

Chapter 6

Armed Conflict and the Environment

Conflict over scarce resources, such as minerals, fish, water, and particularly territory, is a traditional source of armed struggle. Recently, wide-ranging claims have been made to the effect that environmental degradation will increase resource scarcity and therefore contribute to an increase in armed conflict. So far, there has been much controversy and little relevant systematic study of this phenomenon. Most scholarship on the relationship between resources, the environment, and armed conflict suffers from one or more of the following problems: (1) there is a lack of clarity over what is meant by ‘environmental conflict’; (2) researchers engage in definitional and polemical exercises rather than analysis; (3) important variables are neglected, notably political and economic factors which have a strong influence on conflict and mediate the influence of resource and environmental factors; (4) some models become so large and complex that they are virtually untestable; (5) cases are selected on values of the dependent variable; (6) the causality of the relationship is reversed; (7) postulated events in the future are cited as empirical evidence; (8) studies fail to distinguish between foreign and domestic conflict; and (9) confusion reigns about the appropriate level of analysis. While no publications are characterized by all of these problems, many have several of them. This article identifies a few lights in the wilderness and briefly outlines a program of research.

6.1 War, Resources, and the Environment

‘Nations have often fought to assert or resist control over war materials, energy supplies, land, river basins, sea passages and other key environmental resources.’¹ This passage from the World Commission on Environment and Development

¹This article was originally published in *Journal of Peace Research* 35(3): 381–400, 1998. As can be seen in the bibliography in this volume, no other article of mine has been reprinted so many times.

(Brundtland 1987: 290) summarizes a common view of armed conflict.² Thus, Renner et al. (1991: 109) claim that 'throughout human history, but particularly since the system of sovereign nation states, struggles over access to and control over natural resources ... have been a root cause of tension and conflict' and that 'history provides numerous examples of how states and nations were destabilized by environmental collapse leading to famine, migration and rebellion'. Galtung (1982: 99) has argued that 'wars are often over resources'. Brock (1991: 409) asserts that 'control over natural resources has always been important in enabling a country to wage war', citing as an example the Pacific War (1879–84) between Chile and Peru over guano deposits. Westing (1986: particularly Chap. 1 and Appendix 2) has examined how resource competition has contributed to the onset of twelve armed confrontations in the 20th century, ranging from the two World Wars to the Anglo-Icelandic 'Cod Wars' of 1972–73. A more ambitious claim is made by Colinviaux (1980: 10), who asserts that 'history has been a long progression of changing ways of life and changing population', with 'wars, trade and empire' as the results. Ehrlich/Ehrlich (1972: 425) argue that 'population-related problems seem to be increasing the probability of triggering a thermonuclear Armageddon'.

Since the emergence of environmental issues on the international political agenda in the early 1970s, there has been increasing concern that environmental disruption is likely to increase the number of disputes originating from competition for scarce resources.³ Galtung (1982: 99) has argued that 'destruction of the environment may lead to more wars over resources', and suggests that 'environmental effects make a country more offensive because it is more vulnerable to attack and because it may wish to make up for the deficit by extending the eco-cycles abroad, diluting and hiding the pollution, getting access to new resources'. After the end of the Cold War, similar statements have become very common. Opschoor (1989: 137) asserts that 'ecological stress and the consequences thereof may exacerbate tension within and between countries', and Lodgaard (1992: 119) has said that 'where there is environmental degradation, or acute scarcity of vital resources, war may follow'. Similarly, the then Norwegian Defense Minister Johan Jørgen Holst (1989: 123) argued that environmental stress seems likely to become an increasingly potent contributing factor to major conflicts between nations. In

²Earlier versions of this article were presented at a NATO Advanced Research Workshop 'Conflict and the Environment' at Bolkesjø, Norway; a meeting of the NATO Committee on the Challenges of the Modern Society Pilot Study Meeting on Environmental Security in Ankara; the Fifth National Conference in Political Science at Geilo, Norway; at the 38th Annual Convention of the International Studies Association, Toronto; and at the 1997 Open Meeting of the Human Dimensions of Global Environmental Change Research Community at Laxenburg, Austria. Financial support from the United States Institute of Peace is gratefully acknowledged, as is assistance from Norunn Grande, Håvard Hegre, Cecilie Sundby, and Bjørn Otto Sverdrup. I am also grateful for comments from guest editor Paul Diehl and two anonymous *JPR* referees, as well as Tanja Ellingsen, Scott Gates, Dan Smith, and a number of participants at the various conferences.

³Recent literature surveys are found in Rønnfeldt (1997) and Smith/Østreng (1997).

addition, ‘environmental degradation may be viewed as a contribution to armed conflict in the sense of exacerbating conflicts or adding new dimensions’. McMichael (1993: 321) believes that ‘the end-stage of unequal power relations and economic exploitation in the world will be tension and struggle over life-sustaining resources. Fossil fuels, freshwater, farming and fish have already become the foci of armed struggles’. Also on an alarmist note, Kaplan (1994), in a widely publicized article in the *Atlantic Monthly*, predicted a coming world anarchy—sparked in large measure by environmental degradation. The Secretary-General of the Habitat conference in 1996 told participants that ‘the scarcity of water is replacing oil as a flashpoint for conflict between nations...’ (Lonergan 1997: 375).

To this thinking, the prime resource seen as worth fighting for is obviously territory, as in the conflict-filled expansion of European settlers in North America or the border conflicts between China and several neighbors. A more recent variety of territorial conflict concerns the economic zone on the continental shelf, a matter of dispute between most countries which are neighbors at sea and which may raise tiny islands to monumental importance because of their consequences for boundaries at sea. Thus, there are no less than six claimants to all or part of the Spratly Islands in the South China Sea (Denoon/Brams 1997), and the use of force cannot be ruled out. Another is strategic raw materials: the strategic importance accorded to Indochina in the 1950s was justified by US President Eisenhower—in the statement that made famous the ‘domino theory’—with reference to the importance of raw materials such as tin, tungsten, and rubber.⁴ Some such raw materials are closely tied to arms production, others are simply seen as essential to the economy. A third is sources of energy, the most obvious example being oil supplies from the Persian Gulf, a factor in several recent conflicts. A fourth is water, such as the Atatürk dam project in Turkey, which may result in a water shortage in Syria; or the Nile project, which might provoke a serious downstream-upstream conflict between Egypt and Ethiopia. A UN study identified 214 major river systems shared by two or more countries, many of them subject to unresolved disputes (Renner 1996: 619). A fifth resource is food, including grains and fisheries. Disagreements regarding shared fisheries resources have occasioned numerous confrontations between fishing vessels and armed vessels of coastal states, including three ‘Cod Wars’ between Iceland and the United Kingdom in the period 1958–76 (Bailey 1997). Increasing food prices have given rise to domestic violent riots; at the international level, food sales have been used for strategic leverage.

The basic causal chain in this argument runs as follows: population growth & high resource consumption per capita → deteriorated environmental conditions → increasing resource scarcity → harsher resource competition → greater risk of violence.

⁴Statement made by President Eisenhower in a press conference on 7 April 1954, cf. (1954) *Public Papers of the Presidents of the United States. Eisenhower*: 382, quoted from LaFeber (1980: 163). For other statements by US policymakers in the same vein, see Kolko (1985: 76), who finds such references to raw materials to be ‘integral to American policy considerations from the inception’.

Not everyone includes all the elements of this causal chain or puts the emphasis in the same place. Biologists frequently single out population growth as the key causal factor; environmentalists tend to start with environmental degradation; and critics of capitalism tend to emphasize excessive consumption in the First World and the need for the First World to restrict its consumption if the Third World is to be allowed to catch up. There is not necessarily any contradiction between these positions, but they stress different parts of the causal chain. Homer-Dixon and associates use a tripartite division of scarcity (Percival/Homer-Dixon 1998: 282–285): supply-induced (which corresponds to environmental deterioration above), demand-induced (resulting from population growth), and structural (due to inequality, which is not included in the model above).

Despite numerous pronouncements on the relationship between conflict and the environment, there is no consensus on the causal mechanisms. Indeed, several writers have questioned the overall argument. Deudney (1991) and Simon (1996) have listed a number of problems with the notion of increasing resource scarcity.⁵ First, it ignores human inventiveness and technological change, both of which have vastly increased agricultural yields and the rate of resource extraction from raw material lodes. Modern industry is high on processing, which essentially means intensive in capital, technology, and energy, rather in raw materials like minerals. Second, the pessimistic argument overlooks the role of international trade; most scarcities are local rather than universal. Third, raw materials can be substituted, so being dependent on a particular resource today is not the same as being vulnerable tomorrow if the supply lines should be choked off. Fourth, in the event of increasing scarcity, prices are likely to rise, leading to greater economizing, and further technological change, trade, and substitution. In fact, however, these processes have been sufficiently effective in recent decades for raw materials prices to fall even though global consumption of natural resources has increased. Thus, while the international best-seller *The Limits to Growth* (Meadows et al. 1972) predicted imminent scarcities in a number of minerals, such as copper, the trend since then has in fact been in the opposite direction.

Even in the event of scarcities which could theoretically be overcome by imperialist behavior, the major powers have learnt—from Vietnam, Afghanistan, and a number of other wars in the Third World—that subduing a resisting population, however technologically backward, is a very costly affair. On the basis of an overall ‘cornucopian’ view where the human being is the most essential resource, Simon (1989) argues that, rather than furthering war, population growth is likely to end it. Instead of armed conflict, Deudney argues, conflicts over resources such as water may lead to joint exploitation of the resources and a network of common interests. Similarly, resource scarcity based on environmental degradation would encourage joint efforts to halt the degradation. Levy (1995) also argues that

⁵For general broadsides against environmental pessimism, see Maddox (1972), Bolch/Lyons (1993), Bailey (1995), and Easterbrook (1995). A recent response is found in Ehrlich/Ehrlich (1996).

environmental degradation is unlikely on its own to be a major cause of armed conflict; further, that it is not a national security issue for the United States, and is even unlikely to prove interesting as a research area unless seen in conjunction with other causes of armed conflict.

Many of the more balanced statements on environmental factors in conflict are rather cautious about drawing causal links. Westing (1986: 6), for instance, concludes only that 'what the ultimate cause or causes of war might be defies simple explanation and is, at any rate, far beyond the scope of this analysis'. Brock (1991: 410) concedes that the importance of natural resources as a source of conflict is easily exaggerated, citing Lipschutz/Holdren (1990: 121), who argue that despite Eisenhower's famous 'domino' statement and numerous other policy pronouncements, the problem of access to resources has not 'really played such a central role in shaping US foreign and military policy in recent decades'. The same holds for other nations, Lipschutz/Holdren argue, although resources have frequently served as rationalizations for public consumption 'in support of policies with much more elaborate origins' (Lipschutz/Holdren 1990: 123).

Nevertheless, the overall impression of this literature is one of strong pessimism, stated with considerable force. The object of this article is to examine the research foundations for such claims. I begin with a brief summary of systematic research in this area, and go on to discuss nine common theoretical and methodological problems in the extant literature. Finally, I point to some recent work which seems to be moving in a promising direction and outline some priorities for developing this work further.

6.2 Systematic Research

Neither in the environmental literature nor in studies of the causes of war or civil war has there been much systematic research (quantitative or comparative) on the relationship between resources and environmental factors and armed conflict.

A number of studies summarized in Tir/Diehl (1998) have related population density and population growth to conflict and violence. Strictly speaking, these are not measures of either resource scarcity or environmental degradation. But they may provide a good indirect measure, in that a high value indicates a high or increasing load on resources and the environment. Tir and Diehl found that the literature did suggest a link between population variables and international conflict, but that there was little theoretical or empirical consensus beyond that. In their own empirical study of all nations for the period 1930–89, they conclude that there is a significant but fairly weak relationship between population growth and interstate militarized conflict and war, but that population density has no effect.

Territory is undoubtedly the resource studied most extensively in the context of conflict. Numerous studies, including several quantitative ones, have underlined the role of territorial issues in armed conflict. For example, Holsti (1991: 307) concludes that among interstate wars in the period 1648–1989, territorial issues were by

far the most important single issue category: initially figuring in about half the wars, they eventually declined eventually to one-third in the post-World War II period. Only for the period 1815–1914 is territory tied for first place with an issue he calls ‘maintain integrity of state/empire’, arguably in itself a form of territorial conflict. Reanalyzing Holsti’s data, Vasquez (1993: 130; 1995: 284) finds that between 79 and 93 % of wars over the five time periods involve territorially-related issues. Huth (1996: 5) in a study of territorial disputes 1950–90 characterizes this issue as ‘one of the enduring features of international politics’. The territorial explanation of war also fits in with the finding that most interstate violence occurs between neighbors (Bremer 1992) or proximate countries (Gleditsch 1995). It is not always obvious why such conflicts occur—is it because neighbors are more easily available for conflict than other states, because of friction in their day-to-day interaction, or because of disputed boundaries or territories? However, Vasquez (1995) presents a strong case for the territorial explanation.

On the other hand, even where territory is conclusively shown to be a significant factor in armed conflict, the question remains whether the territory itself is at issue, or the resources which may be found on it. For the general question which we investigate here, either version will do. But for more precise theorizing about the link between resources and conflict, we need to understand exactly which resource is decisive. Some resources are probably too trivial to fight over, while a resource such as oil might be seen as economically essential. The territory itself might be seen as important to the identity of a people and the symbolic function might be more important than any material value. In a study of modern border disputes, Mandel (1980: 435) hypothesized that ethnically-oriented border disputes would be more severe than resource-oriented ones because ethnic issues seemed less tractable, more emotional, and less conducive to compromise. He was able to confirm his hypothesis in a study of interstate border disputes after World War II, using data from Butterworth (1976). To extend the concept of ‘resources’ to include ethnic affiliation or the symbolic value of ‘the land of our fathers’, would be possible, but strained.

A rare empirical investigation of resource imperialism is found in a study by Hammarström (1986, 1997), which examined how interventions in the Third World by three major Western powers (France, UK, and the USA) in the period 1951–77 might be accounted for by the presence of economically and militarily essential minerals in the less developed country. Hammarström’s results were essentially negative: the importance of the less developed country as a supplier of minerals did not affect the likelihood of intervention from the USA and the UK, and affected it only slightly in the case of France. This finding also held for the subset of countries within the sphere of influence of the major power, for the subset of minerals upon which the major power was extremely dependent, and for regions rather than individual countries. Hammarström cautions that he has tested the theory on the basis of the theory of economic imperialism only, and that it might also have been analyzed from the perspective of the East-West conflict. But since the major Socialist powers had been largely self-sufficient in raw materials, he felt that such a test would be unlikely to produce very different results.

Anthropologists have studied the influence of environmental factors on tribal warfare in single cases. For instance, Graham (1975) attributes considerable importance to environmental factors in the explanation of the endemic intertribal warfare among the Yuman societies of the Colorado and Gila rivers. As far as modern warfare is concerned, however, there appears to be little systematic evidence. For example, the comprehensive *Handbook of War Studies* (Midlarsky 1989) does not list ‘ecology’, ‘environment’, ‘land’, ‘raw materials’, or ‘water’ in its index.⁶ Neither do the indices of such classical studies of war as Richardson (1960) or Wright (1942/1965).⁷ Within the Correlates of War project—the largest modern research project of its kind—one article finds limited support for the idea that population pressure may be a factor in war initiation (Bremer et al. 1973); but generally environmental factors do not seem to have attracted much attention. Choucri/North (1975) have also investigated the effects of population growth in the international processes that led up to World War I. However, in a more recent wide-ranging book by North (1990), both the environment and war are discussed extensively but the two seem hardly to intersect. In general, those who have researched the general patterns of war have been much more concerned with alliances, power configurations, and other elements of realist theory (and more recently with democracy, economic interdependence, and other elements of liberal theory) than with environmental factors. It is possible, of course, that this is because environmental factors simply do not play much of a role in warfare—but one would feel more confident of this conclusion if environmental hypotheses had at least been tested. Another explanation for the relative neglect of these factors could be that the environmental boundaries of state policy have not been central to the grand political debate until quite recently. Moreover, most research on international conflict has focused on national, dyadic, and systematic attributes for understanding international behavior, whereas the issues involved in conflict have generally been ignored—including, presumably, environmental issues (Diehl 1992).

Domestic armed conflict is dominant in the single case studies on the effects of environmental degradation. But there is even less comparative and quantitative work here than in relation to interstate conflict. Wallenstein/Sollenberg (1997: 343), in a study of armed conflicts after the Cold War (the vast majority of which have been domestic) show that in slightly more than half the conflicts the basic incompatibility concerned territory rather than government. Conflicts over territory were less frequently terminated (or only tentatively terminated with a ceasefire) and were less frequently the subject of peace agreements. The article by Hauge/Ellingsen (1998) stands out as fairly unique in trying to integrate environmental

⁶More recently, Midlarsky (1995) has investigated how the lack of warfare and two environmental variables (rainfall and sea borders) exert positive effects on democracy and the impact of democracy on environmental policies (1998).

⁷With the exception that Wright’s book contains a few references to environmental factors in ‘primitive warfare’, for example, that ‘primitive peoples in extremely cold and extremely hot climates tend to ‘be unwarlike’, while in general ‘a temperate or warm, somewhat variable and stimulating climate favors warlikeness’ (Wright 1965: 63, 552–554).

degradation into a more general model of civil war and test it in a large- N mode. They conclude that environmental degradation does stimulate the incidence of conflict, but less so than political or economic variables and that the severity of such conflicts is better accounted for by military spending. Their study is limited to three types of environmental degradation which mainly affect poor countries and covers a relatively limited time-span (1990–92).

6.3 Nine Common Problems

Apart from the role of population factors and territory in armed conflict there is, then, a notable lack of systematic research on the effects of resource or environmental factors on armed conflict. In the absence of solid evidence, the field has been left wide open to speculation and conjecture. Thus, in debating population pressure, even serious academics are driven to support their respective positions in the US debate by referring to the sparsity of population that anyone can observe out of an airplane window (Bolch/Lyons 1993: 27) or the obvious overpopulation which is evident when one drives in a major city at rush hour (Ehrlich/Ehrlich 1996: 211). Such low standards of evidence make it difficult to assess the state of the art. In what follows, I will concentrate on work with more solid claims to seriousness. Even within this literature, however, there are many problems. This article discusses nine of them, in no particular order.

6.3.1 *Resource Scarcity or Environmental Degradation?*

Many of the references to ‘environmental’ factors that are posited as capable of stimulating an arms race or triggering a war are unclear as to whether the causal factor is absolute resource scarcity or environmental degradation. Virtually all resources are ‘scarce’—to some degree, at some times, or in some places. By definition, scarcity leads to conflict in the sense of conflict of interest. It can even be argued that all conflicts of interest derive from scarcity. However, not all resource conflicts lead to overt conflict behavior, and even fewer to the use of force. Environmental degradation may exacerbate resource conflicts because it reduces the quantity or quality of the resource in question. Pollution of a river, for instance, reduces the quality of the water; but it can also be interpreted as reducing the quantity of clean water, and therefore contributing to increased scarcity. Similarly, air pollution in a city degrades the quality of the air and changes an unlimited public good (clean air) into a scarce one.

Libiszewski (1992: 2) argues that simple resource conflicts are very common, but that the concept of environmental conflict calls for a more restricted use. The latter he defines as a conflict caused by a human-made disturbance of the normal regeneration rate of a renewable resource (Libiszewski 1992: 6). Thus, a conflict

over agricultural land is an ‘environmental conflict’ if the land becomes an object of contention as a result of soil erosion, climate change, and so on, but not in the case of an ordinary territorial or colonial conflict or an anti-regime civil war aiming at the redistribution of land. Non-renewable natural resources (such as oil) are not integrated in any eco-system. Their depletion may lead to economic problems, but they are not in themselves environmental problems, so conflicts over such resources should not be considered environmental conflicts.

Libiszewski’s distinction between those conflicts which result from simple resource scarcity and those which result from environmental degradation is useful. When, for instance, Homer-Dixon (1991, 1994) refers to ‘environmental scarcity’, the terminology itself muddies the waters. In the following, within the bounds of the practical, I will try to keep the two apart. However, I find it more difficult to follow Libiszewski in linking environmental conflict to the concept of an eco-system, with its questionable overtones of balance and equilibrium.⁸

Even the distinction between simple resource scarcity and environmental degradation raises some problems. Today’s simple scarcity may well be the result of environmental mismanagement in the past. The lack of forests around Madrid may be seen as a fact of nature today, but can be interpreted as a result of excessive ship-building in the 16th century, and thus as an old case of environmental degradation. Most, if not all, territorial conflict can be seen as the result of past population policies (or a lack thereof) which have permitted groups to multiply beyond what their traditional territories could support. As far as the present is concerned, however, this distinction sets a useful standard.

6.3.2 *Definitions and Polemics*

The term environmental security was launched to place the environment on the agenda of ‘high politics’ (Lodgaard 1992: 113). If one adopts a broad conception of security as ‘the assurance people have that they will continue to enjoy those things that are most important to their survival and well-being’ (Soroos 1997a: 236), it can be plausibly argued that serious environmental degradation can indeed threaten security. This would be particularly true if the most serious warnings about global warming or holes in the ozone layer turn out to be correct, but even more traditional environmental concerns like air and water pollution can kill more people than smaller armed conflicts or even wars. Politically, then, it makes sense to give such

⁸Libiszewski speaks (1992: 3) of ‘a dynamic equilibrium oscillating around an ideal average’. Whether such equilibria exist in anything but the short term, seems questionable. At least it is implausible that only human intervention can change them. Otherwise, it would be difficult to explain the disappearance of the dinosaurs and other animals long before human beings were numerous enough to have much influence on the global environment, or even before human beings existed. Or should we see the emergence of the dinosaurs, as well as their subsequent disappearance, as part of an ‘ideal’ world?

issues very high priority. Like common security, structural violence, or sustainable development, environmental security made a good slogan—so successful that the US Department of Defense now has a position called ‘Principal Deputy Undersecretary of Defense (Environmental Security)’, the NATO Science Committee is running a series of workshops on environmental security (Gleditsch 1997), and NATO’s Committee on the Challenges of Modern Society is conducting a pilot study on the same topic (Carius et al. 1996). Defense establishments in many countries in NATO and among the cooperating partners in East and Central Europe are rushing to acquire a green image by improving their environmental performance.

But political success does not necessarily make a slogan into a workable research tool (Graeger 1996). Merging two objectives like security and environmental protection into a joint term does not give us new theoretical or empirical insight into whether the two are mutually supportive—or in competition. Those who on the basis of the broad definition of security deliberately disregard the question of armed conflict are in a sense on fairly safe ground.⁹ But most of the literature cannot resist the temptation to bring the danger of armed conflict back in, as a consequence of environmental degradation (Gleditsch 1997; Lodgaard 1992). Indeed, why else would armed forces and military alliances be so interested in environmental security?

On this point, the critical literature (Deudney 1990; Levy 1993) does not take us much further. In part, this literature engages in similar definitional exercises in order to prove the futility of the concept of environmental security. In addition, it demonstrates theoretical and empirical problems in the writings on the environment and security. Some of the critical points are well taken, but if they do not end up in an alternative or improved research design, they are of little help.

6.3.3 *Overlooking Important Variables*

If we could prove that human activity could shift the average global temperature by, for example, 5°, this would be a very important finding. No climate researcher would argue, however, that human activity is the one and only determinant of global temperature. Anyone who correlated emissions of greenhouse gases with temperatures recorded monthly would seem patently ridiculous, since the effect of human activity is likely to be completely swamped by long-established seasonal variations. In the social sciences, such caution is often thrown to the winds. Far too many analyses of conflict and the environment are based not only on bivariate analysis but also on overly simplistic reasoning.

⁹There is still a danger of conceptual slippage, by including all manner of environmental problems in the concept of environmental security, and not just those which are serious enough to be treated on a par with war destruction. This development is reminiscent of the fate of the concept of structural violence (Galtung 1969), which was so successful in the short term that it came to include any social ill—and eventually self-destructed.

The greatest weakness in this respect is that much of this literature ignores political, economic, and cultural variables. When writers on environmental conflict refer to the '214 shared river systems' as potential sources of conflict, they rarely distinguish between rivers which run through poor, undemocratic, politically unstable countries ridden by ethnic tensions, and rivers running through stable and affluent countries. It is tacitly assumed that resource conflicts have a high potential for violence, regardless of the countries' political system or economic orientation. Since democracies rarely if ever fight one another (Gleditsch/Hegre 1997; Russett 1993) and since they rarely experience civil war (Hegre et al. 2001) there is no reason to believe that they will suddenly start fighting over resource issues between themselves, or internally, any more than over other issues. Moreover, if it is correct that democracies generally display more benign environmental behavior than do non-democracies,¹⁰ then democracies are also less likely to generate the kind of extreme environmental degradation which may be assumed to generate violent conflict. Thus, democracy may have a double effect in preventing armed conflict over the environment: it generates fewer serious problems, and it provides other means of conflict resolution once these problems have arisen.

Most work on environmental conflict does not discuss how regime type may influence such conflict. For example, in the many case studies published as project reports by Homer-Dixon and his associates, there are general references to 'key social and political factors' (Percival/Homer-Dixon 1993: 3), to corruption, weakened legitimacy, resource capture by elites, and so on. However, words such as 'democracy' or 'autocracy' do not occur in the model. In view of the extensive theoretical and empirical literature relating the degree of democracy to civil violence in an inverted U-curve (Muller/Weede 1990) a democracy variable should have been included explicitly. The reports frequently hover around the idea that democratic procedures might have something to do with the level of conflict. Yet, none of the reports clearly state that democracy matters, or in what way. Furthermore, the work by Homer-Dixon and his associates is on the whole *more* sensitive to political variables than most studies in this field.

Many of the militarized interstate disputes between democracies have been over resources—or more specifically over one particular resource, fish (Bailey 1997; Russett 1993: 21). At sea, boundaries between states are not yet well settled, and even where they are established by law or by custom, they are not visible. The fluidity of any sea boundary makes it more conflict-prone than an established land boundary. Moreover, fish stocks straddle national boundaries and migrate across them with the seasons, with no concern for the consequences for human conflict. It is not surprising, then, that international fisheries should be ridden with conflict. However, even if fisheries conflicts between democracies may involve some use of force or threats to use it, such conflicts rarely, if ever, escalate to the point where human life is lost. Since 'war' is usually defined as a conflict with more than 1,000

¹⁰As argued by Payne (1995), Gleditsch/Sverdrup (1995), and Gleditsch (1997a); Midlarsky (1998) is more sceptical.

dead (Small/Singer 1982; Wallensteen/Sollenberg 1997), terms such as ‘cod war’ or ‘turbot war’ (Soroos 1997b) are misnomers. Moreover, these conflicts usually involve one private party (a fishing vessel) against representatives of another state (a warship or a coastguard vessel). When such conflicts occur between democracies, the two states take particular care not to engage in force or threats of force between their own representatives. Thus, as far as the militarized part of the conflicts is concerned, these disputes are not really ‘interstate’.

A similar point holds for economic variables. Much of the environmental literature lacks explicit recognition of the fact that material deprivation is one of the strongest predictors of civil war. Moreover, economically highly developed countries rarely fight one another (Mueller 1989), although this regularity is less absolute than the democratic peace. Finally, while economic development does tend to exacerbate certain environmental problems (such as pollution and excessive resource extraction) up to a point, the most advanced industrial economies also tend to be relatively more resource-friendly. Hence, resource competition is likely to be less fierce domestically as well as externally among the most highly developed countries. Going back to the example of shared water resources, highly developed countries have very strong economic motives for *not* fighting over scarce water resources; instead, they use technology to expand the resources or find cooperative solutions in exploiting them. Poor countries generate more local environmental problems, which in turn may exacerbate their poverty and which is also conducive to conflict. Certain types of environmental degradation—like deforestation, lack of water and sanitation, and soil erosion—are part and parcel of underdevelopment.

6.3.4 *Untestable Models*

While there is much single-factor reasoning, some work goes to the opposite extreme. In a series of reports and articles which represent some of the most solid case-oriented work in the field, Homer-Dixon (1991, 1994) employs a very complex theoretical scheme, where four basic social effects of environmental disruption (decreased regional agricultural production, population displacement, decreased economic productivity, and disruption of institutions) may produce scarcity conflicts, group-identity conflicts, and relative-deprivation conflicts. This model has been reproduced in various forms in a number of publications from the Toronto Group, and by others (cf. Hauge/Ellingsen 1998: 301).

Some problematic aspects of these complex models are clearly seen in the case studies from Homer-Dixon and his associates. The rebellion in Chiapas (Howard/Homer-Dixon 1995), for example, is explained by seven (mostly economic) independent variables acting through nine intervening variables and one additional independent variable. Violence in Gaza (Kelly/Homer-Dixon 1995) involves an explanatory scheme of eight independent and intervening variables, which in turn draw on a six-variable scheme for explaining three kinds of water scarcity and a ten-variable scheme for explaining the increasing level of grievance

against the Palestine National Authority. Whether in a large- N or a comparative case study mode, such a comprehensive scheme would be very difficult to test. Empirical testing is not helped by the fact that many of the variables are rather imprecise, such as ‘health problems’. Similar problems can be found in the work of Lee (1996) who has done interesting case studies of Sudan and Bangladesh.

Of course, single-factor reasoning and overly complex models do not go together. But the joint effect of the two phenomena is a lack of modestly multivariate analyses and of a gradualistic approach to model-building. This is not an argument against the development of large and complex models, like those developed in macroeconomics, some of which have also been applied to environmental problems (Nordhaus 1994). But such models must be built gradually, with more limited modules being put to the test first.

6.3.5 *The Lack of a Control Group*

Qualitative and quantitative research serve the same logic of inference, although their styles are different (King et al. 1994: 3). In the literature on the environment and armed conflict, the case study has been by far the dominant approach. Homer-Dixon (1991: 83) criticized earlier writing on this topic as ‘anecdotal’ and has added (Homer-Dixon 1994) a number of carefully documented case studies analyzed on the basis of his detailed theoretical scheme. Levy (1995: 56) argues that Homer-Dixon’s case studies offer ‘more anecdotes, but not more understanding’. Recent studies from Homer-Dixon’s project deal with Gaza (Kelly/Homer-Dixon 1995), South Africa (Percival/Homer-Dixon 1995, 1998) and Chiapas (Howard/Homer-Dixon 1995). Similarly, the Environment and Conflicts Project at the Swiss Federal Institute of Technology has carried out a number of case studies, recently published in three volumes (Bächler et al. 1996).

The charge that such case studies are anecdotal cannot easily be dismissed, in that all of them are single case studies of ‘environmental scarcity and violent conflict’. They offer no variation on the dependent variable,¹¹ thus violating an important principle of research design, whether the approach is qualitative or quantitative (King et al. 1994: 108). Other projects based on single case studies (e.g. Lee 1996) suffer from the same problem. Regardless of the accuracy of the historical description and the excellence of the theoretical model, these studies fail to provide an empirical basis for comparison. In the Toronto Group’s study of Chiapas, for example, ‘weak property rights’ is a factor in creating ‘persistent structural scarcities’ which in turn contributes to the outbreak of rebellion (Howard/Homer-Dixon 1995: 23). But in order to evaluate the causal nature of this link, we need to examine cases without conflict, many of which will certainly also

¹¹Nor, for that matter, do they provide any variation on the independent variable, but that is not necessarily a problem in the research design, cf. King et al. (1994: 137).

be characterized by weak property rights. Only when we know that conflict occurs more frequently in the former group, can we even begin to think about causal links.

Homer-Dixon and associates justify this method by arguing that ‘biased case selection enhances understanding of the complex relationships among variables in highly interactive social, political, economic, and environmental systems’ (Percival/Homer-Dixon 1998: 279; Homer-Dixon 1996). There are two problems with this argument. One 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. I would argue, on the contrary, that any social system is as complex as the theory developed to study it. In other words, the complexity is in the mind of the beholder rather than in the phenomenon itself. Second, almost any methodological limitation can be justified at an exploratory stage. The problem arises if the project does not move on to the next stage, but instead concludes on the basis of the exploratory case studies that ‘environmental scarcity causes violent conflict’ (Homer-Dixon 1994: 39).

Even some of the best quantitative studies on resources and war, those on territorial conflict, suffer from the same problem. Both Holsti (1991) and Vasquez (1993) derive their findings concerning the territorial basis of armed conflict from an examination of the issues involved in the armed conflict. However, they do not examine situations which did not escalate to armed conflict to see if also they contained unresolved territorial issues. Huth (1996), who studies territorial disputes and not just wars, does not include territorial claims which are not expressed publicly (Huth 1996: 24, 239). For example, the question of the Finnish territories conquered by the Soviet Union in the Winter War of 1939–40 could not be raised during the Cold War due to Finland’s somewhat precarious position. Thus, if one wanted to test a hypothesis about conditions under which territorial disagreements are completely suppressed, Huth’s dataset would not be suitable.¹²

In examining only cases of conflict, one is likely to find at least partial confirmation of whatever one is looking for, unless there are very clearly specified criteria for the threshold level of the independent variable assumed to lead to violence. No society is completely free of environmental degradation, nor is any society completely free of ethnic fragmentation, religious differences, economic inequalities, or problems of governance. From a set of armed conflicts, one may variously conclude that they are all environmental conflicts, ethnic conflicts, clashes of civilizations, or products of bad governance. Indeed, conflicts like the internationalized civil war in Ethiopia from the mid-1970s have been described in most of these terms. Only by adopting a research design where cases of conflict and non-conflict are contrasted can the influence of the various factors be sorted out.

¹²Another problem, peculiar to the literature on territory and armed conflict, is that regardless of the issue which started the conflict, the contestants need a territorial base to deploy force of any size; even guerrillas need some sort of safe haven. Thus, armed conflicts, domestic as well as international, at least when they escalate to a certain size, *become* conflicts over territory even if territory was not the most salient issue from the start.

6.3.6 Reverse Causality

It is well established—and in a sense not very surprising—that modern war wreaks havoc on the environment (see e.g. Westing 1990, 1997). The Vietnam War brought this issue to public attention, although earlier large wars had also caused destruction of vital infra-structure and generated other negative environmental effects. More recently, the prospect of a ‘nuclear winter’ pointed to the prospect of the obliteration of human activity on the Northern hemisphere as a result of the environmental effects of a nuclear war. For instance, Sagan/Turco (1993) maintained that a global nuclear war could lead to a worldwide fall in temperature of 15–20 °C. Even more optimistic scenarios than this could put the earth’s climate back to the most recent ice age. These environmental effects could be worse than the direct impact of nuclear war such as blast, fire, and radioactive fallout. Today, the campaign to abolish landmines has focused public attention on the long-term environmental effects of a weapon long after its military utility has gone.

This war-environment relationship is sometimes confused with the possibility that environmental degradation *causes* armed conflict and war. For instance, in arguing for a link from the environment to violent conflict, Holst (1989: 126) points out that five of the six countries on the UN list of countries most seriously affected by hunger had experienced civil war (Ethiopia, Sudan, Chad, Mozambique, and Angola). However, it is highly probable that the violent uprising contributed to the hunger, or even that starvation was used as a weapon of war in some of these conflicts. Thus the most important causal link is very likely the opposite of that indicated by Holst.

A slightly more complicated relationship is suggested by McMichael (1993: 322) as a positive feedback process: ‘environmental destruction and resource scarcity promote war which, when it breaks out, further increases environmental destruction and resource depletion’. However, a somewhat different feedback process seems more likely:

$$\begin{aligned} \text{war} &\rightarrow \text{environmental destruction} \rightarrow \text{resource conflict} \\ &\rightarrow \text{exacerbated armed conflict} \end{aligned}$$

This process starts from a well-documented relationship rather than from a more conjectural one. It also contains in the endpoints the process of violence repeating itself over time, which has been found to be highly significant in studies of interstate war (Raknerud/Hegre 1997) as well as civil war (Hegre et al. 2001). Of course, if the process were to continue indefinitely, these two feedback cycles would be identical. Moreover, the world would have entered a process of accelerating deterioration and violence. Studies of interstate war and civil war indicate that violence is repeated, but not always, and not as a rule with increased intensity. Rather, it may be thought of as an echo, always weaker than the signal it reflects, and petering out in the end. Thus, it does matter whether the process starts with war or with environmental degradation.

6.3.7 *Using the Future as Evidence*

Homer-Dixon, and many other authors in this area, have stressed the potential for violent conflict in the future. There is a lack of empirical study of armed conflicts in the past as well as a lack of explicit theorizing for if and why resource scarcities should have a higher violence-generating potential in the future than in the past. Much of the literature deals with conflicts of interest involving potential violence rather than with actual violence. For example, no one is really arguing that any armed conflict in the past has occurred mainly because of water issues. To argue that water has been a main issue in the many conflicts in the Middle East, and specifically in the wars between Israel and its neighbors, would be to seriously underestimate the explosive ethnic and territorial issues in the region (Lonergan 1997: 383). The argument is entirely in terms of future wars which may happen. In *Silent Spring*, arguably the most influential environmentalist book ever published, Carson (1962: Chap. 1) described in the past tense ‘a town in the heart of America’ hit by mysterious diseases caused by the excessive use of pesticides, but in fact this was ‘a fable for tomorrow’. Similarly, when Ehrlich/Ehrlich (1968: 11) started *The Population Bomb* with a statement that ‘The battle to feed all of humanity is over’, went on to predict that hundreds of millions of people would starve to death, and then discussed the political consequences, they were arguing from future empirical ‘evidence’ which in fact turned out to be wrong. While they now hold that the principal problem ‘of course’ is not acute famine, but malnutrition (Ehrlich/Ehrlich 1996: 76), they also argue that there is every reason to think that the limits to the expansion of plant yields is not far off (Ehrlich/Ehrlich 1996: 80) and liken the human race to animal populations which grow beyond their carrying capacity until they ‘crash’ to a far lower size (Ehrlich/Ehrlich 1968: 67). These are hypotheses based on controversial theory and debatable extrapolations, rather than ‘data’ which may confirm the predictions.

In principle, the future may always differ from the past. Despite whatever painstaking empirical mapping we may have made of past wars, future wars may run a different course. Environmental organizations and other advocacy movements are prone to argue that we are now at a turning-point in human history and that patterns from the past may no longer hold in the future. In saying this, one may easily slip into prophecy. ‘There will be water wars in the future’ is no more a testable statement than the proverbial ‘The End of the World is at Hand!’, unless terms such as ‘the future’ and ‘at hand’ are clearly specified. In an effort to make pessimistic environmental predictions more precise (and to prove them wrong) the economist Julian Simon has repeatedly challenged his opponents to place bets on resource issues. Three environmentalists took him up on this in 1980 and bet that the price of a basket of five metals would rise over a ten-year period. Simon, who thought they would decline, ended up winning the bet (Myers/Simon 1994: 99, 206). To my knowledge, no one has issued bets on environmental degradation and warfare, but conceivably this might be a useful strategy in order to provoke greater scholarly precision.

6.3.8 *Foreign and Domestic Conflict*

Since the end of World War II a large majority of wars have been domestic rather than interstate (Gleditsch 1996: 294). Although the number of domestic armed conflicts, whether the smaller ones or the larger conflicts conventionally called ‘wars’, has declined slightly after the end of the Cold War (Wallensteen/Sollenberg 1997), they remain much more numerous than international armed conflicts. This pattern is unlikely to be broken in the foreseeable future.

Homer-Dixon’s work is explicitly related to domestic conflicts, and Tir/Diehl (1998: 319) argue that most studies of population pressures and war focus on internal conflict. Yet, much of the reasoning about the prevalence of scarce resources as a factor in war is built on lessons from the study of interstate war, as my literature review above indicates. Both at the theoretical and empirical level, the study of interstate conflict has been conducted largely separately from the study of civil war. Some factors are similar, but one cannot easily generalize from one to the other. An obvious difference is that many theories of war at the interstate level are related to the absence of any overarching system of power, i.e. what realists call international anarchy. At the domestic level, war is often related to revolt against excessive state power or its abuse. Many issues which stimulate armed conflicts at the interstate level may be too weak to force a break *within* a society held together by a central authority. Theories linking environmental degradation to violence therefore need to be quite specific concerning whether they are addressing domestic or interstate violence. At this stage it is probably appropriate to have separate explanatory models for the two phenomena—at least in the absence of some bold theoretical thinking concerning how to link theories of violence at the domestic and interstate levels.

6.3.9 *Levels of Analysis*

Studies of war require precision about the unit of analysis. For example, in studies of democratic peace, it is frequently assumed that if democracies do not fight one another, then there will be more peace as the fraction of democracies grows. I have shown elsewhere (Gleditsch/Hegre 1997), that this holds true only under certain conditions. Under a plausible set of assumptions, an increase in the number of democracies is more likely to lead initially to an increase in the frequency of war in the system. Only later, after the degree of democracy is above a certain level, will further democratization decrease the probability of war. Similarly, we cannot automatically generalize theories and empirical evidence concerning resource and environmental factors from one level to another. Below, follow three hypotheses about interstate armed conflict using the same independent and dependent variables, but at different levels of analysis:

- (1) *System level*: In a world with high resource constraints, there will be more interstate conflict.
- (2) *Nation level*: Countries with high resource constraints are more likely to be involved in conflicts with other countries.
- (3) *Dyadic level*: Countries with high resource constraints are likely to be involved in conflict with countries with an ample supply of the same resource, and even (but to a lesser extent) with other countries with the same resource constraints.

Although these three hypotheses are derived from the same kind of thinking, the one does not logically follow from the other. If we assume that the overall frequency of interstate war is regulated mostly by systemic factors (such as the balance of power), or that states' propensity to war is largely determined by national characteristics like regime type or wealth, resource factors may still determine the direction of warfare (i.e. dyadic war). Thus, even if resource scarcities are relevant for 'who fights whom', that is not equivalent to saying that global resource scarcity determines the overall level of armed conflict. This problem of levels is not, to my knowledge, dealt with at any length in the relevant literature, which freely jumps between the dyad, the nation, and the system levels for theory as well as empirical evidence.

6.4 The Way Ahead

The nine problems discussed above add up to a fairly pessimistic assessment of the state of the study of environmental causes of conflict. Even leading studies in the field come up against fairly elementary problems in theory construction or empirical testing. Critical studies, like those of Deudney and Levy, are valuable in pointing out some of these problems. But the critique will serve to advance the field only if it stimulates more satisfactory research.

Systematic cross-national study by social scientists of any aspect of the environment is in its infancy. On the positive side, we may note that economists have done a great deal of research on how economic development drives environmental stress. A common finding in this literature is that the rate of emissions of environmentally harmful products increases with growing wealth, but not linearly; rather the environmental damage tapers off at high levels of development. It is clear that for some noxious emissions (such as SO₂) there is a significant decrease at very high levels of economic development, because rich countries can afford to acquire modern technology and also because their decision-makers put a higher premium on a clean environment.¹³

In recent work on democracy and the environment (Gleditsch/Sverdrup 2002; Midlarsky 1998) attempts have been made to relate indicators of the environmental

¹³Dietz/Rose (1997) provide a brief survey of recent writings.

performance of nations to their regime characteristics. The conclusions from these two empirical analysis are at some variance with one another. Generally, the study of political predictors of environmental degradation lags far behind the study of economic factors.

There is even less rigorous work using environmental degradation as a predictor to conflict. The work by Tir/Diehl (1998) and Hauge/Ellingsen (1998) is relevant and representative of a tradition in theoretically-grounded empirical research on armed conflict, based on cross-national (and, to a more limited degree, cross-temporal) data for all nations. Both these analyses place the analysis of resource and environmental variables squarely within a multivariate perspective. Both studies do indeed find an effect of such variables—population growth in one study; deforestation, land degradation, and low availability of fresh water in the other. Since all these predictor variables are traditionally associated with poverty, this raises the issue if the association between conflict and environmental load (as in the Tir and Diehl study) or conflict and environmental degradation (in Hauge and Ellingsen's work) may be primarily an underdevelopment problem. Highly developed (or even 'overdeveloped') countries also have environmental problems (traffic noise, industrial pollution, etc.) but there is no evidence that such environmental issues generate armed conflict, internally or externally. In this sense, perhaps environmental conflict should be analyzed as a development issue? At least this is an avenue worth further exploration.

A striking feature of the existing empirical studies is the problem of gathering valid and reliable data on the environmental behavior of nations or smaller geographical units. Environmental accounting is miles behind national economic accounting. The environmental variables used in the Tir and Diehl and Hauge and Ellingsen studies, and in Midlarsky (1998), are not very highly correlated overall. Is this mainly caused by low data reliability, or because they tap different dimensions of what might be called environmental performance? In order to answer this question, and to move forward in relating environmental studies and the study of armed conflict, we need major improvements in systematic data collection—a Correlates of War project for the environment.

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