Ecoviolence? Links Between Population Growth, Environmental Scarcity and Violent Conflict in Thomas Homer-Dixon's Work[1]

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"Qualitative degradation or quantitative depletion reduces the total size of the pie. A growing number of people sharing the pie implies that each share of the pie shrinks. And finally, if the pie is distributed in pieces of unequal sizes, some may be too small for people to survive on."

Thomas Homer-Dixon has published extensively on population, environment and conflict. His theoretical framework first appeared in several seminal articles in the early to mid-1990s,[2] and research by Homer-Dixon and his colleagues on the relationship between population, environment and violent conflict has been influential in the field of political science.[3] In view of the widespread nature of human conflict[4] and the prevailing pessimism about population growth and environmental destruction, this linkage is clearly both important and policy-relevant. In addition to outlining what he believes to be the main causal mechanisms, Homer-Dixon has also examined a number of cases in detail.

Homer-Dixon's work is far removed from the simplifications of some of the popular literature on the theme of population, environment and conflict. There is little if any of the sensationalism of Robert D. Kaplan[5] or the doomsday predictions of Paul R. Ehrlich and Anne H. Ehrlich.[6] Homer-Dixon never asserts that population pressure and environmental degradation

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are the sole source of violent conflict. On the contrary, he emphasizes again and again the close interrelationship between demographic/environmental, social and political factors in the generation of violent conflict.

In the following, the basic theoretical scheme of Thomas Homer-Dixon's work on population, environment and violent conflict is presented, and then some of the main criticisms of his work are explored and summarized in five points. These criticisms relate both to his theoretical model and to his empirical studies. Lastly, a brief introduction to some of the recent comparative empirical studies aimed at testing Homer-Dixon's hypotheses more broadly is given.

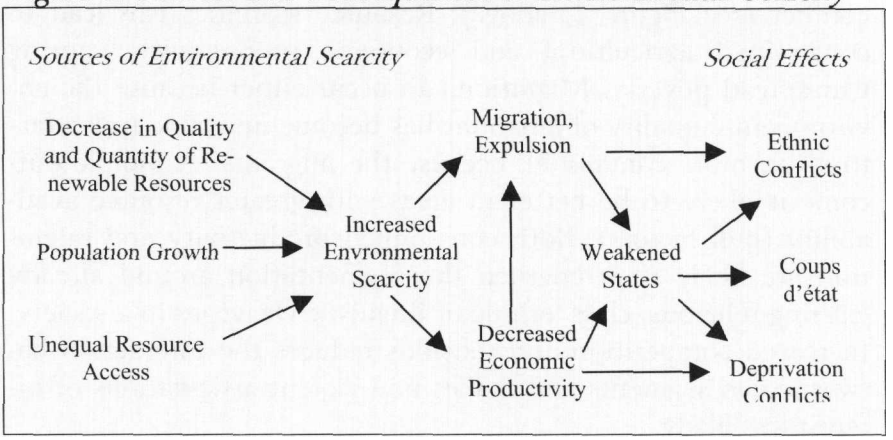
The Links Between Population, Environment and Conflict

Like other neo-Malthusian scholars, Homer-Dixon focuses on population variables.[7] He views population pressure as closely linked to the potential scarcity of renewable resources. While he argues that resource scarcities can cause violent intrastate conflict under unfavorable conditions, he believes that such scarcities are less likely to cause interstate conflict.[8]

Homer-Dixon and Jessica Blitt distinguish among three main causes of resource scarcity.[9] *Supply-induced scarcity* results from degradation or depletion of natural resources. Non-sustainable use may not allow a resource to regenerate.[10] In some cases this process causes a resource to become irreversibly and permanently degraded even though the human activities that led to degradation are halted. *Demand-induced scarcity* is primarily caused by population growth. If a resource base is constant, the availability of resources per person diminishes as the number of persons sharing it increases. Such scarcity can also arise from an increase in demand per capita. A third form, *structural scarcity*, applies only to certain groups who, relative to other groups, are excluded from equal access to particular resources. Such unequal social distribution of a resource does not presuppose actual scarcity if the resource were to be distributed evenly. Figure 1, be-

low, illustrates Homer-Dixon's view of the links among these forms of scarcity and armed conflict.

Figure 1. *Sources and Consequences of Environmental Scarcity*[11]



One of Homer-Dixon's strengths and one of the reasons why he has attracted so much attention is that he presents his notion of environmental scarcity in a very simple and intuitively appealing way. A prime example is his pie metaphor to describe the three forms of resource scarcity. Qualitative degradation or quantitative depletion reduces the total size of the pie. A growing number of people sharing the pie implies that each share of the pie shrinks. And finally, if the pie is distributed in pieces of unequal sizes, some may be too small for people to survive on.

WHAT RESOURCES?

What natural resources are potential bones of contention? Most armed conflicts and wars are over objectives that can broadly be defined as resources.[12] Neo-Malthusians are primarily concerned with resources that are linked to food production. Homer-Dixon and Blitt argue that large populations in many developing countries are highly dependent on four key resources that are especially crucial to food production: fresh water, cropland, forests and fisheries.[13] The availability of these resources determines people's well-being, and scarcity of such resources can lead to violent conflict under certain conditions.

FROM SCARCITY TO CONFLICT

Homer-Dixon predicts that greater resource scarcity tends to have social effects that increase the likelihood of internal violent conflict (see Figure 1, above). Resource scarcities can lead to constrained agricultural and economic productivity, causing widespread poverty. Migration can occur either because the environmental quality of a habitat has become unlivable (push factors) or, more commonly, because the migrants' economic outcome is likely to be better in areas with greater resource availability (pull factors). Both constrained productivity and migration are likely to strengthen the segmentation around already existing religious, class, ethnic or linguistic cleavages in a society. Increased competition and tensions reduces the interaction between such segments and makes non-violent articulations of interest less likely.

Acknowledging that objective deprivation—the mere fact that people are poor—seldom produces strong grievances, Homer-Dixon relies on the theory of relative deprivation.[14] Individuals and groups can experience relative deprivation when they perceive a gap between the situation they believe they deserve and the situation that they have actually achieved. But the deprivation hypothesis significantly overpredicts the likelihood that violent conflicts may occur from grievance; it proves insufficient in explaining the incidence of such events. For grievances to erupt into violent conflict, Homer-Dixon and Blitt therefore assume the presence of two other factors.[15] First, the aggrieved individuals must participate in some sort of collective capable of violent action against the authorities, such as ethnicity, religion and class. People must also feel the relevance of their group identity to their grievances—that they are aggrieved as a group. Second, the political structure must fail to give these groups the opportunity to express their grievances peacefully at the same time as it offers them openings for violent action.

THE ROLE OF INGENUITY

Homer-Dixon acknowledges that the human ability to generate ideas, what he terms ingenuity, is a crucial factor that can help

people overcome resource scarcities.[16] But he sees it as a huge obstacle that many societies, especially in poor countries, are in limited supply of ingenuity. While most neo-Malthusians focus on the absolute physical limits to growth in a society, Homer-Dixon is more concerned about those societies that are "locked into a race between a rising requirement for ingenuity and their capacity to supply it."[17] As the supply of ingenuity shrinks relative to resource scarcity, societies will eventually experience a "critical ingenuity gap." This raises social dissatisfaction, increasing the risk of violent conflict.

Three factors especially limit the supply of ingenuity in poor countries. First, market mechanisms meant to increase the supply of ingenuity as resources decline often fail to work properly. The second factor is social friction. This phenomenon arises with the existence of "narrow distributional coalitions" that are able to attract a large share of the resources for the use of their members only.[18] Finally, shortages of financial and human capital reduce the supply of ingenuity in many poor countries.

Homer-Dixon admits that the main weakness of the ingenuity approach is the current inability among researchers to measure ingenuity quantitatively and thereby predict where and when critical ingenuity gaps will appear.[19] This also implies that it is impossible to verify empirically post facto whether it is the lack of ingenuity that causes some countries to experience resource scarcity.

Critique of the Homer-Dixon Model

Along with the volume of attention that Homer-Dixon has drawn, he has also received a fair amount of criticism.[20] We will discuss five main challenges to Homer-Dixon's work.

Humanity Can Adapt to Scarcity

Members of a broad research tradition of technological optimists, generally referred to as cornucopians, have criticized Homer-Dixon and other neo-Malthusian theorists for being too pessimistic about the relationship between population and natural resources. To cornucopians, scarcity exists by definition when a resource is not in infinite and unconditional supply, but they

refuse to see resources as pies of a fixed size. They give primacy to the human ability to overcome resource scarcity through technology and the application of knowledge. The level of technology influences the size of the pie; in the case of fresh water, technology both determines the quantity that can be extracted from the ground *and* the capacity to purify polluted water. Likewise, high elasticity without any absolute limitation is assumed to exist for the supply of many natural resources. But technology also determines the size of the pie that each individual needs, through, for instance, water-saving measures. This causes elasticity in demand, deflating the effect of an increasing population. Furthermore, pies can be traded for other pies. In some cases, one resource can be substituted for another. Also, as most scarcities are local rather than universal, areas can trade a share of a pie that is locally abundant for a share of another pie that is locally scarce, thereby benefiting from comparative advantages.

Cornucopians probably have a better case against those neo-Malthusians who argue on a more general basis that we are facing a global environmental crisis because the overall capacity of the world's ecosystem is stretched beyond its capacity. Homer-Dixon and associates are careful not to promote such a global view. They argue rather that local resource scarcities arise and persist because market mechanisms and technological developments often fail to work locally in many developing countries, thereby limiting ingenuity. A logical inference stemming from this line of argument is that scarcity can be seen as a result of social inability to utilize the full potential of the available natural resources.

The Concept of Scarcity Becomes Diluted

The divide between supply- and demand-induced forms of environmental scarcity is an important analytical distinction. But we question Homer-Dixon's idea that unequal distribution of natural resources should be considered a form of resource scarcity. Structural differences in resource access should be viewed as a potential source of distributional conflict rather than an issue of

scarcity. Such a phenomenon really says nothing about the actual availability of resources per capita, only about asymmetrical power relations between persons or groups of people that empower some to capture more than their fair share of the pie. A society can enjoy a great abundance of natural resources but still face enormous inequalities. By including structural scarcity, Homer-Dixon could potentially define a solely distributional violent conflict as an environmental conflict.

Homer-Dixon and associates have recently replied to this critique, arguing that "uneven distribution never acts on its own; its impact is always a function of its interaction with resource supply and demand."[21] But even if structural scarcity is only an intervening factor, it questions the importance of resource scarcity as a cause of armed conflict. If groups of people are "ecologically marginalized"[22] because they are denied access to rich natural resources and thus exhaust a more marginal habitat, what is then the greater problem, resources or distribution? We would argue that the actual problem lies in unequal distribution rather than availability of natural resources. Structural scarcity plays a great role in many of the empirical cases that Homer-Dixon and his associates study; they present it as the major source of resource scarcity in the cases of South Africa,[23] Gaza[24] and Chiapas, Mexico.[25] It is probably more accurate to say that distributional issues, and not a lack of natural resources per se, are driving these conflicts.

Resource Scarcity Is Confused with Environmental Change

Discussing contested resources, Homer-Dixon and Blitt also mention global warming and depletion of the ozone layer as issues that eventually will have an impact on resource supply.[26] However, by mentioning these two environmental problems along with changes in the supply of their four key resources—fresh water, cropland, forests and fisheries—Homer-Dixon and Blitt confuse resource supply with environmental change. Global warming and ozone depletion are not issues of resource scarcity by themselves but influence the availability of natural resources. In the Homer-Dixon model any form of environmental degrada-

tion can be translated into a problem of resource supply and one consequence of such a view is that all environmental problems can be interpreted as resource problems, but not vice versa.[27] When they apply resource scarcity as the main explanatory variable for violent conflict, Homer-Dixon and associates should make a stronger effort to separate resource scarcity analytically from the environmental problems that cause this scarcity.

The Theoretical Scheme Is Complex and Shifting

In his seminal articles in *International Security*, Homer-Dixon presents a general model (in the following, referred to as his theoretical model) of the links between population growth, environmental scarcity and violent conflict (see Figure 1 above).[28] While a set of variables and relationships from the theoretical model also appear in a similar form in his five case studies of Chiapas, Gaza, South Africa, Pakistan and Rwanda,[29] these models (in the following, referred to as his applied models) are much more complex than the theoretical model and also quite different from each other. That he postulates a separate model for each of his cases is in itself a problem. Homer-Dixon's modeling of particularities, combined with the extreme complexity of the applied models, reduces the usefulness of his theoretical framework as a tool for broad comparative empirical testing.

The case of South Africa demonstrates the complexity of Homer-Dixon's models. To link environmental scarcity to the outbreak of civil violence in South Africa in the 1990s, Valerie Percival and Homer-Dixon present three different figures.[30] Altogether, this scheme includes four exogenous variables, acting through 21 intervening variables and 45 causal mechanisms to account for the dependent variable, violence. Other case studies from the project have similar degrees of complexity. To explain terrorist violence against Israelis and intra-Palestinian violence (the former is an intervening variable in the explanation of the latter, but not vice versa) Kimberly Kelly and Homer-Dixon invoke six exogenous and eighteen intervening variables and

twenty-eight causal arrows.[31] This scheme is excessively complex.[32]

There is, of course, nothing wrong with theoretical complexity per se. However, in a very large model, the investigator tends to lose track of what goes on within it. Whether in a large-N statistical or a comparative case-study mode, such a comprehensive scheme would be very difficult to test. Given the stochastic relationships that social scientists generally postulate, it is virtually impossible to deduce the effects on the output variables of observed changes in the exogenous variables. One might simulate the whole system, but even small changes in the coefficients representing the causal influences from one variable to the next might have large influences on the outcome. It would therefore be difficult to say whether the results of such simulations were due to assumptions about the relationships, assumptions about the exogenous variables or differences between the cases.

We may also ask whether such a high degree of complexity is necessary. Can we account significantly better for violence with twenty-five variables than with five? We have no way of knowing, because these models are not built incrementally. Unlike, for instance, a model of a national economy, they do not draw upon a long history of theory development and empirical testing for each of the links. We would have preferred to start from the other end and build the models incrementally based on empirical testing of a very basic theoretical model.

The Theoretical Reasoning About Other Aspects of Conflict Theory Is Insufficient

Several ideas in Homer-Dixon's models would appear to have a sound theoretical basis, but we do not believe that he has fully exploited the literature in building the theoretical model. Two examples, relating to politics and economics respectively, indicate that as a result of this, his applied models show a lack of theoretical guidance on these issues.

With respect to the political system variables, the case studies make general references to political factors throughout,[33] but the political variables the applied models use do not clearly cor-

respond to current theorizing about political violence. In the case of Gaza we find references to corruption, repression by the Palestinian Authority (PA) and weakened legitimacy of the PA, which all describe aspects of the political system[34]; the study on South Africa refers to declining national and community institutional capacity and reform process; and the one on Chiapas refers to resource capture by elites, declining state capacity and weak property rights. However, words such as democracy or autocracy do not appear anywhere in the models.[35] In view of the extensive theoretical and empirical literature relating the degree of democracy to civil violence—notably the inverted U-curve proposed by Edward N. Muller and Erich Weede[36] and supported by empirical evidence from a number of studies[37]—one would have thought that democracy might have been included explicitly. Homer-Dixon's studies frequently hover around the idea that democratic procedures might have something to do with the frequency and severity of armed conflict, as when he suggested that elites in Chiapas, through the long history of the state, have "regularly violated constitutional and statutory property rights,"[38] and when he characterized the PRI regime in Mexico as corporatist and authoritarian,[39] and Arafat's methods of government as autocratic.[40] One passage in the study of South Africa actually suggests the inverted U-curve when the authors argue that "Before 1983, the apartheid state was strong enough to control violent protest," but that after the reforms "power relations began to change" and "the new constitution ceded some power to non-white groups."[41] Yet none of the reports come out clearly with a hypothesis that democracy matters or in what way.

A similar problem arises in the way Homer-Dixon's applied models deal with economic variables. Homer-Dixon is not among the environmental writers who propose economic growth as the chief villain. His work tends to emphasize the conflict-inducing effects of poverty and economic marginalization rather than excessive wealth. However, in the most basic form of his theoretical model,[42] the variable environmental effects is influenced only by a combination of population × activity per capita

and available physical resources.[43] His discussion of cornucopians and neo-Malthusians sides squarely with the latter, and he gives seven reasons why cornucopians cannot assume that human beings will be able to use their ingenuity to overcome scarcities as they have in the past.[44] Homer-Dixon views population growth as a key variable in producing the syndrome of environmental scarcity that he describes. Among the factors acting in combination with population growth are consumption patterns. We interpret this to mean that increasing economic activity per capita, along with a larger number of people, contributes to the excessive use of renewable resources and thus to the strain on the environment. Although dependency theory is not explicitly a part of Homer-Dixon's system, his idea might fit well into such a framework: the excessive use of resources in the North leads to ecological marginalization and poverty in the South.

While there is much to be said for these ideas, a discussion of the historical development of resource use in economically advanced countries is missing. There is a growing body of literature, including empirical studies, that argues that the relationship between economic growth and certain types of environmental deterioration assumes the shape of an inverted U-curve.[45] In other words, economic growth initially harms environmental quality, but economic development leads to the invention of new technologies that use scarce resources less intensively and produce less pollution. While historically the rise of industrialism in Western Europe was associated with resource depletion and life-threatening pollution, modern industry operates by much stricter standards for the extraction of raw materials as well as the emission of pollutants. As a result, air quality has improved in many major cities, salmon and trout have returned to the rivers running through major cities, and so on.

It has been suggested that this may have been achieved at the expense of third-world countries in the sense that pollution is exported to places where the rules are less strict. While this may be a problem for the population of recipient countries, the empirical evidence indicates that the volume of such trade is too low to account for the reduced pollution of economically ad-

vanced countries.[46] Of course, many third-world countries are still in an early stage of economic development, so the international community should expect environmental deterioration to increase in the immediate future, as economic growth continues or accelerates. However, as third-world populations and their governments come to place a higher premium on environmental values, we should expect these countries, too, to shift their priorities to environmentally more benign technologies. In fact, precisely because they lag behind, they should be able to exploit technological improvements in production made in economically more advanced countries. There is therefore no need to go through a phase of environmental destruction comparable to the one that occurred in many Western countries. On the whole, the long-term environmental future of third-world countries may be brighter than what is pictured in much environmentalist writing, precisely because most of them are now engaged in a process of economic growth.

As illustrated by the discussion of the political and economic factors, Homer-Dixon's theoretical model is insufficiently based on the existing theoretical and empirical literature. Although it seems to take a large number of relevant factors into account, the way these variables are included in the model does not do full justice to the accumulated knowledge in the field.[47] Again, it would be better to reduce the complexity of the model using a more gradualist approach to model-building.

Homer-Dixon's Testing Procedure Is Unsuitable for Establishing Causality

The way Homer-Dixon tests his model is probably the most controversial aspect of his endeavor. Basically, his strategy is to use case studies in which environmental degradation and violent conflict are present. In the words of Gary King, Robert O. Keohane and Sidney Verba, he selects cases on the values of the dependent as well as the independent variable.[48] It is the former selection process that is problematic. When studying only cases where there is violent conflict, Homer-Dixon deprives himself of the possibility of observing how some countries may have

avoided violent conflict even though their environmental degradation may be as serious as (or worse than) in the cases he has studied.

In his first theoretical article, Homer-Dixon criticized earlier writing on environmental conflict as "anecdotal."[49] After the publication of Homer-Dixon's detailed case studies, Mark Levy concluded that Homer-Dixon had added "more anecdotes, but not more understanding."[50] Regardless of the accuracy of the historical description and the quality of the theoretical model, Homer-Dixon's case studies fail to provide an empirical basis for comparison. In the case study on South Africa, for example, "chronic black urban poverty" contributes to violence through "increased grievances."[51] But to evaluate the causal nature of this link, one would need to examine cases *without* conflict, many of which will certainly also be characterized by urban poverty of particular racial or ethnic groups. Only when it is known that violent conflict occurs more frequently in the former group can scholars even begin to think about causal links.

Homer-Dixon is certainly aware of this criticism and meets it by arguing that "biased case selection enhances understanding of the complex relationships among variables in highly interactive social, political, economic, and environmental systems."[52] But the problem with this argument is that it seems to imply that environmental problems are more complex than other social (or for that matter physical) phenomena that researchers study. No justification is given for this view. On the contrary, any social system is as complex as the theory developed to study it. In other words, the complexity is not in the phenomenon but in the mind of the beholder.

Almost any methodological limitation can be justified at the exploratory stage of research. If Homer-Dixon just wanted to explore the relationship between environmental degradation and armed conflict, with the aim of putting it to a more rigorous test later, there would be no problem with his argument. However, after his first round of case studies, Homer-Dixon concludes that "environmental scarcity causes violent conflict."[53] Over the years, Homer-Dixon has gradually retreated from this position

to argue that "under certain circumstances, scarcities of renewable resources . . . produce civil violence and instability,"[54] and further that "my key finding is straightforward: preliminary research indicates that scarcity of renewable resources—what I term environmental scarcity—can contribute to civil violence."[55]

Homer-Dixon and associates now argue that "the single-case method . . . helps reveal causal mechanisms, but gives little indication of causal effect," and they deny that the Toronto Group's early work contained claims about causal effects.[56] We agree with Homer-Dixon and associates that the case study method is useful to reveal causal mechanisms. But if we focus on causal mechanisms to the exclusion of causal effects, we are actually saying that "If environmental degradation is related to conflict (which we don't know), this is how it seems to work."[57] Homer-Dixon and associates present what they call analogies in the form of the very recent discoveries of the causal mechanisms between smoking and cancer and of the pain-relieving effect of aspirin.[58] But for both these cases, the causal effects are well established through rigorous empirical studies. This is not true for the relationship between resource scarcity and violent conflict.

Many of Homer-Dixon's warnings about environmental conflict—like much environmentalist writing—are based on the *potential* for violent conflict in the future.[59] The basis for making such predictions must be an argument that the future will be different from the past. Seen from this perspective, selecting cases where there is already violence is not necessarily the correct strategy. Instead, he might have looked for cases likely to explode in the near future. His research program would have been immensely strengthened if he had identified such cases and been proven right by events. In the absence of at least some predictive ability, anyone arguing about the future runs the risk of being dismissed like the fundamentalist at Speaker's Corner who preaches every Sunday that "The End of the World Is at Hand."

On the Shoulders of Giants?

Despite the above criticism, Homer-Dixon's contribution to the environment-conflict debate is important. Although there is a

vast literature on environmental conflict, few, if any, writers have had the same overall impact as Homer-Dixon and his colleagues. He has succeeded beyond doubt in placing the environment on the peace research agenda. He has drawn *more* on the theoretical literature on conflict than most environmentalist writers, even though he has not fully taken account of major points relating to the role of democracy and economic growth. He has raised funds for a major program of case studies, which will provide interesting suggestions and raw material for other researchers for years to come. More systematic cross-national empirical studies of the influence of population and resource factors on armed conflict are beginning to appear, and the findings from these studies will provide a crucial test of the validity of Homer-Dixon's hypotheses. If population and resource issues "can contribute to civil violence,"[60] one would expect to find that countries with greater population pressure and greater environmental scarcity experience domestic armed conflict more often than other countries, everything else being equal.

So far, a number of cross-national studies have failed to find strong support for a causal relationship between resource scarcity and violent conflict, although the picture is mixed. Wenche Hauge and Tanja Ellingsen find that indicators of environmental scarcity, such as land degradation, change in forest cover and freshwater availability, are related to armed conflict.[61] But they conclude that such factors are less important causes of conflict than are economic and political circumstances. A major US research effort, the State Failure Task Force Report, fails to find direct effects of environmental degradation on state failure but finds minor influences through the effect of environmental degradation on the quality of life.[62] In a recent study, Henrik Urdal finds no effect of population growth and density on the propensity for domestic violent conflict.[63] Studying international conflict, Hans Petter Wollebæk Toset and his collaborators find that shared rivers and water scarcity slightly increase the likelihood of interstate conflict,[64] while Jaroslav Tir and Paul F. Diehl find an increased propensity for interstate conflict resulting from high population growth.[65]

Most of the studies above lean heavily on Homer-Dixon's theoretical scheme, attempting to falsify what they see as his main hypotheses. The possibilities for empirical testing are however far from exhausted, and we would particularly like to see studies comparing units at a sub-national level (regions, communes, districts). It could be that nation-level studies, like those mentioned above, fail to capture the effect of resource scarcities that arise locally on the propensities for conflict. But so far, empirical evidence indicates that the effects of population growth and environmental scarcity have been exaggerated in the security debate.

Notes

[1] Parts of this article are based on remarks made by Nils Petter Gleditsch at a Roundtable of the University of Toronto's Project on Environment, Population, and Security at the 38th Annual Convention of the International Studies Association, Toronto, 18–22 March 1997. Gleditsch is grateful to Philippe LePrestre for organizing the session as well as exchanging written views and to Thomas Homer-Dixon for friendly exchanges on these and related topics over the years. Some of the points mentioned here are discussed in more general terms, and sometimes in more detail, in Nils Petter Gleditsch, "Environmental Conflict and the Democratic Peace," in Nils Petter Gleditsch, ed., *Conflict and the Environment* (Dordrecht: Kluwer, 1997) pp. 91–100; and Nils Petter Gleditsch, "Armed Conflict and the Environment: A Critique of the Literature," *Journal of Peace Research* 35, no. 3 (1998) pp. 381–400. Nils Petter Gleditsch's work on environmental conflict has been funded by the United States Institute of Peace and the Research Council of Norway. Henrik Urdal's work has also been funded by the Research Council of Norway.

[2] Thomas F. Homer-Dixon, "On the Threshold: Environmental Changes as Causes of Acute Conflict," *International Security* 16, no. 2 (1991) pp. 76–116; Thomas F. Homer-Dixon, "Environmental Scarcities and Violent Conflict: Evidence From Cases," *International Security* 19, no. 1 (1994) pp. 5–40; Thomas F. Homer-Dixon, "The Ingenuity Gap: Can Poor Countries Adapt to Resource Scarcity," *Population and Development Review* 19, no. 1 (1995) pp. 587–612. For some major empirical findings of the Project on Environment, Population and Security (EPS), see Thomas F. Homer-Dixon and Jessica Blitt, *Ecoviolence: Links Among Environment, Population and Security* (Lanham, MD: Rowman & Littlefield, 1998). Thomas F. Homer-Dixon, *Environment, Scarcity, and Violence* (Princeton, NJ: Princeton University Press, 1999) con-

tains a summary of all his work on the issue, and a discussion of his concept of ingenuity is given in Thomas F. Homer-Dixon, *The Ingenuity Gap: How Can We Solve the Problems of the Future?* (New York; Toronto: Knopf, 2000).

[3] Another important project, undertaken by the Environment and Conflict Project at the Swiss Federal Institute of Technology, is equally ambitious in its theoretical approach and in the scope of its empirical studies but less well publicized, is the one. For their major report in English, see Günther Bächler, *Violence Through Environmental Discrimination* (Dordrecht: Kluwer, 1999).

[4] Nils Petter Gleditsch, Petter Wallensteen, Mikael Eriksson, Margareta Sollenberg and Håvard Strand, "Armed Conflict 1946–2001: A New Dataset," *Journal of Peace Research* 39, no. 5 (2002).

[5] Robert D. Kaplan, "The Coming Anarchy," *Atlantic Monthly* 273, no. 2 (1994) pp. 44–76.

[6] Paul R. Ehrlich and Anne H. Ehrlich, *Population, Resources, Environment: Issues in Human Ecology* (San Francisco: Freeman, 1972); and Paul R. Ehrlich and Anne H. Ehrlich, *Betrayal of Science and Reason: How Anti-Environmental Rhetoric Threatens Our Future* (Washington, DC: Island Press, 1996).

[7] Homer-Dixon, "On the Threshold"; Homer-Dixon, "Environmental Scarcities and Violent Conflict"; Homer-Dixon, *Environment, Scarcity, and Violence*; and Homer-Dixon and Blitt.

[8] Homer-Dixon uses the term environmental scarcity instead of resource scarcity. We prefer the latter term and will attempt to use that throughout the article in order to try to separate the idea of scarcity of resources from the concept of processes of environmental change that are assumed to cause such scarcities.

[9] Homer-Dixon and Blitt, p. 6.

[10] Homer-Dixon focuses mainly on degradation of natural resources resulting from human activity. Natural resources can also be degraded or depleted by causes other than human activity, such as natural disasters or natural variation.

[11] Homer-Dixon, "Environmental Scarcities and Violent Conflict," p. 31.

[12] Gleditsch, "Armed Conflict and the Environment," pp. 382–383.

[13] Homer-Dixon and Blitt.

[14] Ted Robert Gurr, *Why Men Rebel* (Princeton, NJ: Princeton University Press, 1970).

[15] Homer-Dixon and Blitt, p. 11.

[16] Homer-Dixon, "The Ingenuity Gap"; and Homer-Dixon, *The Ingenuity Gap.*

[17] Homer-Dixon, "The Ingenuity Gap," p. 605.

[18] Homer-Dixon and Blitt, p. 8.

[19] Homer-Dixon, "The Ingenuity Gap," p. 589; and Homer-Dixon, *The Ingenuity Gap*, p. 230.

[20] For some critical articles, see Geoffrey Dabelko, "The Environmental Factor," *Wilson Quarterly* 23, no. 4 (1999) pp. 14–20; Daniel H. Deudney, "Environmental Security: A Critique," in Daniel H. Deudney and Richard A. Mat-

thew, eds., *Contested Grounds: Security and Conflict in the New Environmental Politics* (Albany: State University of New York Press, 1999) pp. 187–219; Gleditsch, "Armed Conflict and the Environment"; and Mark Levy, "Is the Environment a National Security Issue?" *International Security* 20, no. 2 (1995) pp. 35–62.

[21] Daniel M. Schwartz, Tom Deligiannis and Thomas F. Homer-Dixon, "The Environment and Violent Conflict," in Paul F. Diehl and Nils Petter Gleditsch, eds., *Environmental Conflict* (Boulder: Westview, 2001) p. 275.

[22] Homer-Dixon, *Environment, Scarcity, and Violence*, p. 16.

[23] Valerie Percival and Thomas F. Homer-Dixon, "The Case of South Africa," in Homer-Dixon and Blitt, pp. 109–146.

[24] Kimberly Kelly and Thomas F. Homer-Dixon, "The Case of Gaza," in Homer-Dixon and Blitt, pp. 67–107.

[25] Philip Howard and Thomas F. Homer-Dixon, "The Case of Chiapas, Mexico," in Homer-Dixon and Blitt, pp. 19–65.

[26] Homer-Dixon and Blitt, pp. 4–5.

[27] Nils Petter Gleditsch, "Environmental Change, Security, and Conflict", in Chester Crocker, Fen Osler Hampson and Pamela Aall, eds., *Managing Global Chaos II* (Washington, DC: United States Institute of Peace Press, 2001) p. 55.

[28] Homer-Dixon, "On the Threshold"; and Homer-Dixon, "Environmental Scarcities and Violent Conflict."

[29] Homer-Dixon and Blitt.

[30] Percival and Homer-Dixon, "The Case of South Africa," p. 121.

[31] Kelly and Homer-Dixon.

[32] Gleditsch, "Armed Conflict and the Environment," p. 390f.

[33] Homer-Dixon and Blitt.

[34] In addition, variables like rapid forced immigration and restricted access to water hint at authoritarian or coercive policies and may be indicative of the character of the political system.

[35] Gleditsch has argued that the role of democracy is also essential in the analysis of interstate environmental conflicts. If democracies do not fight each other for other reasons, there is no reason why they should do so over environmental or resource issues. Instead, democracies are likely to react to scarcities or disagreements about resources by cooperative solutions, including interstate agreements. If democracies tend to follow environmentally more benign policies, they are also less likely to generate serious environmental problems. See Gleditsch, "Environmental Conflict and the Democratic Peace." For a more recent argument relating democracy to environmental commitment, see Eric Neumayer, "Do Democracies Exhibit Stronger International Environmental Commitment? A Cross-Country Analysis," *Journal of Peace Research* 39, no. 2 (2002) pp. 139–164.

[36] Edward N. Muller and Erich Weede, "Cross-National Variations in Political Violence: A Rational Action Approach," *Journal of Conflict Resolution* 34, no. 4 (1990) pp. 624-651.
[37] Tanja Ellingsen, "Colorful Community or Ethnic Witches' Brew? Multiethnicity and Domestic Conflict During and After the Cold War," *Journal of Conflict Resolution* 44, no. 2 (2000) pp. 228–249; Håvard Hegre, Tanja Ellingsen, Scott Gates and Nils Petter Gleditsch, "Toward a Democratic Civil Peace? Democracy, Political Change, and Civil War, 1816–1992," *American Political Science Review* 95, no. 1 (2001) pp. 33–48.
[38] Howard and Homer-Dixon, p. 54.
[39] Ibid.
[40] Kelly and Homer-Dixon, p. 92.
[41] Percival and Homer-Dixon, "The Case of South Africa," p. 133.
[42] Homer-Dixon "On the Threshold," p. 86.
[43] In one place, Homer-Dixon explains activity per capita in some detail as a function of, among other things, the economy's current capital stock. Ibid.
[44] Homer-Dixon, "On the Threshold," pp. 99–104.
[45] See for instance M.A. Cole, "Limits to Growth, Sustainable Development Kuznets Curves: An Examination of the Environmental Impact of Economic Development," *Sustainable Development* 7, no. 2 (1999) pp. 87–97; Thomas M. Selden and Daqing Song, "Environmental Quality and Development: Is There a Kuznets Curve for Air Pollution Emissions?" *Journal of Environmental Economics and Management* 27, no. 2 (1994) pp. 147–162; or O Zaim and F Taskin, "A Kuznets Curve in Environmental Efficiency: An Application on OECD Countries," *Environmental & Resource Economics* 17, no. 1 (2000) pp. 21–36.
[46] Gene M. Grossman and Alan B. Krueger, "Economic Growth and the Environment," *Quarterly Journal of Economics* 110, no. 2 (1995) p. 372.
[47] See Nancy Lee Peluso and Michael Watts, eds., *Violent Environments* (Ithaca, NY: Cornell University Press, 2001) for a recent selection of case studies that address the important contextual factors of the environment-conflict nexus in a thorough manner.
[48] Gary King, Robert O. Keohane and Sidney Verba, *Designing Social Inquiry. Scientific Inference in Qualitative Research* (Princeton, NJ: Princeton University Press, 1994).
[49] Homer-Dixon, "On the Threshold," p. 83.
[50] Levy, p. 56.
[51] Percival and Homer-Dixon, "The Case of South Africa," p. 135.
[52] Valerie Percival and Thomas F. Homer-Dixon, "Environmental scarcity and violent conflict: The case of South Africa," *Journal of Peace Research* 35, no. 3 (1998) p. 279.
[53] Homer-Dixon, "Environmental Scarcities and Violent Conflict," p. 39.
[54] Homer-Dixon and Blitt, p. 223.
[55] Homer-Dixon, *Environment, Scarcity, and Violence*, p. 177.

[56] Schwartz, Deligiannis and Homer-Dixon, pp. 282, 284.
[57] See Nils Petter Gleditsch, "Armed Conflict and the Environment."
[58] Schwartz, Deligiannis and Homer-Dixon, pp. 282, 289.
[59] Homer-Dixon, *Environment, Scarcity, and Violence*, p. 177.
[60] Ibid.
[61] Wenche Hauge and Tanja Ellingsen, "Beyond Environmental Scarcity: Causal Pathways to Conflict," *Journal of Peace Research* 35, no. 3 (1998) pp. 299–317.
[62] Daniel C. Esty, Jack A. Goldstone, Ted R. Gurr, Barbara Harff, Marc Levy, Geoffrey Dabelko, Pamela T. Surko and Alan N. Unger, *State Failure Task Force Report: Phase II Findings* (McLean, VA: Science Applications International, 1998) pp. viii–ix.
[63] Henrik Urdal, *The Devil in the Demographics: How Neo-Malthusian Population Pressure and Youth Bulges Influence the Risk of Domestic Armed Conflict.* (Cand. polit. thesis., Department of Political Science, University of Oslo, 2002).
[64] Hans Petter Wollebæk Toset, Nils Petter Gleditsch and Håvard Hegre, "Shared Rivers and Interstate Conflict," *Political Geography* 19, no. 8 (2000) pp. 971–996.
[65] Jaroslav Tir and Paul F. Diehl, "Demographic Pressure and Interstate Conflict," *Journal of Peace Research* 35, no. 3 (1998) pp. 319–339.