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Climate change and conflict

Ragnhild Nordås [a,b,*], Nils Petter Gleditsch [a,b]

[a] *Centre for the Study of Civil War, International Peace Research Institute, Oslo (PRIO), Hausmanns Gate 7, 0186 Oslo, Norway*

[b] *Department of Sociology and Political Science, Norwegian University of Science and Technology, Trondheim, Norway*

Abstract

The prospect of human-induced climate change encourages drastic neomalthusian scenarios. A number of claims about the conflict-inducing effects of climate change have surfaced in the public debate in recent years. Climate change has so many potential consequences for the physical environment that we could expect a large number of possible paths to conflict. However, the causal chains suggested in the literature have so far rarely been substantiated with reliable evidence. Given the combined uncertainties of climate and conflict research, the gaps in our knowledge about the consequences of climate change for conflict and security appear daunting. Social scientists are now beginning to respond to this challenge. We present some of the problems and opportunities in this line of research, summarize the contributions in this special issue, and discuss how the security concerns of climate change can be investigated more systematically.

Keywords: Climate change; Armed conflict; IPCC; Resource scarcity

Climate change

Global climate change will have profound implications for the quality of life of hundreds of millions of people. The prospect of human-induced climate change illustrates for the first time in history that humankind is in a position to exercise a significant influence on the

* Corresponding author. Centre for the Study of Civil War, International Peace Research Institute, Oslo (PRIO), Hausmanns gate 7, 0186 Oslo, Norway. Tel.: +47 22 54 77 04; fax: +47 22 54 77 01.

E-mail addresses: ragnhild@prio.no (R. Nordås), nilspg@prio.no (N.P. Gleditsch).

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global environment.[1] This is a testimony to our inventiveness and power on the planet but also a warning about its possible harmful consequences. The Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC, 2001) firmly established climate change as a political issue on the global agenda. The Fourth Assessment Report, currently being finalized (IPCC, 2007: 3) has estimated it to be 'very likely' that human activities have contributed significantly to the observed temperature increase in the recent half century, i.e. an assessed probability in the interval 90–99%. The IPCC has also outlined a series of probable effects of climate shifts on a plethora of natural systems. These in turn are likely to impact on human activities.

Given the potential range and scope of consequences of climate change, it is not surprising that there is a concern about its security implications. Indeed, this began to surface soon after the TAR was published and has recently accelerated, even though the issue is peripheral in the IPCC reports. On 17 April 2007, climate change was debated in the Security Council, which established it as a security issue. Despite the breadth of this security concern in the public debate, statements about security implications have so far largely been based on speculation and questionable sources. Even the IPCC, which rightly prides itself of being a synthesis of the best peer-reviewed science, has fallen prey to relying on second- or third-hand information with little empirical backing when commenting on the implications of climate change for conflict. The research frontier is being pushed forward in both climate change research and conflict research, but given the combined uncertainties of the two fields, the gaps in our knowledge appear daunting. However, social scientists are now beginning to tackle this dual challenge. This special issue makes a contribution to a more systematic theoretical and empirical assessment of the potential security implications of climate change. Above all, we aim to show that these issues are researchable and should be made a research priority. Of course, caution must be exercised in drawing conclusions from the articles published here and particularly in formulating policy recommendations. Nevertheless, this special issue demonstrates that the concern about the conflict implications of climate change is warranted even though some of the apocalyptic visions currently disseminated by NGOs as well as some governments are less than solidly founded.

The security scenario

The IPCC reports make only scattered comments about violent conflict as a consequence of climate change, and when such a link is mentioned it is largely unsubstantiated by evidence. Nonetheless, the security threat from climate change has been presented in public debate in increasingly flamboyant wording, largely based on secondary and politicized sources.

In October 2003, a report to the US Department of Defense (Schwartz & Randall, 2003) received wide public attention for presenting a grim future scenario with warring states and massive social disturbance as a result of dramatic climate change. The authors argued that their scenario was plausible and that it ''would challenge US national security in ways that should be considered immediately'' (Schwartz & Randall, 2003: 1). More recently, 11 retired US generals and admirals added more military authority to the issue, arguing that ''Climate change can act as a threat multiplier for instability in some of the most volatile regions of the world''

[1] Disregarding the debate about 'nuclear winter' (Sagan & Turco, 1993), an issue that seems to have died with the end of the Cold War and the demise of the strategy of Mutual Assured Destruction.

and that this "presents significant national security challenges for the United States" (CNA, 2007: 1). The German Environment Ministry (2002: 4) has found that "evidence is mounting that the adverse effects of climate change can, particularly by interaction with a number of socio-economic factors, contribute to an increasing potential for conflict", an argument recently extended by the German Advisory Council on Global Change (WBGU, 2007). The United Kingdom used its position as chair of the Security Council to put the issue on the Council's agenda in April 2007 and the British Foreign Secretary Margaret Beckett argued that the impacts of climate change, such as crop failure and lingering drought, sea-level changes, and river basin degradation "went … to the very heart of the security agenda" (UN, 2007).[2] Former UN Under-Secretary-General for Humanitarian Affairs, Jan Egeland and Secretary-General Ban Ki-moon, have linked the conflict in Sudan's Darfur region to climate change and have argued that similar environmental problems are increasingly causing violence in other African countries (Ban, 2007). A number of NGOs have joined the argument. The Christian Aid charity has warned that 184 million people could die in Africa alone as a result of climate change before the end of the 21st century and that "at least one billion people will be forced from home as the effects of climate change deepen an already burgeoning global migration crisis" (Christian Aid, 2006, 2007). Climate change has also been related to conflict in statements by officials of international organizations for research on the environment, such as Kevin Noone, Director of the International Geosphere–Biosphere Programme (IGBP) who made the extraordinary comment that "most conflicts have something to do with the climate" (Askelin, 2004). Among the academics who have identified such a link, we find Sachs (2005), Swart (1996), and Homer-Dixon (2007). But there are also more skeptical voices, such as Bächler (1999: 99), Barnett (2001a, 2001b, 2003), and Suhrke (1997).

The premise providers

The IPCC is by far the most important source laying the premises for the climate change debate. Despite the growing concern about the security implications of climate change, this issue is hardly dealt with in the IPCC reports. In the TAR, a 1000-page-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 region-specific reports, conflict as an outcome of climate change is barely mentioned.[3] The report discusses the challenges of meeting key human needs such as adequate food, clean water, clean air, and adequate and affordable energy services. Heat waves, flooding, storms, and drought can cause famine, population displacement, and the outbreak of diseases, and a decline in the agricultural productivity of rural areas may accelerate migration to the cities. 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. Therefore, "climate change is likely to increase world and country-scale inequity, within the present generation

[2] However, a number of other governments, including representatives of the Group of 77 and the Non-Aligned Movement argued that the Security Council was encroaching on the agenda of other UN agencies and that the issue belonged in the General Assembly and the Economic and Social Council.

[3] The Fourth Assessment Report (IPCC, 2007) is in the process of being published but the material released as of early June 2007 does not lead to any major modifications of our summary and critique.

and between present and future generations, particularly in developing countries'' (IPCC, 2001, Working Group II: 85).

The TAR suggests very few concrete links between climate change and violent conflict. The clearest statement refers to how climate-related migration may increase the risk of political instability and conflict (IPCC, 2001, Working Group II: 85). The discussion of hydrology and water resources suggests a ''potential for international conflict (hot or cold) over water resources'' (IPCC, 2001, Working Group II: 225). Reduced water availability may induce conflict between different users. Specifically, the report refers to reduced water availability in the semi-arid savannah ecosystems of tropical Africa, which could exacerbate conflicts between herdsmen and farmers (IPCC, 2001, Working Group II: 394). Present agreements about water allocations in absolute terms may create conflicts in the future if the total amount of water available is reduced (IPCC, 2001, Working Group II: 225). The TAR suggests also that the fishing industry faces possible adverse effects of climate change (IPCC, 2001, Working Group II: 369f), and that since fish reserves are among the most important economic resources in many countries and fish stocks are trans-boundary resources, this could lead to conflicts between countries. Conflicts over fishing resources have occurred between the US and Canada (relating to the Pacific salmon) and between different nations fishing in the North Atlantic and the Barents Sea. However, these conflicts have not escalated to large-scale violence.

The influential and widely-publicized *Stern Review* on the economics of climate change commissioned by the British government (Stern, 2006) also refers to how conflict 'may' arise under certain circumstances. This is seen mainly as a result of forced migration, which the report puts at up to 200 million people by 2050 – but again this is not the main focus of the review.

The evidence

While the hard science in the climate change debate is backed up by peer-reviewed studies, this is not the case for the literature relating climate change to conflict. The headline hitters are reports from think tanks and governments. To the extent that they cite any relevant sources at all, these tend not to be peer-reviewed. For instance, when the IPCC links forced migration to conflict it cites Myers (1994/1996), Kennedy et al. (1998), and Rahman (1999). Although titled 'Climate Change and Violent Conflict', Rahman (1999) – a chapter in an edited volume – contains little on either conflict or climate change. Norman Myers and Donald Kennedy, although their works are more substantial, are not specialists on conflict and the cited works did not appear in academic journals. While Kennedy et al. (1998) is cautiously formulated, reflecting the tentative knowledge of the social consequences of environmental change, Myers (1996) is a journalistic account based on the assumption that we are on our way to ''environmental ruin worldwide'' (p. 17). Myers sees shortages of food and freshwater and deforestation as issues that could lead to conflict within and between nations. On all of these issues, there are academic literatures that could have served to temper his unremitting neomalthusianism, but these are not cited by the IPCC. In fact, although scarcities like these present major problems for livelihood and health, the possible link to armed conflict is highly contested (Esty et al., 1998; Hauge & Ellingsen, 1998; Theisen, 2006). There is also a great element of uncertainty regarding how global warming will affect the global productivity of agriculture, since some areas are likely to become more suitable for farming. Myers' rough estimate for future environmental refugees (150–200 million) is cited by the *Stern Review*, with an acknowledgement that

"it has not been rigorously tested" (p. 77).[4] An update to 250 million, based on communication with Myers, surfaces in Christian Aid (2007: 6, 50).[5]

The IPCC reference to water conflicts cites Biswas (1994) and Dellapenna (1999). These sources address adaptation and cooperation as much as conflict. There is, indeed, a literature that suggests a potential for water wars (see e.g. Gleick, 1993; Renner, 1996; Klare, 2001), but other writers are very skeptical (Beaumont, 1997; Wolf, 1999). A statistical study finds that neighboring countries that share rivers experience low-level interstate conflict somewhat more frequently (Gleditsch, Furlong, Hegre, Lacina, & Owen, 2006), but a companion study finds that they also tend to cooperate more (Brochmann & Gleditsch, 2006). Yoffe, Wolf, and Giordano (2003) argue that cooperation consistently trumps conflict in handling shared international water resources.

Finally, on the issue of shared fisheries resource, also raised by the IPCC, Myers (1996: 9) notes that nations bordering on the North Atlantic have gone "to the edge of hostilities over cod stocks". But of course, the so-called 'cod wars' or 'turbot wars' (Soroos, 1997) of the North Atlantic are remarkable for their *lack* of interstate violence. Coast guard and naval forces have been involved in these disputes, but so far not a single casualty has been reported.

The causal chains

Although the government and IGO-sponsored writing on climate change fails to cite convincing sources for a link to armed conflict, a literature is just beginning to emerge, as evidenced by the five articles that follow. This literature outlines several possible causal chains from climate change to conflict. The starting-point for most of these is that climate change results in a reduction of essential resources for livelihood, such as food or water, which can have one of two consequences: those affected by the increasing scarcity may start fighting over the remaining resources. Alternatively, people may be forced to leave the area, adding to the number of international refugees or internally displaced persons. Fleeing environmental destruction is at the outset a less violent response to adverse conditions than armed conflict or genocide. But when the migrants encroach on the territory of other people who may also be resource-constrained, the potential for violence rises.

Barnett and Adger (2007) review a broad range of studies of both these effects, focusing particularly on countries where a large majority of the population is still dependent on employment in the primary sector. If climate change results in reduced rainfall and access to the natural capital that sustains livelihoods, poverty will be more widespread, leading to increased grievances and better recruitment opportunities for rebel movements. Some of these effects are confirmed in the articles by Hendrix and Glaser (2007) using inter-annual rainfall data,[6] and Meier, Bond, and Bond (2007) with monthly precipitation data. Raleigh and Urdal (2007) generally find that

[4] The *Stern Review* seems on more solid ground when it notes that 200 million people live in coastal floodplains at less than 1-m elevation (Stern, 2006: 76), although no source is given. Apart from the fact that a 1-m sea-level rise is higher than the IPCC's highest estimate for 2100, no consideration is given to countermeasures, such as dikes, or a gradual retreat from the most exposed areas.

[5] Three quarters of one billion additional forced migrants by 2050, according to Christian Aid (2007), are not displaced by climate change but by development projects such as dams (645 millions), natural disasters (50 millions), and conflict (50 millions).

[6] Using long-term forecasts of rainfall in Africa (which is likely to affect agriculture substantially if the continent continues to rely heavily on rain-fed agriculture), Hendrix and Glaser (2007) find relatively few linear trends.

environmental and demographic variables have a moderate to low effect on the risk of civil conflict, but that local freshwater scarcity increases the conflict risk somewhat. In low-income countries, the effect of water scarcity is stronger in areas with high population growth. Barnett and Adger also argue that climate change will reduce the capacity of states to mitigate these problems, an argument that parallels the argument by Fearon and Laitin (2003) that weak states are more prone to civil war. A possible objection to Barnett and Adger's argument is that urbanization and the decline of employment in resource-dependent sectors is a world-wide phenomenon and one that is generally associated with greater prosperity and stronger states which again means that these countries are likely to be less vulnerable to the conflict-inducing effects of climate change. However, for many marginalized communities within such growing economies, the growth has not alleviated resource dependence. Since climate change is usually discussed in a 50–100-year perspective, a crucial question is how much of the climate-related reduction in agricultural and resource based employment can be absorbed by on-going processes of economic change, which have been accelerated by the globalization of the world economy. While 200 million additional 'environmental refugees' by 2050 (as indicated in the *Stern Review*) may seem like a frightening number, economic migration at an even larger scale is an integral part of the process of development aid. The most recent UN population report estimates that in the next 20 years some 350 million people will move from the countryside to urban areas in China alone (UNFPA, 2007).

Barnett and Adger (2007) and even more so Reuveny (2007) point out that migration may lead to conflict in host communities. Indeed, several studies have cited Bengali immigration from the plains into the Chittagong Hills and Assam an example of this. Suhrke (1997: 257f), on the other hand, argues that this case is unique and that there is no systematic evidence for a general link between migration and conflict. Migrants may also be valued for their skills and for their contributions to cultural variability. A study by Salehyan and Gleditsch (2006) indicates that most countries with an influx of refugees since the 1950s remain peaceful, but the probability of organized armed conflict with more than 25 battle deaths is, nevertheless, more than tripled in migrant-receiving countries. Many migrants come from conflict areas. They retain a direct stake in the outcome of fighting in their country of origin and they can easily be mobilized for one side or the other. Militant groups find it easy to recruit members among the refugees and transnational rebel networks may serve as conduits for the spread of armed violence. For instance, Rwanda became involved in the war in the Democratic Republic of Congo in the late 1990s after Hutu refugees began to organize opposition groups in the camps. Purely environmental refugees, on the other hand, do not have the same political agenda and grievances, nor do they have the same experience in organizing armed insurgencies. While competition for resources or jobs in the host country and inter-ethnic fears may lead to violence in various forms from murder to riots, organized armed conflict is less likely. Large numbers of economic migrants are attracted to Western Europe and North America every year because of employment opportunities. While such immigration is not without friction, it generally does not lead to armed insurgency.

Reuveny (2007) examines 38 cases in Asia, Africa, and Latin America. Half of these he classifies as 'no conflict'. In many, perhaps most, of the 19 conflict cases, the environmental pressures are clearly mixed with inter-ethnic violence that predates the migration, and some cases (El Salvador, Guatemala) were probably escalated by the ideological tensions of the Cold War and fueled by outside powers. In the absence of a multivariate analysis, it is difficult to conclude how much of the violence to attribute to the migration. Many of the violent cases also exhibit mostly unorganized violence and do not show up in compilations of armed conflicts.

Nyong, Fiki, and McLeman (2006) find that drought conflicts in the Western Sahel have been increasing and that climate change could exacerbate such conflicts. But in a study of 27 communities in Northern Nigeria, they argue that the use of traditional institutions in conflict management can moderate such conflicts.

A rather different way in which conflict could be influenced by climate change lies in our response to the burning of fossil fuels, in itself a major cause of the greenhouse effect. Barnett and Adger (2007) note that conflict could come about due to mitigating action to reduce emissions from fossil fuels, although they do not elaborate on this scenario. If the industrialized world makes a large-scale shift to renewable sources of energy or potentially almost inexhaustible sources like nuclear power, this would inevitably have social consequences. A negative effect might be nuclear proliferation. Another possibility is that fossil fuels will be replaced by bio-oil and similar renewable products. This might lead to increased competition for land and potentially to increased food prices. But this scenario has not been investigated by the IPCC or the *Stern Review* or any of the articles in this issue.[7]

Oil dependence is a fairly robust predictor to civil war (Fearon & Laitin, 2003; Ross, 2006) and if oil prices were to decline precipitously from their present high level or if oil dependence decreased, this would reduce the repressive capacity of authoritarian governments as well as the financial motivation for violent secessionist movements. On the other hand, economic decline is also associated with civil war (Collier et al., 2003) and this might increase the risk of civil conflict in oil-producing countries. The net effect for oil-producing countries is not easy to predict. For developing countries that are not oil producers, lower oil prices are likely to be beneficial to development.

The way ahead

Studies of the effects of climate change talk mostly about the future but should learn from the past. Unfortunately, the precision in conflict prediction remains at the stage where meteorology was decades ago: the best prediction for tomorrow's weather was the weather today. Conflict models still have a hard time doing better than predicting that countries at war today will remain at war next year and the peaceful will remain peaceful. But with better theory, more accurate and detailed data, and more sophisticated methods for checking the robustness of the relationships that individual studies come up with (see, e.g., Hegre & Sambanis, 2006), we should soon be able to do better. Five points seem particularly important if we are to make progress in investigating the climate-to-conflict relationship.

First, we need a tighter coupling of the climate change models and the conflict models. The development of more fine-grained data for the physical effects of climate change, incorporating geographic variation, rates of change, and adaptive measures, will facilitate the scientific interface. Much of the literature, including the IPCC reports, when commenting on the social effects tend to move from sophisticated climate models to flimsy evidence and (at best) case studies of unknown representativity. The studies by Hendrix and Glaser (2007) and Raleigh and Urdal (2007) are pioneering in that they show how results from the climate change models can provide input to rigorous studies of conflict. The cross-disciplinary contribution by Hendrix and

[7] In its discussion of the effect of climate change on energy sources, the IPCC (2001, Working Group II: 399) focuses on hydro-electric power stations.

Glaser (2007) makes use of forecast data based on IPCC climate models with respect to sub-Saharan Africa.

Second, we need to consider carefully what kinds of violence we expect to result from climate change. Hendrix and Glaser (2007) study state-based internal armed conflicts at the national level. Raleigh and Urdal (2007) use the same set of conflicts but focus on climate-related scarcities in the conflict zones, since most internal conflicts affect only a limited part of the country. Reuveny (2007) refers to several kinds of violence, including one-side violence (genocide and politicide), non-state violence (between groups, but where the state is not an actor), and unorganized violence. Among the cases of alleged climate-related violence, Rwanda is one of the bloodiest (as is the more recent case of Darfur), but only if we include one-sided violence in our accounting. Theisen and Brandsegg (2007) analyze scarcity conflicts on a new dataset on non-state violence, and argue forcefully that this kind of violence is more likely to be affected by resource scarcity than state-based conflicts. This is a promising avenue for the future study of the conflict implications of climate change. Meier et al. (2007) also study non-state conflicts, but based on event data reported by a conflict early warning network for a limited area along the border of three states. Clearly, a more extended network of conflict monitoring at the local level would be extremely helpful in future empirical studies of climate-related conflict.

Third, the study of climate change and conflict needs to balance the positive and negative effects of climate change as well as the effects of various strategies of adaptation. While the climate change models perform such an assessment for factors that lead to higher and lower rates of CO_2 in the atmosphere and in the effect on temperatures, the discussion on the social effects tend to focus only on an enumeration of possible negative effects, large and small. Although the global net effect of climate change seems likely to be negative, the effects would vary considerably both geographically and by sector. An analogy to the study of economic effects of disarmament, an area of both academic and public concern during the Cold War and after, may be instructive. Many on the right as well as left of the political spectrum focused on the possible negative economic effects of disarmament such as unemployment in the military sector. However, most econometric studies, using established models of the national economies, concluded that the net economic effects of disarmament were likely to be positive and that the problems of unemployment could easily be overcome if the reduced arms spending was channeled in the right direction (Gleditsch, Bjerkholt, Cappelen, Smith, & Dunne, 1996; Klein, Lo, & McKibbin, 1995). In the event, the end of the Cold War led to massive reductions in defense budgets in both East and West and the worst-case scenarios did not materialize.[8] It seems much less likely that such a balanced accounting will yield a positive outcome for climate change, whether measured by an economic yardstick or a conflict measure, but the two multivariate studies published here, Hendrix and Glaser (2007) and Raleigh and Urdal (2007) provide a foretaste of the pros and cons such studies are likely to come up with.

Fourth, we should continue to disaggregate the effects of climate change in our systematic conflict models, both in terms of geographical variations and types of change. Climate change will have a plethora of different outcomes. Human livelihoods could be affected directly through factors ranging from sea-level rise, human health, and changing weather patterns, and indirectly via factors such as migration. These various causal chains need to be mapped

[8] The transition problems were much greater in the former command economies than in the market economies, but not due to disarmament.

and investigated. Also, the impacts are likely to vary considerably between different areas and societies. For instance, although most areas are expected to become warmer, some will heat up more than others. Total rainfall is predicted to increase, but some areas will become drier. There will also be vast variations in terms of the technological and societal capabilities for meeting the challenge of climate change. Modeling these variations, particular constellations of challenges in various locations, as well as adaptive capabilities will be key to improve the capacity to foresee climate-related conflict hot-spots.

Finally, some recent writings on climate change and security focus mainly on consequences for the rich countries. If climate change leads to more deprivation in the Third World, it could also generate additional terrorism that impacts on the security in the wealthy part of the world. But as Barnett and Adger (2007) argue (and this is not a point of great controversy in the literature), regardless of the precise nature and size of the changes, they will primarily affect poor countries (and poor people in the poor countries). The security scenarios may well be constructed with the benign intention of arousing the world to greater attention to a global issue. But they could also lead to greater emphasis on a national security response to whatever degree of climate change is seen as unavoidable. This would not be helpful to the primary victims of climate change.

Increasingly, it is now argued that we are already seeing the effects of climate change unfolding in conflicts in Africa and in Darfur in particular. However, the number of on-going state-based armed conflict has declined by one-third since the peak just after the end of the Cold War (Harbom & Wallensteen, 2007). The severity of conflict, as measured in battle deaths, has been on a declining trend (with several ups and downs) since World War II, first mainly due to a decline of conflict in Europe, then in East Asia (Lacina, Russett, & Gleditsch, 2006). Although there are many troubled areas, in the Middle East and sub-Saharan Africa in particular, there are also signs of hope, such as the decline in the number of on-going conflicts in sub-Saharan Africa in the past decade. While it is possible that climate change may lead to more conflict in the future, it has not so far caused a reversal of the current trend towards a more peaceful world. If the international community makes progress towards a reduction of the greenhouse effect and in efforts to ameliorate its consequences, the security scenario may nevertheless have played a useful role as a self-denying prophecy.

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References

Askelin, J. I. (2004). Konflikter kan ofta kopplas till klimaet. [Conflicts can often be linked to the climate]. *Framsyn, 5*. <www.foi.se/mervetande/index.html>.

Bächler, G. (1999). *Violence through environmental discrimination*. Dordrecht, The Netherlands: Kluwer Academic.

Ban, K. M. (2007). A climate culprit in Darfur. *Washington Post, 16 June*, A15. <www.washingtonpost.com>.

Barnett, J. (2001a). *The meaning of environmental security. Ecological politics and policy in the new security era*. London: Zed.

Barnett, J. (2001b). Security and climate change, Tyndall Centre Working Paper (7). Available from www.tyndall.ac.uk/publications/working_papers/wp7.pdf.

Barnett, J. (2003). Security and climate change. *Global Environmental Change, 13*(1), 7–17.

Barnett, J., & Adger, N. (2007). Climate change, human security and violent conflict. *Political Geography, 26*(6), 639–655.

Beaumont, P. (1997). Water and armed conflict in the Middle East – fantasy or reality? In N. P. Gleditsch (Ed.), *Conflict and the environment* (pp. 355–374). Dordrecht, The Netherlands: Kluwer Academic.

Biswas, A. K. (Ed.). (1994). *International waters of the Middle East: From Euphrates-Tigris to Nile*. Oxford: Oxford University Press.

Brochmann, M., & Gleditsch, N. P. (2006). Shared rivers and international cooperation. Paper presented at the workshop on polarization and conflict. Nicosia, Cyprus, 26–29 April. Available from www.prio.no/files/file47722_cyprus_paper_mb-npg_final.doc.

Christian Aid. (2006). *The climate of poverty: Facts, fears and hope*. London: Christian Aid. <www.christian-aid.org.uk/indepth/605caweek/index.htm>. Accessed 15.05.06.

Christian Aid. (2007). *Human tide: The real migration crisis*. London: Christian Aid. <www.christian-aid.org.uk/indepth/705caweekreport/index.htm>. Accessed 14.05.07.

CNA. (2007). *National security and the threat of climate change. Report from a panel of retired senior US military officers*. Alexandria, VA: CNA Corporation. <http://securityandclimate.cna.org/>.

Collier, P., Elliott, L., Hegre, H., Hoeffler, A., Reynal-Querol, M., & Sambanis, N. (2003). *Breaking the conflict trap. Civil war and development policy*. Oxford: Oxford University Press.

Dellapenna, J. W. (1999). Adapting the law of water management to global climate change and other hydropolitical stresses. *Journal of the American Water Resources Association, 35*, 1301–1326.

Esty, D. C., Goldstone, J. A., Gurr, T. R., Surko, P. T., & Unger, A. N. (1998). *State Failure Task Force Report: Phase II Findings*. McLean, VA: Science Applications International, for State Failure Task Force.

Fearon, J. D., & Laitin, D. (2003). Ethnicity, insurgency, civil war. *American Political Science Review, 97*(1), 75–90.

German Ministry of Environment. (2002). *Climate change and conflict. Environmental policy*. Bonn, Germany: Federal Ministry for the Environment, Nature Conservation, Nuclear Safety. <www.bmu.de/files/pdfs/allgemein/application/pdf/climges.pdf>.

Gleditsch, N. P., Furlong, K., Hegre, H., Lacina, B., & Owen, T. (2006). Conflicts over shared rivers: resource scarcity or fuzzy boundaries? *Political Geography, 25*(4), 361–382.

Gleditsch, N. P., Nordås, R., & Salehyan, I. (2007). Climate change and conflict: The migration link. Coping with Crisis Working Paper Series. New York: International Peace Academy. Available from www.ipacademy.org/our-work/coping-with-crisis/working-papers.

Gleick, P. H. (1993). Water and conflict: fresh water resources and international security. *International Security, 18*(1), 79–112.

Gleditsch, N. P., Bjerkholt, O., Cappelen, Å., Smith, R. P., & Dunne, J. P. (Eds.). (1996). *The peace dividend. In Contributions to economic analysis*. Amsterdam, The Netherlands: North-Holland.

Harbom, L., & Wallensteen, P. (2007). Armed conflict, 1989–2006. *Journal of Peace Research, 44*(5), 623–634.

Hauge, W., & Ellingsen, T. (1998). Beyond environmental scarcity: causal pathways to conflict. *Journal of Peace Research, 35*(3), 299–317.

Hegre, H., & Sambanis, N. (2006). Sensitivity analysis of empirical results on civil war onset. *Journal of Conflict Resolution, 50*(4), 508–535.

Hendrix, C. S., & Glaser, S. M. (2007). Trends and triggers: climate, climate change and civil conflict in sub-Saharan Africa. *Political Geography, 26*(6), 695–715.

Homer-Dixon, T. F. (2007). Terror in the weather forecast. *New York Times, 24 April*. <www.nytimes.com>.

IPCC. (2001). IPCC Third Assessment Report. Climate Change 2001. In five volumes: Synthesis Report (Short version 184 pp. and long version 398 pp.) Working Group I: The Scientific Basis, 944 pp. Working Group II: Impacts,

Adaptation and Vulnerability, 1000 pp. Working Group III: Mitigation, 700 pp. Geneva: Intergovernmental Panel on Climate Change. Cambridge, UK: Cambridge University Press. Available from www.ipcc.ch.

IPCC. (2007). Summary for policymakers, Geneva: intergovernmental panel on climate change. In S. Solomon, et al. (Eds.), *Climate change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge University Press. <http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Pub_SPM-v2.pdf>.

Kennedy, D., Holloway, D., Weinthal, E., Falcon, W., Ehrlich, P., & Naylor, R., et al. (1998). *Environmental quality and regional conflict*. New York: Carnegie Commission on Preventing Deadly Conflict. <http://wwics.si.edu/subsites/ccpdc/pubs/ken/ken.htm>.

Klare, M. T. (2001). The new geography of conflict. *Foreign Affairs, 80*(3), 49–61.

Klein, L. R., Lo, F. C., & McKibbin, W. J. (Eds.). (1995). *Arms reduction: Economic implications in the post cold war era*. Tokyo, Japan: United Nations University Press.

Lacina, B., Russett, B., & Gleditsch, N. P. (2006). The declining risk of death in battle. *International Studies Quarterly, 50*(3), 673–680.

Meier, P., Bond, D., & Bond, J. (2007). Environmental influences on pastoral conflict in the Horn of Africa. *Political Geography, 26*(6), 716–735.

Myers, N. (1996). *Ultimate security. The environmental basis of political stability*. Washington, DC: Island Press. [First edition, 1994, Norton].

Nordås, R., & Gleditsch, N. P. (2005). Climate conflict – common sense or nonsense? Paper presented at the international workshop on Human Security and Climate Change. Holmen fjordhotell, Asker, 21–23 June. Available from www.cicero.uio.no/humsec.

Nyong, A., Fiki, C., & McLeman, R. (2006). Drought-related conflicts, management and resolution in the West African Sahel: considerations for climate change research. *Die Erde, 137*(3), 223–248.

Rahman, A. A. (1999). Climate change and violent conflict. In M. Suliman (Ed.), *Ecology, politics, violent conflict*. London: Zed.

Raleigh, C., & Urdal, H. (2007). Climate change, environmental degradation and armed conflict. *Political Geography, 26*(6), 674–694.

Renner, M. (1996). *Fighting for survival. Environmental decline, social conflict, the new age of insecurity*. New York and London: Norton, for Worldwatch Institute.

Reuveny, R. (2007). Climate change-induced migration and violent conflict. *Political Geography, 26*(6), 656–673.

Ross, M. L. (2006). A closer look at oil, diamonds, civil war. *Annual Review of Political Science, 9*, 265–300.

Sachs, J. (2005). Climate change and war, Published 1 March. <www.tompaine.com/print/climate_change_and_war.php>, Downloaded 29 December 2005.

Sagan, C., & Turco, R. P. (1993). Nuclear winter in the post-cold-war era. *Journal of Peace Research, 30*(4), 369–373.

Salehyan, I., & Gleditsch, K. S. (2006). Refugees and the spread of civil war. *International Organization, 60*(2), 335–366.

Schwartz, P., & Randall, D. (2003). *An abrupt climate change scenario and its implications for United States National Security*. Washington, DC: Environmental Media Services. <www.ems.org/climate/pentagon_climate_change.html#report>.

Soroos, M. (1997). The Canadian–Spanish 'Turbot War' of 1995: a case study in the resolution of international fishery disputes. In N. P. Gleditsch, et al. (Eds.), *Conflict and the environment* (pp. 235–252). Dordrecht, The Netherlands: Kluwer Academic.

Stern, N. (2006). The economics of climate change. *Stern review*. London: HM Treasury. <www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm>. (in book form, Cambridge University Press, 2007).

Suhrke, A. (1997). Environmental degradation, migration, the potential for violent conflictch. 16. In N. P. Gleditsch, et al. (Eds.), *Conflict and the environment* (pp. 255–272). Dordrecht, The Netherlands: Kluwer Academic.

Swart, R. (1996). Security risks of global environmental changes. *Global Environmental Change, 6*(3), 187–192.

Theisen, O. M. (2006). Other pathways to conflict? Environmental scarcities and domestic conflict. Paper presented at the 47th Annual Convention of the International Studies Association. San Diego, CA, 22–25 March. Available from www.isanet.org.

Theisen, O. M., & Brandsegg, K. B. (2007). The environment and non-state conflicts in sub-Saharan Africa. Paper presented to the 48th Annual Convention of the International Studies Association. 28 February–3 March. Available from www.isanet.org.

UN. (2007). *Security Council holds first-ever debate on impact of climate change, 5663rd meeting*. New York: United Nations, Department of Public Information.

UNFPA. (2007). *State of the World Population 2007*. New York: United Nations Population Fund. <www.un.org/News/Press/docs/2007/sc9000.doc.htm>.

WBGU. (2007). Welt im Wandel – Sicherheitsrisiko Klimawandel [World in transition – climate change as a security risk]. Berlin, Germany: German Advisory Council on Global Change. Forthcoming in book from Springer. <www.wbgu.de>.

Wolf, A. T. (1999). "Water wars" and water reality: conflict and cooperation along international waterways. In S. Lonergan (Ed.), *Environmental change, adaptation, human security* (pp. 251–265). Dordrecht, The Netherlands: Kluwer Academic.

Yoffe, S., Wolf, A. T., & Giordano, M. (2003). Conflict and cooperation over international freshwater resources: indicators of basins at risk. *Journal of the American Water Resources Association, 39*(5), 1109–1126.