ENVIRONMENT AND SECURITY

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■ **Abstract**   A broadening research program focused on environment and security emerged over the past 30 years. But the meaning and operationalization of environment and security have been an implicit and increasingly explicit part of the scholarly debate. Approaches range from the more specific focus on the linkages between environmental change and violent (deadly) conflict, the possible role of environmental conservation, cooperation, and collaboration in promoting peace, and the broader focus on potential relationships between environmental change and human security (understood as freedom from both violent conflict and physical want). In addition to the different conceptions of environment and security, the type and direction of causal relationships among different factors continue to be a focus of research. With respect to the environment and violent conflict, which constitutes the largest explicit research stream on environment and security, the debate has centered on whether and why environmental scarcity, abundance, or dependence might cause militarized conflict. Less research has been conducted on the environmental effects of violent conflict and war or traditional security institutions such as militaries and military-industrial complexes. Rigorous research on the consequences of peace or human security for the environment is virtually nonexistent.

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INTRODUCTION

A broadening research program focused on environment and security emerged over the past 30 years. For example, the national security challenges posed by environmental change were specifically highlighted after the Cold War ended. This particular perspective can be traced to the transitional period between Perestroika and the fall of the Iron Curtain, when U.S. and Russian researchers began to collaborate on environmental issues. In a joint article on oceanic security authored by Broadus of the Woods Hole Marine Policy Center in the United States and Vartanov of the U.S.S.R Academy of Sciences, the specific term *environmental security* was defined as "the reasonable assurance of protection against threats to national well-being or the common interests of the international community associated with environmental damage" (1).

But the meaning and operationalization of environment and security have been an implicit and increasingly explicit part of the debate within this emerging research program (2, 3). Approaches range from the more specific focus on the linkages between environmental change and violent (deadly) conflict, to the possible role of environmental conservation, cooperation, and collaboration in promoting peace (4, 5), to the broader focus on potential relationships between environmental change and human security (understood as freedom from both violent conflict and physical want).

In addition to the different conceptions of environment and security, the type and direction of causal relationships among different factors continue to be a focus of research. With respect to the environment and violent conflict, which constitutes the largest explicit research stream on environment and security, the debate has centered on whether and why environmental scarcity, abundance, or dependence might cause militarized conflict (6–8). Less research has been conducted on the environmental effects of violent conflict and war or traditional security institutions such as militaries and military-industrial complexes (9–11). Rigorous research on the consequences of peace or human security for the environment is virtually nonexistent.

We first analyze the most extensive research to date on the environment and violent conflict, focusing on scarcity, abundance, and dependence perspectives. Next, the literatures on environmental cooperation and peace as well as the relationships between environmental factors and the broader notion of human security, understood as more than just the absence of violent conflict, are examined. We then synthesize the even less-developed scholarship that probes the reverse causal relationships between different forms of insecurity or security and the environment, and we conclude with recommendations for creating a more integrated research agenda in the future.

ENVIRONMENTAL AND VIOLENT CONFLICT

Large research projects on environment and violent conflict were prominent during the 1990s within the growing research program on environment and security. These included two major scholarly efforts focused on investigating the consequences

of environmental scarcity and violent conflict jointly organized by the Peace and Conflict Studies Program at the University of Toronto and American Academy of Arts and Sciences (AAAS) on the one hand, and the Swiss Peace Foundation's Environment and Conflicts Project (ENCOP) on the other. A much less extensive literature on the sources of some violent conflict stemming from external resource dependence on the part of high-income countries, e.g., the United States, rather than internal resource scarcity in developing countries also exists. A major effort initiated subsequently by Paul Collier, first at the World Bank and then at Oxford, spurred another stream of research focused on environmental abundance and violent conflict that contradicted some of the emerging conventional wisdom about scarcity and dependence.

Environmental Scarcities and Violent Conflict

The research on environmental stress and violent conflict conducted in the 1990s predominantly utilized comparative-historical methods and approaches. One of the most prominent was the University of Toronto-based AAAS project, which comparatively investigated and analyzed 16 regional and country case studies and involved more than 100 researchers from a range of backgrounds to further delineate plausible causal mechanisms between environmental stress (understood as the scarcity of natural resources) and violent conflict. Researchers implemented similar methods in each case to produce comparable evidence and induce middle-level causal generalizations (12).

Three types of scarcity creating processes were analyzed in the project: supply-induced, demand-induced, and structural scarcity. Supply-induced scarcity is generated through processes of depletion and/or degradation of natural resources. Demand-induced scarcity is driven by the increased consumption generated largely by growth in income and population. Structural scarcity involves the unequal distribution of natural resources across social groups. These different types of scarcity are not mutually exclusive and often empirically interact in actual cases.

The main empirical finding of the research project was that environmental scarcity can contribute to violent conflict but primarily in the form of civil war or insurgency and not international war. Thus, intranational and transnational violent conflict involving at least one nonstate actor was more likely caused by environmental scarcity rather than state versus state militarized violence (13). Two key causal mechanisms known as "resource capture" and "ecological marginalization" were inductively derived as most likely. Resource capture occurs when powerful groups, experiencing or anticipating shortages, shift natural resource distribution in their favor and thereby foster conflict between themselves and have-nots (demand and supply scarcities leading to structural scarcities). The conflicts we are seeing in Nigeria's oil-producing regions are a case of this phenomenon (14). Ecological marginalization involves the long-term migration of people, often to ecologically vulnerable areas, which might not have otherwise been suitable for habitation, as a result of unequal resource access and population growth in their home regions. The Chiapas rebellion in Mexico is a case that has been associated with theories of ecological marginalization (15, 16).

However, environmental stress associated with different and interlinked environmental scarcities was not found to directly cause any type of violent conflict. Rather, environmental stress in combination with other factors such as lack of legitimate (often not democratic), capacious political institutions or weak civil societies usually generated these negative outcomes. For example, recent conflicts in central Africa, particularly Rwanda and Darfour, exemplify this multiple conjunctural causation. The project recommended further investigation of factors that might counteract the violence that is partially conditioned by environmental scarcity. Subsequent scholarship suggested that the existence of *ingenuity*, understood as the ability of some societies to create adaptive ideas to address change, was an essential counter to violent conflict conditioned by environmental stress (17).

The ENCOP was initiated about the same time as the Toronto-based AAAS project and generated complementary ideas and results based on similar analytic assumptions and research methods. Environmental conflicts were defined in the project as traditional conflicts that were induced or sparked by environmental degradation (18). *Maldevelopment* (associated with increases in poverty and inequity, natural resource overexploitation, environmental degradation) and *environmental discrimination* (when access to natural capital for certain groups is systematically restricted by the conscious activities of distinct and often powerful actors with control over those environmental resources) were proposed as factors contributing to violent conflict.

ENCOP identified contexts (not necessarily country units) that were most susceptible to environmentally induced violent conflict including the following: drylands, mountain areas with low-land versus high-land interactions, transboundary river basins, areas degraded by dams and mines, tropical forests, and sprawling metropolises. ENCOP research linked these susceptible contexts to the triggering factors of maldevelopment and environmental discrimination to generate seven major types of conflict in which environmental stresses play a role, even if not necessarily the primary or predominant one: ethnopolitical conflicts, center-periphery conflicts, internal migration conflicts, cross-border migration conflicts, demographically caused migration conflicts, international water conflicts, and global environmental conflicts, such as ozone depletion and global warming, even though the latter were not specifically studied (6, 19).

The results of the ENCOP largely supported the Toronto-based AAAS project in that environmental scarcities were found to most likely cause violent intranational and transnational but not international (state versus state) conflicts. A major difference between the two projects was a much broader inclusion of political, economic, social, cultural, and institutional variables in the work of ENCOP investigators. The cost of this inclusiveness was conclusions that are less sharp than the Toronto-based AAAS project and typologies that are informative but not mutually exhaustive nor exclusive. Both projects paid attention, although not much, to the conflict prevention or minimization role played by factors such as capacious states, strong civil societies, and the presence of democratic institutions.

Preventative factors such as social learning, monitoring systems, anticorruption initiatives, or dense social networks were not explored (20, 21).

Another strand of literature emphasizes the perils of resource dependency in overdeveloped demand centers, such as the United States, instead of focusing on environmental scarcity in underdeveloped countries. Among the resource conflict dependence scholars, Klare has been most strident in his writings with books whose titles, such as *Resource Wars* and *Blood and Oil*, reflect the fervor of his argument (7, 21a). Following the tragic events of September 11, 2001, scholars such as Klare argued that much of the United State's national security strategy is focused on stabilizing the availability of extractive resources, particularly oil. This resource determinism is presented as a critique of U.S. foreign intervention motivated by greed rather than need, which also highlights the peril of relying on nonrenewable resources. Although the general empirical support for this hypothesis seems weak, the second war in the Gulf initiated by the United States suggests that, as with intranational and transnational conflicts, environmental scarcity can be a contributing or facilitating, rather than primary, factor in the security policies of developed countries highly dependent on imported natural resources (22).

Environmental Abundance and Violent Conflict

Statistical analysis of large sample (large N) data sets, counterfactual thought experiments, and additional carefully controlled case comparisons (particularly of cases where environmental scarcities did not lead to violent conflict), attempting to increase the rigor of the research and reliability of the results, became increasingly important to the scholarship on environment and security beginning in the late 1990s. Several international organizations, e.g., the United Nations Environment Program, and a range of researchers from the fields of civil wars and security studies began to examine the role of environmental factors such as natural resources in their investigations of violent conflict (23, 24).

Collier & Hoeffler (23), first at the World Bank and then as leaders of an Oxford University research project, were leaders in arguing that natural resource abundance rather than scarcity was critical to the incidence of civil war. They proposed that, holding the level of grievance constant, more rebellions are likely in countries with an abundance of natural resources. This is ostensibly because natural resources predation is often an aim and sometimes the primary goal of insurgent movements. The looting of natural resources is hypothesized be pivotal in financing, for example, a militia's purchases of arms, labor, and food.

Using the ratio of the financial value of primary commodity exports over gross domestic product (GDP) as a measure of natural resource abundance and employing a large-N statistical methodology, Collier & Hoeffler (23) found a significant parabolic relationship with violent conflict. More specifically, the risk of civil war onset was greatest when the GDP share of primary commodity exports for a country was around 35% (23). Some subsequent cross-national statistical

analyses also found that natural resource abundance in a particular sector (such as oil or minerals) was a cause of violent conflict rather than environmental scarcity (8, 23).

Several environmental and human rights groups supported this "honey pot" perspective in their own research and analysis, for example, on cases of conflict over diamonds (26). Moreover, some researchers have found that the implementation of peace agreements is likely to be more difficult in countries abundant in natural resources (27). Others have also suggested that natural resource dependence poses difficulties in postwar peace-building efforts (28).

However, other large-N statistical studies did not identify a large or significant relationship between natural resource abundance and civil war. For example, Fearon & Laitin (24) found no such linkage despite including a relatively comparable set of civil wars in their data set and operationalizing resource abundance in the exact same way as Collier & Hoeffler. In a follow-up article, Fearon confirmed again that minor departures from the Collier & Hoeffler approach, such as using yearlong data rather than grouping data in five-year intervals or employing a multiple imputation statistical methodology to include cases with missing data, resulted in primary commodity exports no longer being associated with civil war in statistical terms (29).

The results of a rigorous analysis of 13 most likely case studies also yielded little evidence that rebels looted of legal agricultural commodities or that oil funded start-up costs of insurgency movements, and in only one case did "booty futures" in oil revenue fund the start-up costs of a rebellion (30). Correspondingly, however, there is consistent evidence from the statistical (even Collier & Hoeffler themselves) and less-extensive case study research that high levels of oil production in a country are associated with civil war risk (29–31).

Resource curse theorists (29, 32) postulate that oil abundance is particularly pernicious not primarily because it offers a tempting prize to rebels but because oil-abundant countries tend to lack strong state bureaucracies. Oil abundance minimizes the need to collect general tax revenues, which is often one of the major functional reasons for building capacious state agencies. The statistical results support the weak state hypothesis, but many of the measures widely used to operationalize state strength—government observance of contracts and investor perception of expropriation risk—are not particularly compelling proxies. But this argument and supporting evidence of weak state institutions being associated with civil war outbreak is ironically consistent with the ideas and results offered by scarcity researchers that strong political institutions can reduce the likelihood of violent conflict in developing countries.

In perhaps the most comprehensive conceptual and statistical work to date—formulating a range of more complex mechanisms, employing more sophisticated statistical techniques, as well as utilizing more persuasive and fine-grained measures—Humphreys (31) does find support for the weak state mechanism rather than rebel financing hypothesis. Conflict initiation is correlated with past resource production (for both oil and diamonds) rather than potential future production (oil

stocks). But the findings also indicate that natural resource abundance also effects conflict onset independently of state strength.

Moreover, Humprehys does find a link between primary commodity dependence more broadly and violent conflict (not just natural resources) (31). Evidence supports the hypothesis that extreme dualism in an economy is associated with a small manufacturing sector and lack of dense internal trade (called the sparse network mechanism). Contrary to previous research, Humphreys also discovers that violent conflict in which natural resources are at stake tend to be shorter in duration and often end in the military defeat of one of combatants. Indeed, the evidence he analyzes does not suggest that parties in violent conflicts where resources are abundant have difficulties negotiating termination of war.

Implications

The debate between environmental abundance and scarcity approaches has not progressed very far partly because the scholars in these communities do not engage directly with each other very much. Perhaps even more importantly, there are clear differences in research style and the philosophy of knowledge between the two perspectives. Abundance researchers such as Collier, Fearon and Humphreys primarily come from a postpositivist hypothetico-deductive tradition, often employing formal modeling and predominantly large-N statistical methods of analysis. They correspondingly value simple, specific propositions with testable implications and seemingly clear policy prescriptions.

Scarcity proponents such as Homer-Dixon and Baechler have to date been guided by assumptions, such as "causal processes are exceedingly complex, involving multiple physical and social variables, feedback loops, interactive effects and nonlinear responses..." and "although the underlying influence of environmental factors on conflict may sometimes be great, the complex and indirect causation in these systems means that the scanty evidence available is open to many interpretations" (12). Given this complexity and imperfect knowledge, the focus has been on using methods and developing theories consisting of plausible, generalizable causal mechanisms and not simple specific predictions as well as on diagnostic frameworks of potential intervention points rather than on ostensibly universal and precise policy change packages.

Scholars from the field of political ecology have argued that a more dialectical and holistic research agenda on environment and violent conflict is needed (33). The focus would be improved understanding of why certain environmental conditions in different types of contexts breed various kinds of violent conflict rather than linear causality formulated by, or misinterpreted from, conventional analyses of scarcity and abundance. For example, political ecology questions for investigation include, Are lootable resources more likely to lead to conflict under generalized conditions of scarcity? Or visa versa (34)? Moreover, scarcity and abundance approaches seem to converge on the importance of factors, such as the

ability of strong political institutions and civil societies to minimize the extent or prevent the outbreak of violent conflict.

BROADENING THE ENVIRONMENT AND SECURITY RESEARCH PROGRAM

Numerous scholars have explored a range of themes that go beyond an investigation of the potential environmental factors and causal mechanisms leading to violent conflict (35). One strand of research examines the conditions under which environmental factors can be a source of cooperation and even promote longer-term peace (and thus security) (4). A second set of researchers probes the reverse causal relationships, e.g., the environmental consequences of war and powerful security institutions such as military agencies (10). A final emerging area of scholarship both expands the notion of security as well as different causal directionalities, including the possibilities of virtuous and vicious cycles between the environment and human security (3).

Environmental Cooperation and Peace Building

Some scholars have increasingly focused their attention on the potential for using environmental threats as a common aversion to stimulate conflict resolution and collaborative behavior toward longer-term peace (4, 37, 38). The evidence from research on transboundary water treaties suggests the potential for environmental cooperation as a mechanism for peace building (39). The field has also been extended further to focus on conservation measures such as transfrontier zones or "peace parks" in promoting security (40).

The key to these approaches in environment and peace building is to dispense with linear causality and instead consider conflict de-escalation processes as nonlinear and a complex series of feedback loops (38). Positive exchanges and trust-building gestures are a consequence of realizing common environmental threats. Often a focus on common environmental harms (or aversions) is psychologically more successful in leading to cooperative outcomes than focusing on common benefits, which may lead to competitive behavior over the distribution of the gains generated (41).

Skeptics argue that cooperation on environmental issues among adversaries would be relegated to low politics such as trade and might not translate into a larger resolution of the high politics of national security from military threats. In this view, environmental conservation would at best be a means of diplomatic maneuvering between midlevel bureaucrats and at worst be a tool of co-optation by the influential members of a polity. Such critics give examples of cooperation on water resources between adversarial states, such as India and Pakistan or Jordan and Israel, without subsequent translation into broader reconciliation or peace (42). Thus, it could be argued that resource and environmental issues are not

important enough in world politics to play a larger instrumental role. However, a more positive framing of the case might claim that water resources in this context are so important that even military adversaries must show some semblance of cooperation over them even if it does not spillover to broader peace and security (38).

Furthermore, the generative use of environmental issues in building peace must be considered in an evolutionary way over longer time horizons and repeated interactions, premised empirically in the following nonteleological conditions (43, 44):

- Development of a joint information base on a common environmental threat
- Recognition that cooperation is essential to alleviate that threat
- A cognitive connection and trust building from initial environmental cooperation
- Continued interactions over time because of environmental necessity
- Clarification of misunderstandings and de-escalation of connected conflicts
- Increased cooperation and resultant peace building

Given the necessity for certain environmental resources and a growing realization that environmental issues require integrated solutions across (and within) borders, the likelihood for their instrumental use in conflict resolution has increased in recent years (34).

One of the earliest contributions to the development of the study of environmental peace building was Haas's work on the Mediterranean Action Plan (45). Correspondingly, there is a growing commitment to *bioregionalism,* the realization that ecological management must be defined by natural delineations such as watersheds and biomes rather than by national or other borders (46). In this regard, numerous joint environmental commissions between countries and jurisdictions have taken root all over the world. This has played out in various ways at international forums wherein bioregionalism and common environmental sensitivities have sometimes transcended traditional notions of state sovereignty. Regional environmental action plans, such as that in the Mediterranean, as well as those in the Nile Basin, Caribbean, and Red Sea, are examples of this (34).

The potential of peace parks, in particular, resurfaced during the 1990s as a productive environmental approach to cooperation, even though the Waterton Glacier was declared the first of numerous international peace parks between Canada and the United States in 1932 (40). Transboundary conservation schemes, such as La Amistad Biosphere Reserve, Si-a-Paz, and the Maya Biosphere Reserve in Central America, arguably demonstrated their value as proving grounds for international cooperation, as confidence-building measures, and as symbols that support longer-term peace processes (47). Although environmental peacemaking may have great potential to help prevent future conflicts, and environmental cooperation more generally might be of great help in stabilizing affected areas and preventing a recurrence of violent conflict in locations emerging from

protracted periods of war, much more systematic analysis and rigorous scholarship is required (48).

Violent Conflicts, Militaries, and the Environment

Efforts to investigate the environmental effects of war as well as that of military activities and institutions more generally are growing (10, 49). Over 30 years ago, Westing (49a) detailed the negative environmental consequences of the Vietnam War. Many scholars presented evidence of the environmental damage of the 1991 Gulf War (50). Kanyamibwa (50a) has more recently demonstrated the loss of biodiversity and undermining of conservation programs caused by the Rwandan civil war (1998). There is thus a growing presumption that militarized violent conflict, in particular, must be damaging to the environment with the only empirical question being to what extent and through what mechanisms.

Land use, water supply and sanitation systems, transportation infrastructure, air quality, biological resources, and the functioning of ecosystem services are often disrupted by war (49, 51). Warfare can negatively effect the environment as a result of physical destruction of the landscape through bombardment of the terrain as well as the deployment of weapons such as land mines and buried ordnance (52). Violent conflicts also disrupt social systems and generate refugee flows that can further add to environmental scarcities and pollution in receiving areas, such as in the case of Central America during the 1980s (53).

In addition to the direct and indirect effects of war and violent conflict, the effects of military activities and institutions on the environment are increasingly under greater scholarly scrutiny. Some scholars argue that the single greatest predictor of environmental damage is the presence and strength of militaries, from the local to the global scales (48, 49). The extensive but hidden damage of the Cold War on the natural environment of the United States and the successor states of the former Soviet Union has become increasingly substantiated (9, 54, 55). Evidence is also mounting that the presence of authoritarian regimes that generally depend on strong military institutions, high levels of military spending, repression, and the restriction of human rights are highly likely to be environmentally destructive (56–58). For example, average population growth rates are systematically higher in authoritarian regimes versus their democratic counterparts (59).

The environmental effects of militaries occur not only during but also in the buildup for combat. These effects include pollution from the production and testing of weapons as well as from the use and storage of military toxins and waste, which can damage the environment and human health (52, 60). The world's military institutions are also among the greatest users of natural resources and polluters: It is estimated that together they consume as much petroleum as Japan does annually and contribute to between 6% and 10% of total global air pollution. Moreover, the comparative environmental regulation of militaries is even weaker than that of private companies (49).

Hooks & Smith (11) offer one instructive example of high-quality scholarship on military institutions and the environment. Conceptually, they advance a theoretical framework that identifies four mechanisms to explain negative environmental consequences: (*a*) the *treadmill of production* in which environmental bads are both produced largely by capitalist economic growth coalitions (business, labor, and government) and distributed through market mechanisms, (*b*) the *coercive polity* in which they are produced by capitalism but distributed by racist states as in apartheid South Africa; (*c*) *military industrial complexes* in which they are generated from militarism and distributed largely through market mechanisms, and (*d*) *treadmills of destruction* in which environmental bads are produced by the demands of geopolitical militarized competition but distributed primarily through racist state practices. They find systematic evidence to substantiate that the treadmill of destruction mechanism transpired in the United States by showing that dramatically increasing numbers of environmentally dangerous military bases (those with significant quantities of nuclear, chemical, and biological ordnance) were located on or near Native American lands.

Much more systematic research on the environmental consequences of violent conflict and militaries such as this is needed. Indeed, some researchers have provocatively contested the general scholarly views, summarized above, by arguing that peacetime economic activity is by far the greatest source of environmental damage, whereas military buildup during peacetime is at best a distant second most important factor, and actual war-related effects tend to be minimal (J. Brauer, unpublished results). Even some mainstream conservation scholars have offered evidence that environmental destruction increases in some postwar contexts, particularly when indigenous peoples have been marginalized and repressive states have gained or regained dominance (62). And still others have argued that traditional military institutions and activities can be "greened" to reduce their net environmental impacts and, potentially, even contribute to environmental improvements (63, 64).

Environment and Human Security

A growing number of scholars have reiterated the need for a much broader conceptualization of security and, correspondingly, its relationships to the natural environment, environmental factors, and environmental change (35, 65) A particular convergence has grown around the value of examining human security since the late 1990s (2, 3). Human security is understood as the survival and dignity of human beings through freedom from fear and freedom from want. The range of both environmental threats to and opportunities for human security are likely to be numerous and complex, perhaps even more so than those related to violent conflict. The role of increased human security on environmental conservation and sustainability is potentially positive but as yet unresearched.

Environment-human security relationships can even be more direct compared to the environmental links to security more narrowly defined (such as national

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security) or operationalized (deaths from violent conflict). For example, water scarcity directly and negatively effects human security—both in the form of fear and want as well as the actual ill health and death it causes. This link between environmental stress (water scarcity) and human insecurity exists even if environmental scarcity does not contribute to violent conflict. Likewise, natural resource abundance in the form of oil or other minerals is linked with environmental degradation, such as air and water pollution, across ecological scales that again increase human insecurity.

A focus on environment and human security includes, for example, the violent displacement of people or negative health consequences (human insecurity caused by large-scale human-induced environmental transformations) from development projects such as mines or large dams even if these do not generate militarized conflict or war (38, 58). Human insecurities also manifest from consequences, such as increased pollution, crowding, resource scarcity, crime, and group struggles, associated with rapid, high-density urbanization, which is among the most powerful environmental change trends in many parts of the world (66).

Another key area of research that expands the operationalization of security to a more human rather than a national security of violent conflict focus has come largely from the natural sciences and concentrates on the threats posed by the physical invasion of pathogenic organisms and environmentally harmful biological agents (67). These agents could be exotic plant species or more insidious human pathogens that are transmitted by various human and/or nonhuman mechanisms such as the Severe Acute Respiratory Syndrome virus. Scholarship on environment and security must analyze both the incidental and deliberate release of such agents as potential threats to agricultural production, food supply, forests, and public health (68).

Certainly natural disasters directly impact human security without generally leading to war even if they do often involve increases in violent crime (69). These include both slow-onset disasters, e.g., drought and desertification, as well as sudden-onset events, such as earthquakes, floods, or hurricanes. Already occurring and highly likely impacts from global climate change include increases in natural disasters, deaths, disease, illness, crop loss, and biodiversity loss have tremendous implications for human security (70). The possibility of violent conflict induced by climate change is increasingly seen as nonnegligible.

Research on vulnerability and coping to environmental stress has become much more sophisticated over several decades and offers some compelling insights for the relationships between environment and human security. Indeed much of the earlier work focused primarily on mechanisms for reducing the human (social and economic) costs of natural hazards such as extreme weather events, floods, and earthquakes (71). Now vulnerability analysis is being applied increasingly to development projects and violent conflicts as well. It is recognized that human vulnerability or insecurity is latent in social systems prior to onset of natural hazards or human pressures and that disasters or humanitarian emergencies are more likely to occur as the stress exceeds the coping capacity of the system (72, 73).

These approaches broadening the environment and security research program have met with considerable criticism. Some scholars have argued that the primacy of national security as a policy priority has prompted many fields to consider their linkages to this imperative, without a workable agenda for action and with connections that are at best tenuous (74). Part of the concern emanates from the ever-expanding definition of security, including poverty and deprivation that is often included in notions of human security. Indeed, the debate has even been studied by anthropologists as an exemplar of the "social life of an environmental discourse" (75).

TOWARD A MORE ROBUST RESEARCH PROGRAM

The crucial role of environmental factors in determining the fate of human beings and human societies remains a compelling argument, though it is often made anecdotally rather than through rigorous empirical research (76). The future of the environment and security research program should certainly be less focused on the debate between abundance and scarcity theories of violent conflict, although this work should continue to be developed (77). As suggested above, key questions such as the environmental effects of violent conflict and militaries or the complex relationships between environment and human security require even more concerted focus and systematic research.

Moreover, explicit research investigating the variation and changes in societal, rather than solely academic, meanings and understandings of environment and security from a more interpretivist philosophy of science should be more explicitly part of the research program in the future (75). For example, How do changing cultural norms about the environment alter violent conflict and military dynamics (78)? Does the presence of high levels of corruption contribute differentially to likelihood of violent conflict versus that of human insecurity? Indeed for the research program on environment and security to realize its ultimate potential, much more conscious and deliberate engagement with contending assumptions about the form and function of theories, philosophies of knowledge (ontological and epistemological assumptions), and acceptable research strategies must occur (79). With this type of dialogue as a foundation, the transnational interdisciplinary research program on environment and security will produce ever more sophisticated and useful knowledge for the world (80).

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