terms of the long-running discussion of environmental security, clearly requires further updates to incorporate the new climate projections that earth-system science is generating.



Despite twenty years of discussions since the initial adoption of the United Nations Framework Convention on Climate Change (UNFCCC), there is still no binding agreement to limit greenhouse gas emissions effectively. Thus, given the obvious failures of mitigation thus far, the difficulties of adaptation, and the increasingly urgent need to consider in greater depth the consequences of climate change, the possibility of geo-engineering the climate has also been highlighted recently by both British and American researchers in particular.<sup>26</sup> In the 1990s, many climate activists refrained from discussing geo-engineering, arguing that it would constitute a serious distraction from what should be regarded as the priority: implementing mitigation measures. Indeed, government planners often thought of geo-engineering as science fiction for the distant future, while it also made sense to focus on mitigation on the assumption that prevention is preferable to cure when it comes to matters of climate change. However, given the fact that the international community has not seriously – or successfully – engaged in prevention, as the rapid retreat of the Arctic Ocean ice cap in particular is demonstrating, geo-engineering is now, reluctantly, being considered. At the very least, it will constitute an option for those countries whose industrial capabilities permit them to attempt to adjust the climate and either reduce the frequency and scale of extreme events or provide more conducive local conditions. The current loss of property and lives as a result of such extreme events makes these discussions more pressing as climate change accelerates.

### Urban Vulnerabilities

While droughts and floods – the product of either too little or too much rain – have lately received much media and governmental attention, recent media discussions have concentrated first and foremost on hurricanes. Late in 2012, superstorm Sandy inundated large parts of New York and the east coast of America while, on the other side of the Atlantic, Britain once again faced severe flooding, unrelated to Sandy. Almost simultaneously, parts of the Philippines

suffered severely from Typhoon Bopha, with images on television broadcasts recalling the extraordinary deluge in Taiwan caused by Typhoon Morakot in August 2009. If major storms are now either more severe or more frequent as a result of the greater amount of energy in the hydro-meteorological system or, as the case of Sandy suggested, if storm speed and tracks may be altered by jet-stream ‘blocking’ patterns caused by changes in Arctic ice cover,<sup>27</sup> then cities in the Northern Hemisphere are clearly vulnerable, too. The focus on recent storms is a useful corrective to earlier assumptions in environmental-security discussions that most climate disruptions would be in rural and remote regions. These events have demonstrated that environmental security is not just a matter of concern for the rural periphery, involving conflicts over pastures, irrigation water and food. It is now also about metropolitan insecurities, and it is thus a matter for urban planners as well as rural development experts.

While it is difficult to assign responsibility for any single event to general processes of climate change, a climate in which larger amounts of energy appear in the guise of warmer seas and more moisture in the atmosphere is likely to mean more frequent or more severe storms.<sup>28</sup> Rising sea levels caused by the expansion of warming water and the melting of terrestrial ice caps will make coastal areas more vulnerable to storm surges, too. Droughts may affect urban water supplies or, by reducing the flow in rivers, constrain electricity production (by reducing the power available both directly – decreasing hydro-electric production through dams and river generators – and indirectly – reducing the amount of cooling water available for use by thermal power stations). In hot summers, when demand for electricity is enhanced by widespread air-conditioner usage, this is another factor adding to people’s vulnerability.

While large storms like Hurricane Katrina, which in 2005 caused the inundation of New Orleans and considerable loss of life, grab much attention, less dramatic flooding, like that of Bangkok in 2011, also has noticeable consequences. A number of major

car-industry companies had production facilities there and the floods caused disruptions in the global car-parts supply system. Vulnerabilities to such events are attracting the attention of planners in many parts of the world, especially given that humanity’s propensity for building cities in convenient coastal locations makes many of them very vulnerable. The failure of emergency planning and the very poor response by the American federal government to the New Orleans emergency in 2005 made it clear to planners and politicians that detailed preparation is essential to avoid damage and deal with rescue and reconstruction. Yet many communities have been slow to absorb the lessons regarding vulnerable infrastructure and the failure to plan for contingencies.

Building resilient cities is now a priority, both for private developers and public authorities.<sup>29</sup> Here security may require practical adjustments to zoning bylaws and property-taxation arrangements to facilitate such simple modifications to buildings as ensuring that key electrical units are not placed in basements where they are vulnerable to flooding. This is not the kind of issue that has usually been considered a matter of security, but the provision of infrastructure and its maintenance in the face of disruptions is key to keeping people safe and maintaining public order.<sup>30</sup>

An alternative is to ignore the dangers and use financial measures such as insurance and catastrophe bonds to subsequently rebuild should disaster strike. Some Caribbean states in particular use this strategy, which has been supported by a financial sector anxious to profit from financial instruments such as catastrophe bonds, through which investors, in effect, bet against disaster in particular places. Given the fragility of financial markets in the aftermath of the 2008–09 financial crisis, scepticism concerning the likelihood of funds being available after a major disaster is undoubtedly warranted. Crucially, catastrophe bonds and, more generally, insurance are beyond the reach of the most vulnerable people, who are typically too poor to even buy simple insurance, much less become

involved in more sophisticated financial arrangements.<sup>31</sup> Insofar as human security is concerned, financial measures are not what is needed for those most likely to be in harm's way. While financial measures may constitute resilience of a form for states and corporations, it is not a sustainable option for either poor urban dwellers or small-scale rural agricultural producers.

It is important to note, however, that while the cost of disasters is rising, many populations have historically been much more vulnerable to natural disasters. In part, this was simply because of a lack of effective warning systems: weather satellites are a relatively recent innovation, and emergency services are now much more effective than in the past, even if they are frequently improvised at short notice. While in 1992 Hurricane Andrew caused billions of dollars of losses to Florida, it caused many fewer deaths than the Great Miami Hurricane of 1926. Nonetheless, the rapid growth of cities in vulnerable locations raises the spectre of frequent disasters in future, and given the likelihood of increased storm intensity as the climate changes, this suggests that mitigation and adaptation need to be considered together. Innovations such as solar-powered high-rise buildings, which both indirectly reduce the use of carbon fuel and are more resilient to power disruptions should disaster happen, are clearly the way of the future.

### **Climate Adaptation and Conflict**

As the failures of mitigation have become more apparent, attention has increasingly shifted to matters of climate adaptation, often in such important but banal matters as building bridges higher in anticipation of increased sea levels or larger floods.<sup>32</sup> Yet critics warn that unless more attention is paid to the social and political dimensions of adaptation, these measures are more likely to cause conflict than prevent it.<sup>33</sup> If the assumption that adaptation is necessarily a good thing is disregarded, its potential dangers are easier to see, especially when considering the global dimensions of the current transformation of the planet. This is particularly clear in relation to agriculture, especially in

Africa. It is also important to recognise that these matters are closely tied to what has been described as a 'new scramble for Africa', as the continent's resources are once again sought to fuel the global economy.<sup>34</sup> The struggles over diamonds in Sierra Leone, oil in Nigeria or raw materials used in mobile phones that come from the Congo have generated headlines in recent decades, but the larger integration of African commodity supplies into the global economy is the context within which adaptation has to be considered.

Humans have become an urban species and much of the global economy now revolves around bringing commodities, fuel and food to cities and, to a much lesser extent, recycling and disposing of the waste that urban consumption generates. With growing alarm around the spikes in global food prices witnessed in 2009 and 2011, coupled with headlines of drought and declining crop production in 2012, many states and agricultural corporations have begun thinking seriously about security of food supply and about reinvesting in agricultural production alongside processing and distribution. This reflects the traditional pattern of European and American commercial interests, but also that the global political economy of land is increasingly driven by land purchases by Indian and Chinese investors seeking supplies of food from abroad.<sup>35</sup> If weather patterns are likely to be disrupted as climate change accelerates, ensuring a diversity of sources of production is a sensible strategy for states as well as corporations involved in food production and transportation. Adaptation to climate change therefore becomes, in part, a matter of taking precautionary measures in the present to secure food supplies in the future; Gulf states, for example, are especially concerned about the food supplies that will support their rapidly growing populations in the coming decades.

While much food is still produced and consumed locally, not least because of the high transportation costs associated with perishable and heavy items, international trade in grains and other foodstuffs is an important part of the global economy. Tropical fruit and

vegetables, just like luxury items, are flown all over the world daily. Indeed, metropolitan economies have long depended on distant food supplies and have indirectly disrupted distant ecologies in the process.<sup>36</sup> Vulnerabilities to international supply are a matter of security for many states, which in the British case, at least, dates back to the nineteenth-century Corn Laws, as well as being a key issue in both world wars. Many of the supplies Britain depended on during this period came from abroad and specifically from plantation agriculture. Meat supplies from distant colonies, once refrigerated ships were perfected in the late nineteenth century, were also a key part of British eating habits.

Formal decolonisation in many parts of the world in the latter half of the twentieth century did not alter these patterns substantially, and as the global economy has expanded, so has the trade in agricultural commodities. Yet adaptation strategies, planned as a hedge against coming climate disruptions, are now accelerating the purchase of land in tropical areas by both corporations and states, and raising important questions about the disruption of local production in favour of commercial production for export. While the latter is usually seen as a positive arrangement in terms of the conventional understanding of economic development, it frequently involves the displacement of small farmers and the disruption of the subsistence-production arrangements that are crucial to food security for rural populations.

'Land grabbing' is the controversial term now frequently assigned to the process of expanding international commercial control over property in developing countries, and while the complicated ways in which this plays out make simple denunciations of the process unhelpful, the ripple effects of these processes through African property markets in particular are considerable.<sup>37</sup> If the influx of foreign investment inflates prices and expectations in rural economies, pricing smallholders out of the market and in the process replacing traditional economies with commercial ones for foreign markets, then in a crucial sense those displaced by the process – and those unable to

undertake agricultural activities because of rising land prices – become a new source of social and political instability.<sup>38</sup> Where this plays out, climate adaptation, rather than climate change itself, is the cause of instability.<sup>39</sup> This reversal of the traditional focus on environmental causes of conflict towards the unintended consequences of adaptation measures is key to thinking through the complicated security consequences of dealing with climate change; simple policy options that ignore complex local circumstances may simply replay the earlier colonial patterns that previously produced dislocation and conflict.

The pattern of rural land use and market price hikes is further complicated by the complex financial mechanisms of carbon markets, some of which use ecosystems in the global South as carbon sinks to absorb emissions generated elsewhere.<sup>40</sup> Frequently these ‘sinks’ are tropical forests where fast-growing trees quickly absorb carbon from the atmosphere. Under the UN Clean Development Mechanism, and other such financial arrangements, funds are transferred to ‘Southern’ countries to provide carbon-sink services to ‘offset’ excess carbon emissions in developed countries.<sup>41</sup> Carbon markets require sinks, located mostly in developing countries, and in so far as land is purchased to provide forestry plantations to ‘sink’ carbon, this serves to raise prices on land markets in ways that frequently preclude local use of the forests, use up water supplies and disrupt local ecologies.

Similarly, recent enthusiasm for burying charcoal and hence storing the carbon in the soil, or ‘biochar’ as it is frequently known, as an agricultural sink often fails to address seriously the practical uses of charcoal, including by farmers. Focusing only on the ‘sink’ aspects of ecosystems and imposing rules and regulations from afar is not likely to be a process that works smoothly.<sup>42</sup> Insofar as these new patterns of rural transformation also dislocate rural economies and speed up rural migration to the burgeoning conurbations of the South, Northern mitigation measures may serve to aggravate rural conditions in Southern states.

Thus while both mitigation and adaptation measures make sense from a Northern perspective, ironically they may be a cause of conflict and insecurity in the South. If these insecurities are then, in turn, understood as a security threat, whether in terms of terrorism-related concerns within fragile states, or some other framework for dealing with insurgencies, the irony and confusion about the sources of danger is compounded. Careful analysis of causal mechanisms and the impact of actions that have indirect consequences is very important in matters of climate security for the simple yet crucial reason that the earth’s climate and economic system are connected; the economic system is, as such, adding new ‘forcing mechanisms’ to the climate system.

As these examples of the unintended consequences of adaptation suggest, the environment can no longer be considered as something external to human actions. Ecologies are being transformed by humanity in complicated ways that frequently have circular logics, which need to be addressed seriously by policy-makers concerned with environmental security. If attempts at both mitigation by offsetting emissions and adaptation by further transforming rural landscapes are troublesome, the clear implication is that a direct focus on building economies not powered by carbon fuels ought to be a priority for all concerned about security in its various forms. Given the delays in setting economies on this path, however, it may well be that directly adjusting the earth’s temperature may, through geo-engineering, be attempted in the not-too-distant future.

### Geo-engineering

While discussions of geo-engineering have been underway for decades, until recently most climate activists and state policy-makers have not wished to engage in them.<sup>43</sup> There are a number of good reasons for this, not least the moral hazard argument – namely, the fear that if research into the matter generates apparently affordable and plausible suggestions as to how to control the climate, then the urgency of the need to deal with greenhouse gas emissions will dissipate and policy initiatives to enhance

solar-energy replacements for fossil fuels will not come to fruition quickly enough. A parallel argument suggests that because technological gambles to alter solar-radiation levels artificially are always going to be highly risky – for many reasons, including the still rudimentary knowledge of crucial aspects of how the earth system functions, and the fact that many proposed geo-engineering measures may be irreversible – avoiding them and focusing on the more important matter of mitigation is more important.<sup>44</sup>

In addition, a focus on temperature alone, which is advocated by some popular geo-engineering plans – including the so-called ‘solar radiation management’ options to reduce the amount of sunlight reaching the earth’s surface – leaves the problem of carbon-dioxide levels in the atmosphere, as well as other environmental transformations, unresolved. Should the technology of geo-engineering, or the economic resources required to undertake it, cease to be available in the future, then heating will resume if carbon-dioxide levels remain high. Of even greater concern is the fact that, even if solar-radiation management does limit temperature rise, carbon dioxide will continue to acidify the oceans – the home of much of the life on the planet – with dire consequences with regard to both the short-term availability of fish-based protein for humans and the long-term destruction of many of the most important forms of planetary life.<sup>45</sup> Strategies for reducing the amounts of carbon in the atmosphere, beginning with mitigation to cut emissions in the first place, are hence the first priority.

The political obstacles to geo-engineering are also a major consideration, one that raises some very old security concerns related to the potentially dangerous decision by one power to act unilaterally in a way that other leaders may feel is a challenge either to their power in general or to their national interests directly.<sup>46</sup> In addition, a huge range of actors and technologies might be party to geo-engineering; there is no reason to assume the exclusive involvement of states, and there are no clear guidelines for appropriate conduct in arenas where a number of environmental regimes might be

judged appropriate for governance arrangements.

One example of such difficulties emerged in 2012, with a small-scale attempt to measure the effects of enhancing the iron content of the Northern Pacific waters. This private venture, using a ship to disperse several hundred tons of iron sulphate into the ocean off of Canada's west coast, raised questions as to who might be authorised, and by what agency or state, to carry out this kind of experiment.<sup>47</sup> The questions concern whether this is a matter of polluting the ocean, whether it is a matter for common agreement by parties to the United Nations Convention on the Law of the Sea, and how such experiments might be monitored. Attempts to test theories concerning geo-engineering on a large scale raise concerns about possible unanticipated weather modifications and other environmental hazards. Small-scale experiments with artificial cloud-making also raise similar concerns.

A further vexing political question is what temperature geo-engineering ought to aim to achieve for the Earth – and who should decide. There are no institutions that can make such decisions, at least not yet. The United Nations Framework Convention on Climate Change is premised on the assumption that pre-industrial levels of greenhouse gases, and the related temperature range over the previous few thousand years, is the answer, and that dangerous interference with this should be avoided. However, once the possibilities of adjusting the planetary system are seriously discussed, this fraught matter becomes unavoidable. Different temperatures will undoubtedly have various impacts depending on location.

In a scenario where there is substantial disagreement – and one medium-sized state decides that it is in its interests to initiate a unilateral attempt to modify the climate, perhaps by the favoured strategy of injecting sulphate aerosols into the high atmosphere to mimic volcano-induced aerosol cooling effects – it remains to be established how the resulting political controversy would play out. In the 1970s, similar concerns regarding the use of weather modification as a potential weapon of

war led to international agreements to ban weather modification.<sup>48</sup> China uses cloud seeding to attempt to adjust rainfall events, most famously during the 2008 Olympics in Beijing, with unknown effects on neighbouring states.<sup>49</sup> Geo-engineering is, in that sense, already being carried out on a small scale, even if its ostensible purpose is restricted to local weather modification.

It is then but a small step to the argument that many human activities are in fact already a facet of geo-engineering, even if the intention behind them is not to directly manipulate the climate. Burning fossil fuels, clearing land for agriculture and building cities are all causing, among other things, climate change, so, in fact, humanity is already in the process of constructing an artificially manipulated environment. Environment as an external facet of human life is in this sense a thing of the past, having been replaced by the current Anthropocene era.<sup>50</sup> In turn, this again poses the question of what kind of an Earth the industrialised part of humanity is constructing for future generations – and, crucially, who decides what must be secured for this future and what happens if powerful actors, states or corporations fundamentally disagree about who should make such decisions and how they should be enforced.

### **Anthropocene Security**

Serious discussion of global environmental security must consider the interconnected nature of the world, especially as ecological research shows that human society is in the process of dramatically changing how the earth system operates. In these circumstances, the actions of one state have consequences not just for its neighbours, but for the whole system. Co-operation on climate security thus becomes imperative, as individual self-interested action has the potential to generate a range of different kinds of conflict. Security dilemmas will abound if states take unilateral action on climate modification. Institutional innovation is also needed urgently. Traditional environmental-protection arrangements therefore need to be developed substantially in order to govern the earth

system in the new circumstances of the Anthropocene.

Ironically, if international disputes over climate were to become very serious and were to trigger major interstate war, the use of nuclear weapons in such a war, even in fairly limited engagements, might generate a nuclear winter and global cooling.<sup>51</sup> Such macabre considerations, however, are of little help in terms of climate change over the medium or long term, because elevated carbon-dioxide levels would remain after the smoke and dust had fallen out of the atmosphere, leaving the remnants of humanity still facing the climate-change problem and, in a world ravaged by nuclear war, probably much less able to do anything about it. Above all else, geo-engineering reminds security scholars that maps of separate autonomous states are not the appropriate basis for discussing security in the Anthropocene era when the consequences of human actions are so all-encompassing. Neither are discussions of state boundaries and traditional notions of sovereignty helpful for considering the kinds of vulnerabilities that people in rapidly urbanising parts of the world face because of changing climates and economic and infrastructural disruptions.<sup>52</sup>

Since their adoption by the United Nations in 2005, the principles of the Responsibility to Protect have influenced the security agenda. This agenda, under the rubric of human security, focuses on practical matters relating to keeping people alive and reducing violence in the event of social disruption. There is now extensive literature on this topic looking specifically at regional differences, while emphasising the importance of economic and governance mechanisms in ensuring that people do not become vulnerable to climate change.<sup>53</sup> Societal stability is important, but the key theme underlying discussion of the Anthropocene is that the world (and not only the climate) is being changed dramatically by human actions, so that while social stability is emphasised as a goal, the context within which humanity strives for such a goal is also changing. As such, the unforeseen consequences of fossil-fuelled economic transformation have to be worked into the discussion, both in terms of practical



matters of the vulnerability of the new urban spaces where the majority of humanity lives, and the potential conflict generated by attempts to adapt to such transformations.

The discussion of the Anthropocene makes it very clear that appeals to a universal humanity, which used to be dismissed by realists as idealist wishful thinking, now have to be taken seriously as the context for security thinking. Just as large numbers of nuclear weapons make the consequences of warfare so serious that mutual restraint becomes much more important in terms of security,<sup>54</sup> now the transformation of the earth system also requires discussion of co-operative measures to keep the planet within the broad ecological parameters that gave rise to human civilisation. Humans are collectively remaking the circumstances in which future generations will live, and simply assuming that the human project will continue regardless of the actions of the present generation is no longer a plausible premise on which to base strategic thinking. The phrase favoured by the US military in its long-term planning, that of 'shaping the future', is, it turns out, not just a strategic aspiration, but a simple statement of what humanity is currently doing to the planet itself. Security thinking has to incorporate this new context if it is to deal appropriately with climate change in particular and the larger transformations of the biosphere more broadly.

Thus, contrary to some currently popular conventional wisdom, the geopolitical context for humanity is not a given and permanent cartographic arrangement. Instead, earth-system science, as well as the discussion of human security, makes it clear that the parameters that matter in terms of strategic planning and world order are being actively remodelled by the global economy.<sup>55</sup> Most of the landscapes that matter are now artificial rather than natural in terms of what is grown and the ways in which rivers and other waterways operate. The infrastructures that allow modern economies to function stretch

right around the globe in the form of trade routes and commodity chains; some corporations are already planning to reduce vulnerabilities to climate change precisely by rethinking their supply networks.<sup>56</sup>

Globalisation is an economic process, but very much an ecological one too, and one that is reshaping the context for human action. As climate change accelerates, the amount of rainfall that falls, as well as where and when it falls, how high tides rise and whether the Arctic Ocean is covered by a permanent ice cap are increasingly indirect consequences of human actions. This is the new geopolitical context of the Anthropocene era, and the new strategic context for planning environmental security. As such, the emphasis in contemporary environmental-security thinking has to be on the global economy and, crucially, on strategies for building societies that are not dependent on fossil fuels, with all of their dangerous climate-change implications.

### Climate Security

The global economy, with all of its environmental consequences and interconnections, is the cause of climate change, yet could also provide its solution, if in the coming decades an appropriate system is constructed to power it. That, rather than concerns with peripheral rural instability or environmental migrants, has to be the priority for serious deliberations – both policy and academic – concerning environmental security.<sup>57</sup> Peripheral disruptions are symptoms of climate change and the transformations wrought by the global economy, not the cause of the key concerns for environmental-security thinkers.

It is just as necessary to ensure that both mitigation and adaptation do not cause or multiply existing disruptions. The advantage of the theme of the Anthropocene is that it constantly reminds analysts that the environment is not an exogenous factor shaping the fate of humanity, as nineteenth-century writers once

understood matters. The environment is now being actively recreated by the global urban economy, and the often unforeseen consequences of rural disruptions set in motion by the search for resources to feed cities. Now, any serious planning for the future must also consider the further dimensions that climate change is adding to these transformations.

When it comes to climate change, assumptions of external dangers confronting modern states across borders are simply not the appropriate premise for intelligent discussion of environmental security. It is those states' reliance on fossil fuels and a global economy for resources and supplies that is setting climate change in motion. This is what has to be tackled, and soon, if major disruptions that the writers of climate-change scenarios warn about, with all the likely consequences for human civilisation, are to be avoided.<sup>58</sup>

Policies that focus on rural peripheral disruptions as the key danger fail to grasp the causes of planetary transformation. While they may provide conveniently familiar justifications for military action in Africa and Asia on the part of Northern states, such actions do not begin to grapple with the root causes of the transformations that are causing climate change. That key geopolitical fact can no longer be ignored as climate change reconfigures the discussion of environmental security, and with it both the understanding of humanity's role as a planet-changing agent and the recognition that it is no longer possible to avoid dealing with the consequences of today's enormous fossil-fuelled economy. ■

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## Notes

- 1 Rita Floyd and Richard Matthew (eds), *Environmental Security: Approaches and Issues* (London and New York, NY: Routledge, 2013).
- 2 Jessica Mathews, 'Redefining Security', *Foreign Affairs* (Vol. 68, No. 2, 1989); Norman Myers, 'Environment and Security', *Foreign Policy* (No. 74, 1989); Joyce Starr, 'Water Wars', *Foreign Policy* (No. 81, 1990–91).
- 3 Rita Floyd, *Security and the Environment: Securitization Theory and US Environmental Security Policy* (Cambridge: Cambridge University Press, 2010).
- 4 Thomas Homer-Dixon, 'On the Threshold: Environmental Changes as Causes of Acute Conflict', *International Security* (Vol. 16, No. 1, 1991).
- 5 Gunther Baechler, 'Why Environmental Transformation Causes Violence: A Synthesis', *Environmental Change and Security Project Report* (Vol. 4, Spring 1998); Colin Kahl States, *Scarcity and Civil Strife in the Developing World* (Princeton, NJ: Princeton University Press, 2006.)
- 6 Daniel Moran (ed.), *Climate Change and National Security: A Country Level Analysis* (Washington, DC: Georgetown University Press, 2011).
- 7 Richard Benedick, *Ozone Diplomacy* (Cambridge, MA: Harvard University Press, 1991).
- 8 See for instance the discussions in 2007 and again in 2011 at the UN Security Council, 'Security Council Holds First-Ever Debate on Impact of Climate Change on Peace, Security, Hearing Over 50 Speakers', press release SC/9000, 17 April 2007, <<http://www.un.org/News/Press/docs/2007/sc9000.doc.htm>>, accessed 17 May 2013; and UN Security Council, 'Security Council, in Statement, Says "Contextual Information" on Possible Security Implications of Climate Change Important When Climate Impacts Drive Conflict', press release, SC/10332, 20 July 2011, <<http://www.un.org/News/Press/docs/2011/sc10332.doc.htm>>, accessed 17 May 2013.
- 9 Christian Webersik, *Climate Change and Security: A Gathering Storm of Global Challenges* (Santa Barbara, CA: Praeger, 2010). Global emissions of greenhouse gases are summarised by the United States Environmental Protection Agency at <<http://www.epa.gov/climatechange/ghgemissions/global.html>>, accessed 16 May 2103.
- 10 Simon Dalby, *Security and Environmental Change* (Cambridge: Polity, 2009).
- 11 Will Steffen et al., *Global Change and the Earth System: A Planet under Pressure* (Berlin: Springer, 2004).
- 12 Kurt M Campbell et al., *The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate Change* (Washington, DC: Center for Strategic and International Studies and Center for a New American Security, 2007); German Advisory Council on Global Change, *Climate Change as a Security Risk* (London: Earthscan, 2008).
- 13 Intergovernmental Panel on Climate Change, *Climate Change 2007* (Cambridge: Cambridge University Press, 2007).
- 14 Ole Magnus Theisen, Helge Holtermann and Halvard Buhaug, 'Climate Wars? Assessing the Claim that Drought Breeds Conflict', *International Security* (Vol. 36, No. 3, 2011); John O'Loughlin et al., 'Climate Variability and Conflict Risk in East Africa 1990–2009', *Proceedings of the National Academy of Sciences* (Vol. 109, No. 45, 2012).
- 15 Gregory White, *Climate Change and Migration: Security and Borders in a Warming World* (Oxford: Oxford University Press, 2011).
- 16 Richard Matthew, Jon Barnett, Bryan McDonald and Karen O'Brien (eds), *Global Environmental Change and Human Security* (Cambridge, MA: MIT Press, 2010).
- 17 Hans Günter Brauch et al. (eds), *Globalisation and Environmental Challenges: Reconceptualising Security in the 21<sup>st</sup> Century* (Berlin: Springer-Verlag, 2008).
- 18 Philippe Le Billon, *Wars of Plunder: Conflicts, Profits and the Politics of Resources* (London: Hurst, 2012).
- 19 Shlomi Dinar (ed.), *Beyond Resource Wars: Scarcity, Environmental Degradation, and International Cooperation* (Cambridge, MA: MIT Press, 2011).
- 20 Anthony D Barnosky et al., 'Approaching a State Shift in Earth's Biosphere', *Nature* (Vol. 486, No. 7, June 2012).
- 21 United Nations Environment Program, *GEOS Global Environment Outlook: Environment for the Future We Want* (United Nations Environment Program, 2012).
- 22 Mark Pelling, *Adaptation to Climate Change: From Resilience to Transformation* (London: Routledge, 2011).
- 23 Nick Mabey, Jay Gullede, Bernard Finel and Katherine Silverthorne, *Degrees of Risk: Defining a Risk Management Framework for Climate Security* (London: E3G, 2011).
- 24 Kevin Anderson and Alice Bows, 'Beyond Dangerous Climate Change: Emission Scenarios for a New World', *Philosophical Transactions of the Royal Society A* (Vol. 369, No. 1936, January 2011).
- 25 Potsdam Institute for Climate Impact Research and Climate Analytics, *Turn Down the Heat: Why a 4°C Warmer World Must be Avoided* (Washington, DC: World Bank, 2012).
- 26 Royal Society, *Geoengineering the Climate: Science, Governance and Uncertainty* (London: Royal Society, 2009); Bipartisan Policy Center, 'Geoengineering: A National Strategic Plan for Research on the Potential Effectiveness, Feasibility, and Consequences of Climate Remediation Technologies', Bipartisan Policy Center, Washington DC, 2011.
- 27 For a summary of this discussion see Charles H Green et al., 'Superstorm Sandy: A Series of Unfortunate Events', *Oceanography* (Vol. 26, No. 1, 2013).
- 28 Kevin Trenberth, 'Framing the Way to Relate Climate Extremes to Climate Change', *Climatic Change* (Vol. 115, No. 2, November 2012).
- 29 In the aftermath of the 2012 superstorm Sandy, condominium developers in New

- York suddenly began to pay attention to ways of making their buildings more resilient to future storms. See Julie Sattow, 'The Generator is the Machine of the Moment', *New York Times*, 11 January 2013. On climate-change-driven innovations in urban architecture in general, see Alisdair McGregor et al. (eds), *Two Degrees: The Built Environment and Our Changing Climate* (London: Routledge, 2013).
- 30 Stephen Graham (ed.), *Disrupted Cities: When Infrastructure Fails* (London: Routledge, 2010).
  - 31 Kevin Grove, 'Insuring "Our Common Future"? Dangerous Climate Change and the Biopolitics of Environmental Security', *Geopolitics* (Vol. 15, No. 3, 2010).
  - 32 Pelling, *Adaptation to Climate Change*.
  - 33 Linda Wallbott, 'Political in Nature: The Conflict-Fueling Character of International Climate Policies', in Jürgen Scheffran et al. (eds), *Climate Change, Human Security and Violent Conflict: Challenges for Societal Stability* (Berlin: Springer-Verlag, 2012).
  - 34 Padraig Carmody, *The New Scramble for Africa* (Cambridge: Polity Press, 2011).
  - 35 Derek Hall, *Land* (Cambridge: Polity Press, 2013).
  - 36 Richard Tucker, *Insatiable Appetite: The United States and the Ecological Degradation of the Tropical World* (Lanham, MD: Rowman and Littlefield, 2007).
  - 37 Lorenzo Cotula, 'The International Political Economy of the Global Land Rush: A Critical Appraisal of Trends, Scale, Geography and Drivers', *Journal of Peasant Studies* (Vol. 39, No. 3–4, 2012).
  - 38 One example is the recent controversy over Indian purchases in Ethiopia. See John Vidal, 'Indian Investors are Forcing Ethiopians off Their Land', *Guardian*, 7 February 2013.
  - 39 This discussion is usefully summarised in Geoff Dabelko, Lauren Herzer, Schuyler Null, Meaghan Parker and Russell Sticklor (eds), 'Backdraft: The Conflict Potential of Climate Change Adaptation and Mitigation', *Woodrow Wilson Center Environmental Change and Security Program Report* (Vol. 14, No. 2, 2013).
  - 40 Matthew Paterson, 'Who and What are Carbon Markets For? Politics and the Development of Climate Policy', *Climate Policy* (Vol. 12, No. 1, 2012).
  - 41 The crucial international financial mechanism is the United Nations Clean Development Mechanism: <<http://cdm.unfccc.int/>>, accessed 14 May 2013.
  - 42 Melissa Leach, James Fairhead and James Fraser, 'Green Grabs and Biochar: Revaluing African Soils and Farming in the New Carbon Economy', *Journal of Peasant Studies* (Vol. 39, No. 2, 2012).
  - 43 David Humphreys, 'Smoke and Mirrors: Some Reflections on the Science and Politics of Geoengineering', *Journal of Environment and Development* (Vol. 20, No. 2, 2011).
  - 44 A comprehensive discussion of the technical possibilities is beyond the scope of this paper; see Naomi E Vaughan and Timothy M Lenton, 'A Review of Geoengineering Proposals', *Climatic Change* (Vol. 109, Nos. 3–4, 2011).
  - 45 Grantly Galland, Ellycia Harrould-Kolieb and Dorothee Herr, 'The Ocean and Climate Change Policy', *Climate Policy* (Vol. 12, No. 6, 2012).
  - 46 Johannes Urpelainen, 'Geoengineering and Global Warming: A Strategic Perspective', *International Environmental Agreements: Politics, Law and Economics* (Vol. 12, No. 4, November 2012), pp. 375–89.
  - 47 Jeff Tollefson, 'Ocean Fertilization Project off Canada Sparks Furore', *Nature* (Vol. 490, No. 7421, 25 October 2012). In theory, at least, plankton growth can be stimulated by the artificial provision of key nutrients in short supply, in particular ocean waters. If the plankton absorb carbon dioxide while growing, and then sequester it once they die by sinking to the bottom of the ocean, carbon-dioxide levels are supposedly slightly reduced.
  - 48 United Nations, Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD). The Convention on Biological Diversity is also used in arguments against geo-engineering.
  - 49 Clifford Coonan, 'How Beijing Used Rockets to Keep Opening Ceremony Dry', *Independent*, 11 August 2008.
  - 50 Will Steffen et al., 'The Anthropocene: From Global Change to Planetary Stewardship', *Ambio* (Vol. 40, No. 7, November 2011).
  - 51 Alan Robock and Owen Brian Toon, 'Local Nuclear War, Global Suffering', *Scientific American* (Vol. 302, No. 1, 2009).
  - 52 Hans Günter Brauch et al. (eds), *Coping with Global Environmental Change, Disasters and Security: Threats, Challenges, Vulnerabilities and Risks* (Berlin: Springer-Verlag, 2011).
  - 53 Scheffran et al. (eds), *Climate Change, Human Security and Violent Conflict*.
  - 54 Daniel H Deudney, *Bounding Power: Republican Security Theory from the Polis to the Global Village* (Princeton, NJ: Princeton University Press, 2007).
  - 55 Robert Kaplan's *The Revenge of Geography* (New York, NY: Random House, 2012) is dangerously misleading because of its failure to think through these contemporary transformations.
  - 56 See, for instance, the co-operative effort between corporations and Oxfam America in the Partnership for Resilience and Environmental Preparedness (PREP), 'Value Chain Climate Resilience: A Guide to Managing Climate Impacts in Companies and Communities', July 2012, <<http://www.oxfamamerica.org/publications/prep-value-chain-climate-resilience/?searchterm=Value%20Chain>>, accessed 14 May 2013.
  - 57 Duncan Depledge and Tobias Feakin, 'Climate Change and International Institutions: Implications for Security', *Climate Policy* (Vol. 12, Supplement 1, 2012), S73–S84.
  - 58 Paul R Ehrlich and Anne H Ehrlich, 'Can a Collapse of Global Civilization be Avoided?', *Proceedings of the Royal Society B* (Vol. 230, 2013).