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Abstract:

Human-induced climate change is one of the most drastic neo-Malthusian scenarios. The suggested causal chains presented in the literature from climate change to social consequences like conflict is long and fraught with uncertainties. Therefore they are hard to evaluate. One of the more widely-described scenarios is from global warming to sea-level rise to extensive migration to conflict, but even for this scenario every link is contested. Climate change has so many potential consequences for the physical environment that we could expect a large number of potential paths to conflict. This paper summarizes some of the points found in reviewing the literature on environmental security and conflict, and presents some scenarios in which climate change can have an effect on violent conflict. In addition, some paths to improved and increased knowledge on this topic are suggested.

¹ This paper is a very preliminary version. Comments are welcomed.

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Introduction

In October 2003 a report to the US Department of Defense (Schwartz & Randall, 2003) received wide public attention after being released to *Fortune*. This study outlines a grim future scenario with warring states and massive social disturbance as a result of dramatic climate change. Admitting that their climate change scenario may not be the most likely, they nevertheless argue that it is plausible and that it would challenge US national security in ways that should be considered immediately' (op.cit.: 1).

Professor Kevin Noone, Director of the International Geosphere-Biosphere Programme (IGBP), was recently quoted as saying that 'most conflicts have something to do with the climate' (Askelin, 2004). However, a search in the web pages of the IGBP for the word 'conflict' returns no hits. This peculiarity is symptomatic for the environment-conflict nexus. The popular literature frequently refers to an important link between climate change and violent conflict. But when it comes to academic articles or reports, or even web pages, climate change and conflict are rarely mentioned in the same sentence. Moreover, the link is rarely substantiated by convincing evidence.

In a preface to an IUCN expert report to OECD, Mark Halle asserts that 'the relationship between environment and security feels right' (Halle et al., 1999: 000), and Byers & Dragojlovic (2004: 000) in an editorial in *Human Security Bulletin* state that 'in the future, as climate change progresses ... conflicts over natural resources could increasingly take centre-stage' and that the situation in Darfur 'is likely linked to a changing climate'. Others warn that it is necessary to be cautious about the link between climate change and conflict (Barnett, 2001: 5). And the most important agenda-setter for the debate on climate change, the International Panel on Climate Change (IPCC), does not feature conflict prominently as a result of climate change. In fact, in the report's summary for policymakers there are no references to conflict at all.

The concept of environmental security got a foothold in academic and popular literature over two decades ago. But in spite of the large literature generated since then, the link between environmental change and conflict has rarely been studied systematically. Homer-Dixon and his associates claim to have found a link in a series of case studies (see particularly Homer-Dixon, 1999), but their causal claims have varied somewhat over time. The belief that environmental change will increase resource scarcity and in turn cause conflict remains dominant in the public debate, although Barnett (2001: 000) characterizes such claims as 'highly speculative' due to insufficient evidence. Gleditsch & Urdal (2004) comment in *International Herald*

Tribune that ‘environmental destruction and scarcity of renewable resources can present a danger to life and livelihood in many third-world countries. But these hazards are not primarily linked to a danger of war. Exaggerating the security aspects of environmental decay hardly helps our efforts to overcome the negative effects of resource scarcity.’

In the various climate scenarios, change can occur abruptly or as a slow process, and the effects are many and diverse. Discerning the general patterns of future climate change is a difficult task for the natural sciences. Tracing the patterns of violent conflict presents no less a challenge for the social sciences. Although the research frontier is being pushed back in both areas, the gaps in our knowledge are formidable and the combination of two sets of uncertainties daunting.

In this paper we summarise some of the claims found in the literature on environmental security, in searching for scenarios, in search for scenarios in which climate change could lead to violent conflict. The most prominent general link goes from climate change via sea-level rise and migration, but we will also trace some other links.

Climate Change and Conflict

In October 2004, an editorial by Byers & Dragojlovic in *Human Security Bulletin* stated that ‘for centuries, wars have been fought for territorial expansion, ideological or religious dominance, and national pride. In the future, as climate change progresses and its effects become more pronounced, conflicts over natural resources could increasingly take centre-stage’. The conflict in Darfur is their prime case. They claim that the conflict in Darfur is probably linked to the changing climate in the Sahel region of North Africa. The climate change has forced nomadic herders to move into adjoining farming areas for longer periods of time, ‘often outstaying their welcome’. As competition for fertile land and access to water intensified, ‘numerous local clashes broke out and the herders and farmers began to acquire more deadly weapons’ (Byers & Dragojlovic, 2004).

Byers & Dragojlovic cite the International Crisis Group and the US Department of State in support of their view that competition over resources is a major cause of the conflict. Although they admit that climate change may not be the sole reason for the desertification in the area, they point to a claim in the Third Assessment Report of the IPCC claims that climate change alone could exacerbate desertification. However, the IPCC report is quite reserved with respect to a possible causal relationship between climate change and specific conflicts. Moreover, a search conducted on the web pages of the International Crisis Group (www.icg.org, December 2004) for the keyword ‘climate change’ does not give any relevant hits relating to the conflict in

Darfur. In fact, the search does not indicate that the role of climate change is emphasized or even mentioned by the International Crisis Group for any of the countries or region in which they are involved. A search in the web pages of the US Department of State (www.state.gov, December 2004) yielded no explicit statement or documentation of the claim that the conflict in Darfur is caused directly or indirectly by climate change.

The debate about climate change and conflict is an extension of an older debate about how conflict may be affected by environmental change more generally (Barnett, 2003; Homer-Dixon, 1994; Swart 1996). For instance, Mark Halle of the World Conservation Union stated in the foreword of an expert report to the OECD in 1999 that 'the relationship between environment and security feels right', and that 'it seems intuitively correct to assume a direct correlation between environmental degradation on the one hand and social disruption and conflict on the other' (Halle et al., 1999: 1). Rwanda, the Soccer War between Honduras and El Salvador, the Ethiopian highlands, and even the conflict between Israel and Palestinians are put forward as cases in point. Halle believes that according to many analysts environmental conflicts may soon occur in China, India, and Brazil. Halle presents environmental degradation as the long sought-for organizing principle, the underlying explanation, and 'a credible cause behind so many symptoms' based on 'countless examples' (1999: 1). Barnett (2001: 50), on the other hand, argues that 'there is little if any evidence to suggest that environmental problems do cause violent conflict'.

The New 'Soft' Security

Since the 1970s there have been calls to redefine security to include 'soft' politics issues like poverty, health, and also the environment (Matthew, Gaulin & McDonald, 2003). Falk (1971) focused on what he called the 'first law of ecological politics': Time is of the essence, the more rapid the environmental change the more difficult it will be to adapt to its impact. He linked the question of environmental scarcity to the conflict between the rich and powerful and the poor and marginalized, as the wealthy will use more and more violent means to secure their riches and defend themselves from those with less power.

In a series of influential writings Lester Brown (1977) portrayed food security as the main security issue of the future, outlining competition over fishing rights and water conflicts between Bangladesh and India among the future scenarios (1977: 39). He argued that militaries are incapable of solving the challenges posed by the deterioration of biophysical systems. He therefore called for budget reallocations from military expenditure to peaceful measures for assuring food security.

The Brundtland report *Our Common Future* (1987) introduced the term 'environmental security' to a wide audience, but climate change was not yet a key topic. After the end of the cold war environmental security to some extent filled the gap left by the waning threat of global nuclear warfare, since it supplied a similar devastating and worldwide threat scenario. Indeed, the thawing of the cold war made it possible for traditionally 'soft' politics to move closer to the center-stage. Scholars like Homer-Dixon (1991, 1994), Ehrlich & Ehrlich (1990), and Swart (1996) prominently featured the security implications of environmental change.

Environmental security remains a contentious concept, and a clear definition has been difficult to agree upon (Græger, 1996). The question has been raised whether the concept is fruitful at all, or simply functions as a normative concept or a catchword for 'all sorts of lobbies to achieve all sorts of goals' (Allenby, 2000).

A search for 'environmental security AND conflict' at the ISI web of science yielded 25 hits for the time period 1946–2004. The oldest of the articles is from 1992, and most of the other articles in the list have been published during the last five years. According to Matthew et al. (2003: 858), the environmental security story has been remarkably consistent, suggesting that environmental stress, operating through a set of intervening variables, could contribute to violent conflict, and thus constituted a threat to national and international security. However, climate change is mentioned only briefly in most of this literature, and more as a background factor than as an independent cause of conflict.

The idea of 'ecoviolence' has become a part of a security-development nexus (de Soysa, 2005), where civil violence is interpreted largely as a fight for survival in an environment moving towards a threshold of collapse (Homer-Dixon 1999; Homer-Dixon & Blitt 1998; Kaplan 1994; Schwartz, Deligiannis, & Homer-Dixon, 2000). In support of this worldview, a number of case studies have been conducted by Homer-Dixon and his colleagues in the so-called Toronto school; Homer-Dixon, 1994; Homer-Dixon & Blitt 1998), as well as by others (e.g. Barnett & Adger, 2001). Recognizing that the empirical evidence is still fairly weak, Bächler (1999a, b) calls for more elaborate case studies that interact with other studies of conflict, poverty, and ethnicity. Gleditsch (1998), on the other hand, has criticized the case study work for selecting on the dependent variable: studying only the conflict cases and ignoring the peaceful cases. Instead of more case studies, Gleditsch calls for greater attention to research methods and design, and systematic studies with improved data.

Prime Premise Provider: IPCC

Scenarios presented in the literature as potential outcomes of climate change include changes in rainfall patterns leading variously to drought and floods, extreme and unpredictable weather causing storms and hurricanes, melting of the polar icecaps resulting in sea-level rise, and a temperature rise with heavy impact on the potential for agriculture in different regions. Some areas of the planet might become too hot for human habitation, whereas other parts might become more fertile and available for growing crops that traditionally would not survive in the current climate. On the positive side, there is the agricultural potential of the Siberian plains. On the negative side, there is among other things the hazard of a more widespread incidence of diseases like malaria, dengue, cholera, and yellow fever.

The assessment reports of the Intergovernmental Panel on Climate Change (IPCC) provide some of the most influential sources of information for policy as well as the popular debate. In the Third Assessment Report (TAR) (IPCC, 2001), Working group II is particularly relevant. Its 1,000 pages long volume on 'Impacts, Adaptation and Vulnerability' of socio-economic and natural systems deals with topics ranging from hydrology and water resources, ecosystems, coastal zones and marine ecosystems, human settlements, energy and industry, insurance, and health, in addition to regional reports from all continents, as well as the polar regions, and small island states.

The First IPCC Assessment Report (IPCC, 1990) played an important role in establishing the Intergovernmental Negotiating Committee for a UN Framework Convention on Climate Change by the UN General Assembly. The UN Framework Convention on Climate Change (UNFCCC) was adopted in 1992 and entered into force in 1994. It provides the overall policy framework for addressing the climate change issue. The Third Assessment Report was submitted to the 7th Conference of the Parties to the UNFCCC and Parties agreed that it should be used routinely as a useful reference for providing information for deliberations on agenda items of the Conference of the Parties. The reports from the IPCC provide the most important collective frame of reference with regards to the scenarios for climate change and evaluations of the potential impacts of climate change.

Among the new areas of emphasis in the TAR are linkages between global environmental issues and the challenges of meeting key human needs such as adequate food, clean water, clean air, and adequate and affordable energy services. The TAR asserts that the relative vulnerability of different regions to climatic change is largely determined by their access to resources, information, and technology, and by the stability and effectiveness of their institutions. Furthermore, 'climate change is likely to increase world and

country-scale inequity, within the present generation and between present and future generations, particularly in developing countries' (IPCC, 2001, Working Group II: 85). Human society will face new risks and pressures as a result of climate change, and people and ecosystems will need to adapt to future climate regimes. The report makes a detailed study of the vulnerabilities of human populations to future climate change, including associated sea-level rise and changes in the frequency and intensity of climate extremes such as floods, droughts, heat waves and windstorms, and taking into account potential impacts on water resources, agriculture and food security, human health, coastal and other types of settlements, and economic activities. Furthermore, the report includes chapters assessing the vulnerabilities and challenges facing each of the continents, the polar areas, and small island states. The clearest link between climate change and conflict presented is the statement that 'migration of populations affected by extreme events or average changes in the distribution of resources might increase the risks of political instabilities and conflicts' (IPCC, 2001, Working Group II: 85). References used to back this statement are Myers (1993), Kennedy et al. (1998), and Rahman (1999).

Although titled 'Climate Change and Violent Conflict', Rahman (1999) – a chapter in an edited volume – contains little either on conflict or climate change and has a weak empirical foundation. Repeating claims like this in the TAR gives them wider recognition, but not more credibility. Norman Myers and Donald Kennedy, although their works are more substantial, are not authorities on conflict either.

The chapter on hydrology and water resources does not argue outright that climate change will lead to violent conflict. There is some literature suggests a potential for water wars (see e.g. Gleich, 1993; Renner, 1996; Klare, 2001), but other writers are very skeptical (Beaumont, 1997; Wolf, 1999). Neighboring countries that share rivers experience low-level interstate conflict somewhat more frequently (Furlong, Gleditsch & Hegre, 2005), but they also tend to cooperate more. Wolf (1999) argues that cooperation generally trumps conflict in handling shared water resources.

The IPCC report points out that scarcity of clean freshwater often constrains economic development and that changes in the cycling of water between land, sea, and air could have significant impacts across many sectors of the economy, society, and the environment. As a result of climate change the magnitude and frequency of floods are likely to increase in most regions, whereas others will experience low flows. Demand for water generally is increasing as a result of population growth and economic development, but it is falling in some countries, due to more efficient utilization and new technologies adopted to handle low water availability. Changes in climate are

expected to have serious impacts in some parts of the world, particularly parts of the world with poor water management practices – vulnerable communities and poorer regions of the globe. However, the report also states that non-climatic changes may have a greater impact on water resources than climate change.

Societal characteristics that maximize susceptibility to climate change include poverty and low income levels, which prevent long-term planning and provisioning at the household level, poor water control infrastructure, lack of human capital skills for system planning and management, population pressure, and cultural factors such as risk aversion.

Although this chapter of the IPCC report does not promote a dramatic water war scenario, it is one of the few chapters where a potential link between climate change and conflict is mentioned at all, making the observation that ‘much has been written about the potential for international conflict (hot or cold) over water resources’ (IPCC, 2001, Working Group II: 225). The report has a separate point on water and conflict that states that a change in water availability has the potential to induce conflict between different users, with reference to Biswas (1994) and Dellapena (1999). In chapter 4, on *Hydrology and Water Resources*, it is also noted that negative trends in water availability could have the potential to induce conflict between different users, with reference to Kennedy et al. (1998). These conflicts are presented in the report to potentially occur between users in the same area – cities versus farmers, for example – or between users in different parts of a river basin.

The chapter concludes that ‘where there are disputes, the threat of climate change is likely to exacerbate, rather than ameliorate, matters because of uncertainty about the amount of future resources that it engenders’ and that ‘one major implication of climate change for agreements between competing users ... is that allocating rights in absolute terms may lead to further disputes in years to come when the total absolute amount of water available may be different’ (IPCC, 2001, Working Group II: 225).

Chapter 5 of the report analyses the effects of climate change on ecosystems and their goods and services, from sectors such as agriculture, forests, and wetlands. Changes in global climate and atmospheric composition are likely to have an impact on most of these goods and services, with significant impacts on socioeconomic systems (Winnett, 1998), and climate change is likely to interact with other global changes, including population growth and migration, economic growth, urbanization, and changes in land use and resource degradation. This chapter asserts that ‘degradation of natural resources is likely to hinder increases in agricultural productivity and could dim optimistic assessments of the prospects of satisfying growing

world food demand at acceptable environmental cost.’ (IPCC, 2001, Working Group II: 253). Food security is a central concept in this reasoning.

The report points to different expectations regarding food security in the future. Globally, food security seems to be improving for the majority of the world’s poor. The global number, however, also masks variation in food security among regions, countries, and social groups (IPCC, 2001, Working Group II: 253).³ According to the report ‘multiple lines of evidence suggest that agricultural productivity potential is likely to continue to increase’ (ibid.). However, less optimistic expectations include the ‘evidence that the Asian rice monoculture may be reaching productivity limits because of adverse impacts on soils and water’ (ibid.). Soil degradation is seen as one of the major challenges for global agriculture. Such degradation of natural resources is presented as a potential hardship for human societies by the report, but nowhere in the chapter is there a link to violent conflict, as suggested by Homer-Dixon (1999: 63f) and by Hauge & Ellingsen (1998).

IPCC (2001) also deals with coastal zones and marine ecosystems. Earlier, emphasis has been in three areas: the coastal zone itself, impact of sea-level rise, and little else. Indeed, the only focus has been on economic effects and not on social and cultural systems. TAR recognizes that ‘progress in evaluating the potential effects of climate change and sea-level rise on socioeconomic systems has not been as substantial as that relating to biogeophysical impacts’ (IPCC, 2001, Working Group II: 346).

There is inequitable vulnerability to hazards in coastal zones and marine ecosystems. Examples include population shifts in Pacific island nations such as Tonga and Kiribati. In Tonga people have had to move from outer islands to the main island, and forced to settling in low lying areas and the old dumping site. This has led to high vulnerability to flooding and disease (p. 366). Storm surge flooding has led to high mortality in Bangladesh. However, the highest mortality is detected among children, the old and weak, as is also evident in many other cases, most recently in the natural disaster in Southeast Asia, where about half of the victims of the tsunami were children.

In the Second Assessment Report Bijsma (1996) identified three possible responses by the people in the coastal regions: 1) Protect themselves, e.g. with seawalls; 2) Accommodate (e.g. houses on poles); or 3) Retreat (e.g. flee the area). Whether people in general choose one over the others given their situation, and both push and pull factors, need to be established

³ In lower income countries, political instability and inadequate physical and financial resources are presented as the root causes of the food security problem, whereas in higher income, developing countries, food insecurity stems from unequal distribution of food resulting from wide disparities in purchasing power.

through further research. Also, how these choices again affect conflict risk is yet to be established.

Socio-economic resilience is the capability of a society to prevent or cope with the impacts of climate change and sea-level rise, including technical, institutional, economic, and cultural ability. Resilience can be strengthened mainly by decreasing the probability of occurrence of hazard (managed retreat or protection), or avoiding or reducing its potential effects and facilitation recovery if hazards occur. Regarding adaptation in marine ecosystems (IPCC, 2001, Working Group II: 369), the fishing industry faces possible adverse effects of climate change that can be aggravated by an inadequate utilization of fish reserves. Fish reserves are among the most important economic resources in many countries, and environmental impacts could affect the catch volume and thereby national economies. Fish stocks are trans-boundary resources. In the case of the Pacific salmon, problems that have arisen in the agreement between the US and Canada are attributable in part to the effects of large-scale climate fluctuations (IPCC, 2001, Working Group II: 370). The scope of such conflicts in the future, and the potential for escalation to violence, are not assessed by the report. However, the risk of conflict over fishing resources may be exacerbated by the difficulty of adaptation between multiple competing users who possess incomplete information about the resource (Miller, 2000).

Chapter 7 of the report states that human settlements are expected to be among the easiest to adapt to climate change, 'given appropriate planning and foresight and appropriate technical, institutional, and political capacity' (IPCC, 2001, Working Group II: 383). The factor that is expected to have the most major effect on human settlements is flooding, landslides, cyclones becoming more destructive, and water supplies affected (all these factors are considered in the IPCC terminology 'established but incomplete'). More speculative factors include fire danger, hail, and windstorm.

Another well established fact according to the report is that energy demand in some locations is sensitive and parts of the supply system are vulnerable. This could potentially be of importance with reference to the claimed link between oil and conflict (Ross, 2004). However, the example in the IPCC report is related to hydroelectric power more than oil, and the report states that this is the energy source most likely to be affected by climate change (IPCC, 2001, Working Group II: 399). The types of effects of climate change discussed in this chapter of the report are changes in productive capacity and changes in demand, that physical infrastructure or services may be directly affected (e.g. by floods), and that populations may be affected through extreme weather, changes in health status, or migration. Furthermore, climate change is supposedly more likely to have important impacts

on the development of settlements in resource-dependent regions or coastal or riverine locations. In coastal regions (especially on river deltas and small islands) sea-level rise will be the most fundamental challenge of global warming that human settlements face.

According to the report, 'climate change has the potential to enlarge equity-related gaps in human settlements and systems' (IPCC, 2001, Working Group II: 389), and more importantly, with respect to links between climate change and potential violent conflict: 'Climate change could reduce water availability in the semi-arid savannah ecosystems of tropical Africa ... Conflict already occurs between herdsman and farmers in this region' (IPCC, 2001, Working Group II: 394).

With reference to a case study of Northern Ethiopia by Meze-Hausken (2000), the report notes that human populations tend to adapt to inter-annual variability of climate via migration, although migration may be the last of a complex set of coping strategies.

In the management and adaptation of human settlements, climate change simply adds to the old concern about coping with our natural environment, and the usual concerns of urban planners etc. (IPCC, 2001, Working Group II: 401). Many coping mechanisms are presented with respect to planning and design, management, and institutional frameworks for human settlements to adapt to changes in climate. There are multiple pressures on human settlements that interact with climate change. These other effects are seen as much more important in the short run, and climate is only a potential player in the long run. For example, dealing with rapid urbanization will be much higher on most countries' agenda than longer term issues of climate change.

Another topic for the report is the effect of climate change on human health. It is stated that socio-economic impacts of large epidemics could alter the relative strength of different communities and countries, and thus change the relative power between them. This could potentially lead to some level of instability or conflict.

Some societies that are very vulnerable could become even more so as they lose larger parts of their population, and thus have a harder time defending their territory. However, due to technological developments in both production and industry in general and in the military sector in particular, the human factor in sheer numbers is possibly less important now than earlier, and the trend continues in the direction of lessening importance of the factor of manpower.

Remarkably, there is not yet a single epidemiological study that has clearly related recent climate trends to a particular disease (IPCC, 2001), so the link between climate change and disease remains somewhat speculative.

By the time this scenario of widespread disease potentially becomes a reality, medicine might also have developed enough to lessen vulnerability. Also, sanitation systems, vaccination programs, nutritional conditions, animal husbandry, irrigation, and land-use management influences whether the presence of a disease in animals such as mosquitoes will lead to a break out of disease in human populations (IPCC, 2001, Working Group II: 927). Mosquitoes are known for being very sensitive to climate change, so this factor could severely alter the spread of diseases through altered patterns of disease vectors. A large number of complex processes are at work, and many possible additional factors that can mediate between climate change and health effects in the human population. Again, the time factor could be vital, as adaptation to abrupt changes should imply more severe challenges than changes occurring at a slower rate.

The overall impression from the report from Working Group II of the IPCC is that the link between climate change and conflict is not pronounced, and the places where such a link is mentioned, it is rather weakly substantiated by reference to empirical literature or clear examples. The assumption or expectation of there being such a link thus seems to come from other sources, and be repeated by different authors in different settings somewhat like a rumor that spreads from person to person without critical questions being asked.

The Climate Change reports by IPCC have been used as the foundation for several other publications, for example an Information Kit by the UNDP and UNFCCC. The climate change information kit released in 1999 lists the following ways in which the climate is thought to change: A global warming of about 2 degrees Celsius between 1990 and 2100, with an uncertainty range of 1–3.5 degrees. Furthermore, the earth's average sea-level is predicted to rise by about 50 cm by 2100. The uncertainty range is large – 15 to 95 cm – and changing ocean currents could cause local and regional sea levels to rise much more or much less than the global average.

Regional and seasonal warming predictions are much more uncertain. Although most areas are expected to warm, some will heat up much more than others. The northern regions, northern Canada and Siberia could expect to be 10 degrees centigrade higher in winter in 2100 than in 1990, and inland areas are expected to warm faster than coastal regions. Total rainfall is predicted to increase, but at the local level trends are much less certain. The frequency and intensity of extreme weather events such as storms and hurricanes may change.

Rapid and unexpected climate transitions cannot be ruled out. The most dramatic would be collapse of the West Antarctic ice sheet, which would lead to a catastrophic rise in sea-level, and changes in ocean circula-

tion. For instance, such a weakening of the Gulf Stream that warms Europe could potentially take place in only a few decades.

Climate change is also expected to have wide-ranging consequences for human health. Factors such as food, safe drinking water, secure shelter, and settings that can protect against and controlling infectious diseases can be affected by climate. Furthermore, the climate change summary states that 'heat waves, flooding, storms, and drought can cause deaths and injuries, famine, the displacement of populations, disease outbreaks, and psychological disorders', and an effect on human settlements can be an outcome of climatic changes, as for example 'a decline in the productivity of natural resources in rural areas may accelerate rural-to-urban migration'.

The Wider Debate

One of the few scholars tackling the question of climate change and security at some length, Barnett (2001b), notes that climate change, despite being the most prominent and best-studied of environmental problem, has received little attention and systematic analysis as a security issue. His own writings provide good overviews of the literature and the evidence (and lack thereof), but he does not contribute much new empirical evidence linking climate change to conflict.

Barnett (2001a,b; 2003) explores ways in which climate change might lead to conflict. He argues that 'because sovereignty over delineated territory is the material substrata of national security, then physical processes such as sea-level rise may undermine national security in serious ways' (Barnett, 2001b: 4). Furthermore, national security has an internal dimension of state legitimacy. With reference to Rapkin & Avery (1986), he argues that political stability and the legitimacy of governments may be compromised by climate change, and 'governments for whom the material well-being of their people is highly sensitive to external forces such as changing terms of trade, or where material well-being is in decline, tend to be relatively more unstable, and the country relatively more prone to internal violent conflict' (ibid). Countries that depend on a natural resource that is sensitive to climate change will experience problems if the supply of that resource deteriorates. State legitimacy will be eroded and conflicts may occur. However, the effect of climate change is indirect, such as via undermining of economic individual and collective livelihood, health effects through freshwater, food, and spread of diseases, undermining of state strength (economic and military), and inequality between people.

If one accepts the view of Homer-Dixon (1999) that environmental change is a factor in violent conflict, climate change should be an 'exacerbating factor in violent conflict in the future' (Barnett, 2001b: 5), as climate is a

‘macro-engine’ or overarching contributor to a plethora of forms of environmental change. However, ‘it is necessary to be cautious about the links between climate change and conflict’ (ibid), Barnett provides a range of reasons why there might not be such a link and why the empirical evidence is weaker than claimed by some of the theoretical literature. Any claims about the effect of climate change on violent conflict will therefore be ‘highly speculative’ (ibid.).

Small island states are the most vulnerable to climate change. However, these areas are economically and politically marginal states with less capacity for violence than other states (Barnett, 2001b: 000). They also have experienced relatively less violent conflict after decolonization than other developing states. Although the ramifications of climate change for these states could be tremendous, the outcome is not necessarily widespread violence.

The research agenda on climate change and conflict proposed by Barnett (2001b) should focus on intrastate rather than interstate conflict and on the areas already affected with factors that increase the likelihood of conflict, such as economic and political change and high income inequality. Also, research would, ‘profitably focus on areas where renewable resources are particularly sensitive to climate change’ (Barnett, 2001: 7), such resources in particular as soil, water, firewood, and fish. Developing countries in particular fall into this category. Conflicts due to climate change are most likely to occur in developing countries, particularly in Africa and Asia, except for scenarios of low-probability high-impact events such as slowing of the oceanic thermohaline circulation, where even the developed regions could be affected.

Forced migration is a key variable in many climate change-to-conflict scenarios, including case studies by Bächler (1999a,b), Homer-Dixon & Blitt (1998), and Swain (1993). The crucial question in that argument is how the decision to migrate is made and the extent to which environmental change is an important factor. Although he agrees that the migration scenario is a crucial link between climate change and conflict (with reference to van Ireland et al., 1996 and Rahman, 1999), Barnett also states that ‘people rarely move for environmental reasons alone’ (2001b: 8). Furthermore, he points to Goldstone (2001) who observes that very few large scale migrations end in conflict. In extension of his proposed research agenda, Barnett suggests studying existing patterns of ‘environmental refugees’, as these may be indicative of points of future conflict. The empirical investigation of such emigration and immigration is critical to a research program on climate change-to-conflict links.

The widely-publicized report prepared for the US Department of Defense (Schwartz & Randall, 2003) presents a scenario for rapid climatic

change, and the possible implications for US national security. The report points to the possibility that a gradual global warming could lead to relatively abrupt changes in temperature. The report further explores a gloomy scenario of rapid climate change that implies 'harsher winter weather conditions, sharply reduced soil moisture, and more intense winds in certain regions that currently provide a significant fraction of the world's food production' (p. 1).

According to the report, the result of climate change could then be significant drop in the human carrying capacity of the Earth's environment.⁴ The report then explores how scenarios of abrupt climate change could 'potentially de-stabilize the geo-political environment, leading to skirmishes, battles, and even war due to resource constraints' (p. 2) such as food shortages, decrease in the availability of clean fresh water, floods and droughts, and disrupted access to energy supplies due to extensive sea ice and storminess.

This report also outlines how national strategies would differ depending on the carrying capacity and the local resources available: nations with the means would build 'virtual fortresses' to preserve their resources, whereas less fortunate countries, especially those with enmities with their neighbors 'may initiate in struggles for access to food, clean water, or energy. Unlikely alliances could be the result, as the defense objectives and priorities shift, and 'the goal is resources for survival rather than religion, ideology, or national honor' (p. 2).

However, the report also states that a scenario like the one presented has never been experienced by human civilization previously: weather or climate conditions that are persistently disruptive and abrupt such as imagined in this report have never been seen by humanity. The implications that they draw in the report are therefore hypothetical and dependant on the nuances of potential climate change, the adaptability of humanity and decisions by policymakers (p. 14). The consequences of climate change in the past are briefly used as examples of possible outcomes: the cooling of the climate in the 14th century that contributed to the destruction of the Norse community in Greenland and the more recent example of the Irish potato famine (induced in part by climate change) that killed a million people. Future scenarios for violent conflict or at least tension in Europe include Scandinavians moving southward and Germans and Dutch moving to Italy and Spain. As a result, there may be conflicts within European Union over food and water supply. The report also suggests that there may be skirmishes

⁴ Harvard archeologist Steven A. LeBlanc (1999) also asserts that warfare in the prehistoric American Southwest can be understood in terms of climate change, population growth, and their consequences

over water and immigration, conflict between Germany and France over the Rhine for commercial purposes, and southward movements to countries such as Algeria, Morocco, Egypt and Israel. For Asia the report suggests intervention over energy resources, be immigration to Burma from India, Bangladesh, and China, persistent conflict in South-East Asia and even civil war in China. For the United States the report foresees a flood of refugees from the Caribbean and Europe, disagreements with Canada and Mexico over water, fishing rights conflicts, and an armed conflict between Chinese and US naval forces in the Persian Gulf to secure the supply of oil.

To add to these grim prospects, the report states that 'as famine, disease and weather-related disasters strike due to the abrupt climate change, many countries' needs will exceed their carrying capacity' (p. 18). This will contribute to a sense of desperation, which is likely to lead to offensive aggression in order to reclaim balance' (p. 18). In this 'world of warring states' (p. 19), a further danger is stated as inevitable – the proliferation of nuclear arms, driven by the need to develop nuclear energy in response to diminishing oil reserves (p. 19).

To top the gloomy outlook, the report argues that it is not unlikely that we are rapidly approaching a threshold of climate change, where the pace of change will pick up dramatically. With very few references to academic literature on conflict, this report asserts the link from climate change to conflict, but fails to describe the mechanisms that would link the two. Whether or not one believes this gloomy view depends in large part on one's faith in human ingenuity and ability to adapt to change.

In the following we move to a brief outline of some prominent perspectives on conflict and discuss what guidelines they may provide as to where the potential causal relationships between climate change and conflict might be found.

Causes of Violent Conflict

Theories of civil war focus on what motivates people to stage a violent uprising and what the opportunities are for insurgents. Collier & Hoeffler (1998, 2002) describe conflict as based either on greed or on grievance. Do people fight as a result of marginalization, frustration, or relative deprivation? Or do they rather fight about a honey-pot which gives them a financial motive and an opportunity to mobilize? A great deal of recent research has evolved around this dichotomy. It may also provide some guidance when searching for causal pathways from climate change to conflict. Closely linked to the dichotomy of greed versus grievance is that of scarcity versus abundance. If one believes that conflicts are generally caused by grievances, one would also expect resource scarcity and deterioration of the natural environment (due to

climate change or other factors) to ignite conflict. Bächler (1999a,b) and Homer-Dixon (1999), among others, fit this model of conflict.

Those that argue for resource abundance and financial opportunity as central mechanisms for conflict would have a very different view on the conflict potential as a result of climate change and subsequent environmental degradation. Both Collier & Hoeffler (2002) and de Soysa (2002) have argued that violent conflict is particularly likely if there is an abundance of lootable resources.

In the empirical literature on conflict, one finds near-consensus on a few factors. For civil war, Gates (2002) and Sambanis (2002) find that development, conflict history, and ethnic dominance or polarization contributes to conflict. Other factors are generally thought to increase the risk of violent conflict, but partly disputed. These include political instability, regime change, time since independence, natural resource dependence, large population size, and rough terrain. More uncertain factors for which they judge the literature to be undecided include the size of ethnic diasporas, demographic variables, participatory regime types, state capacity, and international factors such as the spreading of conflicts across borders. Although these factors are not consistent in all studies of civil war, it is generally assumed that poor countries with a semi-democratic regime type, with large minorities, and a turbulent past are among the countries most likely to experience further outbreaks of conflict.

Regarding interstate conflict, geographical proximity clearly increases the risk (Bremer, 1992), whereas democracies hardly ever fight one another (Gleditsch & Hegre, 1997). Great powers are more often involved in conflicts than smaller powers and alliances and relative power also affect the risk of conflict. Finally, having a history of conflict increases the risk of conflict occurring between the same protagonists in the future (Raknerud & Hegre, 1997).

The role of resources in conflict is especially relevant to climate change scenarios. Ross (2004) summarizes the literature on what we know about natural resources and intrastate conflict. Oil exports are linked to the onset of conflict, but agricultural production is not, and primary commodities exports (as an aggregate measure of resource dependency) is unrelated to conflict (p. 338). He stresses that all correlations between civil war and natural resources could be spurious if both factors being caused by for instance weak rule of law and a lack of security of property rights, which would discourage investments. Also, there might be a reversed causality, meaning that 'civil wars may cause resource dependence by forcing a country's manufacturing sector to flee while leaving its resource sector ...the major force in the economy by default' (p. 338). In contrast to this summary,

Collier & Hoeffler (2002) find that the ratio of primary commodities exports to GDP do tend to increase the risk of civil conflict, but that the relationship is not linear. Resource dependence increases the risk of conflict up to a certain level, but when it rises beyond 32%, the risk of conflict diminishes. Fearon & Laitin (2003) were unable to replicate this finding and Fearon (2005) argues that it is an artifact of Collier & Hoeffler's model, with an analysis by five-year periods.

Both case studies and quantitative studies find that oil increases the risk of conflict (Ross, 2004). In the quantitative camp, Fearon & Laitin (2003) and de Soysa (2002) find that the oil exporter face increased conflict risk. Fearon & Laitin attribute this to oil-rich states having weaker state apparatuses, and suffering a political 'Dutch disease'. The key to intrastate peace, according to Fearon & Laitin (2003: 88), is to have a well-financed and administratively competent government and legal accountability. State weakness 'marked by poverty, a large population, and instability' are the best predictors of civil war risk.

How are the Causes of Conflict Affected by Climate Change?

Among the factors known to affect conflict, development could clearly be affected by climate change. Climate change may have an effect on the availability of clean freshwater, which is important for development. Factors like soil erosion, spread of diseases, and drought can also severely impair development. There seems to be wide agreement that states lagging in economic development, particularly in Africa and parts of Asia, are particularly vulnerable to climate change. Climate changes may make it even more difficult for these countries to climb out of poverty.

Furthermore, the ethnic composition of countries can be altered by migration. This is one of the most widely cited conflict-generating effects of climate change in the literature. Whether or not those that are affected by climate change make the decision to flee their country or neighborhood due to the stress on their natural environment is a key question in this regard. If climate models could be extended to predict the migration patterns for specific regions, it might be possible to determine changes in the ethnic composition. The state's response to influxes of refugees and to ethnic and religious diversity will nuance this picture. There is no necessary relationship between ethnic composition and conflict, although there is a potential for conflict if this relationship is handled unwisely (Nordås, 2004).

Political instability, another factor widely believed to affect conflict, may be one of the adverse outcomes of climate change. Rapkin & Avery (1986) argue that countries that are relatively sensitive to external forces, such as changing terms of trade, or countries that face material decline are

more unstable, and thus more conflict prone. Barnett (2001b) argues that climate change can undermine individual and collective economic livelihood, human health (through lowered food and water security), and that this can create instability and lessened state legitimacy and strength.

We have mentioned the importance of oil in conflict. Policies designed to implement the Kyoto protocol are likely to affect the price of oil and may thus be relevant for conflict. Most models of climate change, according to Barnett (2001b: 5) suggest that implementation of the Kyoto protocol will increase oil prices and reduce demand in developed countries, thereby driving down projected revenues for oil exporters. If the theoretical explanation for why oil rich countries are more conflict prone than other states follows the logic of oil exporters having weaker state apparatuses (Fearon & Laitin, 2003) this could have some significance for the prospects of war in the future. A state that has less 'socially intrusive and elaborate bureaucratic system to raise revenues – a political 'Dutch disease' (Fearon & Laitin, 2003: 81) could be vulnerable to social upheaval in face of diminishing revenues to the state as a result of falling oil prices. However, if the Kyoto protocol does work to stabilize climate change in the future, the two effects might cancel each other out. This points to a more general problem in studies of the effect of climate change: There is more focus on the likely negative effects of climate change than on possible positive effects.

Several factors that have more mixed findings in systematic empirical investigations of conflict, could be affected by political instability or negative economic development. In particular, the population factors could be affected by 'environmental refugees', people fleeing drought affected areas or a declining countryside in search of a livelihood in ever-growing urban areas. Urbanization is also one of the destabilizing factors mentioned in various literatures on political instability, as rapid urbanization tends to weaken social structures, and lead to widespread marginalization, crime, pollution, and health problems. The total picture of the problems related to underdevelopment and poverty do weaken state capacity, and climate change could therefore potentially contribute to an already unstable situation, and possibly mount to conflict. However, adaptation to migration and immigration can also act as a buffer against the onset of violence. The decision to migrate is not straightforward either. We know little about the decision to migrate due to climate change. Much of the literature considers this question at a very general level, and has little empirical research to draw on. Meze-Hausken (2000: 380) concludes from historical and contemporary cases that 'climate change per se is seldom found to be the root of migration'. Vulnerability is found to be a complex issue, and she also shows that 'people in marginal regions have developed a great variety of adaptation mechanisms, which

strengthen their ability to cope with both slow climatic changes and extreme climatic events' (ibid: 379). Barnett (2001b) also notes that migration will not necessarily be the most likely outcome of environmental stress. Also, if people affected by climate change this will not necessarily result in conflict. One might speculate that this will change as the globe becomes increasingly populated; however, there are also numerous examples of large cities such as Hong Kong where people live peacefully albeit in a crowded state.

The environmental literature frequently suggests that political violence is a function of inequality. For Homer-Dixon (1991), 'structural scarcity' – i.e. unequal distribution of resources – is one of the three basic forms of environmental scarcity. There is little support for a link between inequality and conflict if inequality (often called vertical inequality) is measured by the general income distribution (Collier & Hoeffler, 1998; Hegre, Gissinger & Gleditsch, 2003). A more promising lead is to look at horizontal inequality, using inequality measures that take into account identity group affiliations, such as ethnic affinities (see e.g. Lichbach, 1989, Stewart, 2000; Sen, 1992). So far there are few systematic studies of this relationship (Østby, 2005).

On the whole, the literature suggests that climate change will have the most adverse effects on those groups that are already vulnerable due to poverty, low education, and a general lack of resources. The areas of the globe most likely to be hit by dramatic effects of climate change are for instance the Sahel region of Africa, Bangladesh, and other poor areas. If inequalities within communities, states, regions, and globally are likely to increase, the empirical investigations of the relationship between inequality and conflict will be even more relevant in the future. Those with ample resources will be more able to protect themselves against environmental degradation, relative to those living on the edge of subsistence who will be pushed further towards the limit of survival. One of the central issues will then be whether this results in apathy or an uprising against the more fortunate. Some point to historical cases such as the French revolution coinciding with severe weather disturbances, and European colonial expansion in Southeast Asia being facilitated by droughts, and thereby linked to climate change (Grove, 1995). Furthermore, the "17th-century crisis", a series of interlocking economic, social and political upheavals between 1635 and 1665, has been interpreted as the result of diminishing resources and climate change (Parker, 2001), an uprising of the poor and subsequent conflict. Although the intuition of such causality has widespread appeal, it seems unlikely that those who are the most marginalized will have the opportunity to respond – however 'unfair' this may be.

Learning from History?

Most of the current debate about climate change and security is framed in terms of the future and based on trends from the recent past. But climate change is by no means a new phenomenon, so more distant experiences may also be worth examining. Historians, such as Weiss (2000; 2001) has investigated the effects of climatic disturbances on societal collapse, and conclude that climate was one of the primary agents in the collapse of prehistoric and early historical societies. Recently, Diamond (2005) has once again surveyed thousands of years of human history, this time with a view to establishing how come societies fail collapse and others choose to succeed.

Among the major stories of failure examined by Diamond is Norse Greenland. First settled in the tenth century by Vikings crossing from Iceland, this outpost of European civilization lasted nearly 500 years, and then collapsed. It took about 300 years until Nordic settlers came back to take control of the old colony. Climate change is definitely a part of the story of the collapse of the Nordic settlements. It affected the conditions for agriculture, fishing, and hunting. Having arrived at a relatively warm period, the Norsemen were unable to handle the fluctuations in the succeeding centuries. In addition to affecting local conditions, a cooler climate also meant that voyages by sea to Greenland were impeded by ice and that trade with Europe became increasingly difficult. Violence is also a part of his story. The physical conditions increasingly favored the Inuits. The Norsemen were unable or unwilling to come to terms with them, and ended up fighting them.

Diamond is not an environmental determinist, in fact he states he does not 'know of any case in which a society's collapse can be attributed solely to environmental damage' (op. cit.: 11). He explains the decline and survival of societies in terms of a five-point framework: environmental damage, climate change, hostile neighbors, friendly trade partners, and society's response to its environmental problems. The decline of the Norse settlements in Greenland may not have been and the collapse of the civilization in Easter Island that built so many impressive statues, were triggered by environmental problems. But the civilizations in Tikopia, the New Guinea highlands, and Tokugawa Japan were able to adjust to their environmental problems in more constructive ways, and survived.

In turning to today's problems, Diamond generally sides with environmental pessimists in arguing that it is impossible for people in the Third World to reach current First World living standards (p. 496). Objections to this view he dismisses as a series of 'one-liners' (pp. 503ff.), but the contrary

views are not really engaged.⁵ He presents two maps of ‘Political Trouble Spots of the Modern World’ and ‘Environmental Trouble Spots of the Modern World’ (p. 497). The source for these maps seems to be what a hypothetical ‘ivory tower ecologist’ with no interest in politics and a ‘First World politician’ with no interest in the environment would have responded if asked about the worst trouble spots. The two maps are identical, without documentation beyond the reference to the two imaginary respondents, and the trouble spots seem somewhat arbitrary.⁶ So, although Diamond’s book is full of insight about historical cases, he does not provide much guidance of direct relevance for today’s problems.

An Improved Research Agenda

Although the subject matter of discerning whether or not there is a relationship between climate change and violent conflict is very large, several possible ways of going about improving our knowledge spring to mind, and several suggestions have been made in recent literature (e.g. see Barnett, 2001b; Matthew, Brklacich, & Bryan McDonald, 2004). However, the suggestions do not provide easy ways of getting to the core of the issue. Given the complexity of determining the impacts of climate change on the natural environment as well as the possible roads to violent conflict, this is not surprising.

Some of the possible ways ahead that have appeared during the revision of the literature are the following: Some important data collection tasks should be undertaken, particularly on the importance of environmental push factors in migration that are related to climate change. A partial solution could be to use data on natural disasters as proxies for abrupt climate change, in order to test the effect of such events on the level of political violence associated, and also the migration patterns that could potentially follow such events. The enormous tsunami disaster in Southeast Asia in December 2004 could potentially provide a proxy scenario for severe abrupt climate change. So far, this disaster has led to enormous suffering and economic setbacks, but not to increased conflict. In fact, peace talks were revived in the Aceh province of Indonesia after the Dec. 26 Indian Ocean tsunami killed up to 160,000 people in the region.

Another research priority is to examine the so-called zero cases, where environmental degradation does *not* lead to conflict. One of the most pronounced criticisms of the work of Homer-Dixon and his colleagues is that

⁵ For instance, Diamond (2005: 509) makes two unsubstantiated claims about views allegedly expressed by the leading cornucopian writer, the late Julian Simon, which he then proceeds to trash. I have repeatedly but unsuccessfully tried to obtain documentation from Diamond for his rendering of Simon’s views.

⁶ In the Americas, Haiti is the only trouble spot. In Africa, the only problems occur in Madagascar, Rwanda, and Somalia.

they have a selection bias in their case studies, and that they study only cases where the outcome is social disruption and conflicts (Gleditsch, 2001). Further research is also needed on the effects of environmental change and particularly climate change on political and social instability. Are countries affected by rapid environmental change more politically unstable than other countries?

It also seems clear that further research into scarcity versus abundance and conflict potential is needed. Matthew, Brklacich & McDonald (2004) argue that researchers must move beyond the either/or debate, or scarcity and abundance, as opposing claims about the causes of conflict. In fact, 'it may be useful to integrate these theories to produce broader frameworks with greater explanatory power. For example, are abundant lootable resources more likely to lead to violent conflict under conditions of generalized scarcity, or vice versa?' (2004: 10).

Barnett calls for a research agenda that focuses on intrastate conflicts, as he reckons that environmental change tends to be a contributing factor mostly to conflicts within rather than between states (2001b: 6). On the assumption that environmental change will primarily affect smaller conflicts, one might go beyond conflicts defined by a threshold of casualties, such as the 1,000 deaths of the Correlates of War project or the 25 annual deaths required by the Uppsala/PRIO conflict data (Gleditsch et al., 2002). It may be necessary to look at a broader range of conflicts from riots, protests, and even non-violent conflicts, which might be precursors to later violent confrontations.

Finally, Barnett (2001b) calls for a research agenda with special attention to states that are in transition, either economically or with regard to their political regime, and where income inequalities are high, as these will be the most vulnerable to conflicts as result of climate change. He would also like the research community to investigate in particular those areas where renewable natural resources such as soil, water, firewood, and fish are particularly sensitive to climate change, and he states clearly that 'critical ... is the role of emigration and immigration' (2001b: 9).

Conclusion

The notion that climate change is a potential security threat is stated repeatedly in various reports and articles. However, just as the broader environmental change-scarcity-conflict argument has been severely criticized on theoretical, methodological, and empirical grounds, it has not yet been convincingly demonstrated that climate change is an important factor in conflict (Barnett, 2003).

The suggested causal chains from climate change to social consequences like conflict are long and fraught with uncertainties. One could ask whether it is indeed conceptually fruitful to be talking about climate change and conflict at all. Climate change is such a wide term that it can be hard to use in any meaningful sense in research, and grasp it in a holistic manner, as there seem to be no direct effects between climate change and violent conflict. However, climate change covers most of the aspects that have been treated in the resources and conflict literature, as well as in the environmental security and conflict literature. Climate change will most probably have many effects, and different effect in different areas. It could be a slow changing process, or potentially lead to abrupt changes as we cross a certain threshold. Sea-level rise is the most talked about scenario, potentially leading to population displacements, but other effects can be drought or flooding, soil degradation, heat waves, spread of diseases. Some people will suffer from the consequences of climate change, while others might gain from increasing average temperatures. In cases where there is competition in face of or as a result of climate change, conflicts may or may not occur, but the people already having the most resources to start with (in terms of both finances and human capital) will probably gain in such scenarios as well.

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