

Integrating Perspectives on Environmental Security

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Preface

This issues paper on environmental security is one piece of work within a larger set of activities in the Stockholm Environment Institute's *Poverty and Vulnerability Programme*, funded by the Swedish International Development Cooperation Agency (Sida). The paper reviews dominant literature on environmental security and introduces newer themes where environmental security is addressed from a vulnerability perspective. As such, this issues paper does not engage in new research but provides a basis of understanding to assist development aid professionals in linking environmental security thinking with development policies and programmes.

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Abstract

The purpose of this paper is to present approaches to environmental security and to identify issues within this field that are relevant to development policies and programmes aiming at alleviating poverty and addressing environmental degradation. Debate over the concept and definition of environmental security has been important in this field, as it has resulted in diverse research foci and results. Here, we introduce the debates, key insights in different areas, contributions of vulnerability analysis to enhancing security, and suggestions to advance current practice and understanding.

Environmental degradation and violent conflict is the most heavily investigated research agenda under the rubric ‘environmental security’, and we present the shared understandings, issues remaining under debate, and criticisms of the work that has been done thus far. We then make a case for using vulnerability approach in thinking about environmental security, emphasising that the vulnerability perspective places focus on livelihoods and poverty and expands the focus of analysis from state security and violent conflict to other security issues central in the lives of vulnerable groups. We review emerging dimensions of the environmental security debate as reflected in livelihood conflicts, hydropower construction, and health risks associated with climate change and urban livelihoods in developing countries areas. Research in these areas highlights how vulnerability analysis can contribute both in conceptualising environmental security and in identifying and understanding the most significant threats to vulnerable groups. Finally, beyond working with the current set of lessons learned on causes of violent conflict, we suggest several promising paths for practitioners and researchers in considering how to create institutions that can respond effectively to a variable environment and the shifting needs of the most vulnerable in a changing society.

1 Introduction

The concept of environmental security rises out of a concern that environmental changes and events, especially degradation, are increasingly serious pressures on livelihood security and perhaps contribute to violent conflict. While the role of the environment in providing security for humans has been a prominent concern since the 1970s, “environment security” as a specifically named field of research has gained increasing attention over the past 15 years. There have been numerous studies and programmes related to environmental security, including several ambitious projects mounted by Homer-Dixon and colleagues at Toronto (1991, 1996, 1998), Baechler and colleagues in Switzerland (1998, 1999), the International Peace Research Institute in Oslo, and the International Human Dimension of Global Change Programme (Lonergan, 1998).

These projects attempt to take the analyses of the declining environmental basis of human well-being a step further by moving from an investigation of the causes to examination of the implications of declining conditions for governance and sustainable development. Relatively simple hypotheses about a connection from environmental scarcity to conflict and basic formulations about the importance of environmental life support services to human security were quickly elaborated. Addressing the multiple forces influencing governance and sustainable development quickly became central in the empirical dimensions of the environmental security debate.

Since the post-Cold War re-examination of security issues began, attention to environmental dimensions of security issues has remained high. Concern persists over the possible impacts of global and regional environmental change on social and political institutions and relations *within* and *between* states, and for good reason. We know that human-induced changes in the planetary environment now exceed the extent of natural variability, producing serious threats to human progress globally. The environmental risks that impinge upon the well-being of people are often either transboundary in nature or affect social groups differentially, and are a growing source for both potential conflict and cooperation. We are beginning to see the first effects of climate change and know that their adverse impacts will be strongly concentrated in developing countries. As such these effects will particularly afflict the poorest and most vulnerable groups and directly threaten access to needed freshwater supplies and food-security systems while indirectly placing livelihoods at risk. It is clear in this context that environmental security issues are, at heart, also issues about vulnerability (Kasperson, J.X. and Kasperson, R.E., 2001a; Kasperson, R.E. and Kasperson, J.X., 2001b).

1.1 Purpose and structure

This paper focuses on identifying the linkages between environmental degradation/change, high order threats to human well-being, and vulnerability analysis. The purpose of this paper is to both present approaches to environmental security and to identify issues within this field that are relevant to development policies and programmes aiming at alleviating poverty and addressing environmental degradation.

Section two of the paper introduces the concept of environmental security and the original motivations for this new type of security thinking. The academic debate over the meaning of “environmental security” and about the usefulness of this type of security thinking is also briefly reviewed. Vulnerability approaches to these debates are introduced as a useful way forward for environmental security analysis. This section demonstrates that the academic debates over environmental security have influenced the character, focus, and findings of research agendas in this field. For this reason how environmental security is defined has significant bearing on the usefulness of research results to achieving sustainable development goals.

In section three we consider what is known about environmental security. Research on the role of environmental degradation in causing violent conflict has tended to dominate concrete case-study work in environmental security, and we review the findings from this research as well as the critiques and limitations to this research. In this body of work we find that although the ability to predict conflict has not been developed, the research does serve to identify a set of circumstances where environmental scarcity may play a role in conflict. We also argue that findings from this line of investigation have yet to adequately integrate lessons from work on livelihoods and poverty.

In section four we look at some findings indicative of broader bodies of work, especially those focusing on livelihoods and poverty. This work is presented as a related dimension in environmental security thinking when it is addressed from a vulnerability perspective. Specific research agendas focused on livelihood security and health security are also presented in order to illustrate the relevance of this work to policies and programmes aiming at sustainable development. Here, threats to security beyond conflict are addressed, and an argument is made for incorporating research from a livelihoods perspective into the environmental security field.

Livelihood Definition

A livelihood comprises the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living.

Source: Chambers and Conway, 1992.

We conclude by synthesizing the key elements of discussion and identifying what we view as the most significant gaps in current knowledge. Suggestions for further inquiry in this area prioritise strategies to support non-violent resolution of conflicts and provision of greater security for the poor.

2 The Environmental Security Concept

Given far ranging discussions over sustainable development, in common usage, the term “environmental security” can almost sound redundant. Security of future generations is one way of expressing the ultimate goal of sustainable development, but, in fact, work identified as “environmental security” often addresses a narrower scope of issues within sustainable development. Two competing approaches have motivated a significant portion of contemporary debate over the concept of environmental security. The first is to create a distinct, useful, analytical approach, and thus many analysts have focused on the linkages between environmental degradation and violent conflict. The second is to engage with the complex ways that social and environmental systems are coupled to one another, and have resulted in broader conceptualizations of environmental security. The usefulness of analysing environmental issues as new forms of “national security” issues and the appropriate range of situations to be considered under that title are key conceptual issues under discussion. In introducing the concept of environmental security it is helpful to begin with an example of one type of environmental security problem. This example illustrates some of the initial motivations for thinking in terms of environmental security and introduces the contemporary issues in this field of research.

Bangladesh has experienced over 70 cyclones between 1970 and 2000 (D’ercole and Pigeon, 1998). The sum of human life lost to cyclones in Bangladesh is enormous, and vast numbers of people have been put at severe risk. Table 1 below shows fatalities estimates for some of Bangladesh’s most severe cyclones and demonstrates the devastating impact these natural events can have in this country.

Table 1. Deaths due to cyclones in Bangladesh

Year	Deaths
1955-1969	68,829
1970	300,000
1974	2,500
1985	11,050
1991	139,000
1994	133
1997	263
1998	3

Sources: Munich Reinsurance Company (2000); IFRC, (2002).

In April of 1991 Bangladesh's coastline was struck with a disastrous cyclone resulting in a storm surge that raised water levels as much as seven meters and ultimately resulted in 139,000 deaths. The eventual costs of such natural disasters include other significant losses. In this case, over 3 million people were affected by the storm and over 100,000 acres of cropland were destroyed. The high death toll and overall impact were not only due to natural features of Bangladesh and the severity of the cyclone, but were also directly linked to the vulnerability of poor groups in the country. It is known that the great majority of the 790,000 homes destroyed were those of poor people (D'ercole and Pigeon, 1998). Further, studies in Bangladesh have shown that more vulnerable groups within the country, such as rural women, had higher death rates than other social groups during and after this catastrophe (Baden *et al.*, 1994). The exceptionally high population density in Bangladesh meant that many people were exposed to the cyclone and that the areas at risk will be reoccupied, not abandoned. The lack of physical and service infrastructure aggravated the situation as lack of safe drinking water and food, sanitation services, and access to health care further resulted in serious health impacts among the survivors. Bangladesh does not have the highest occurrence rate for these types of natural disasters (although it is very high), but it does have among the highest death rates, highest levels of indicators for socio-economic vulnerability, and largest affected populations (D'ercole and Pigeon, 1998). As the history of coastal Bangladesh indicates, the combination of natural events and socio-economic circumstances have raised issues of security in popular consciousness well before professional efforts to frame an "environmental security" field, and the dimensions of those security problems extended from massive loss of lives and property to longer term health and development impacts.

The contemporary debate over environmental security started about 15 years ago with an argument that the traditional definition of security for nations needed to be rethought in recognition of significant environmental dependencies, such as reliance on adequate cropland and safe drinking water (Hjort af Ornas and Lodgaard, 1992; Ullman, 1983; Tuchman, 1989). This "redefining" of the security concept was a reaction against a view of security that focused on the security interests of the nation state in terms of wars or the avoidance of wars between states. Typically, the traditional definition of national security focuses on threats to a state's sovereignty and the survival of the state as such. The concept of environmental security was introduced in an attempt to expand this conceptualization of security by suggesting that human-induced environmental degradation and demographic pressures are new emerging security problems at the national and international levels. The argument for an environmental security perspective arose from three key observations: environmental threats can have catastrophic outcomes, traditional security thinking does not prepare society to deal with these threats, and, unlike traditional security issues, environmental threats are not confined by national boundaries. Common examples of these new threats are climate change and sea level rise, ozone depletion, land degradation, fisheries collapse, water scarcity, and increased spread of infectious diseases.

The initial work on environmental security argued that environmental degradation will lead increasingly to environmentally based political instability. It is argued that there is a potential that environmental decline may lead directly to violent conflict, but the focus is more oriented towards the notion that the impacts of environmental degradation "on nations' security is felt in the downward pull on economic performance and, therefore, on political stability" (Tuchman, 1989).

This paper agrees in spirit with these early formulations of the environmental security concept, particularly in the notion of broadening the security concept to address environmental threats. Environmental security as presented here is understood as the notion that some forms of environmental change in combination with socio-economic drivers increasingly threaten basic human interests and thus should be considered high order threats to human well-being in the same way a military threat is a high order threat to human well-being.¹

¹ The notion of human well-being from a normative perspective is highly contested and much of normative theory (ranging from political liberalism and theories of impartiality to post-modernism) challenges the possibility of developing a definite set of basic criteria that can define a basic sense of human well-being that is *universally* acceptable. This paper will not enter into this

2.1 Debate over definition and divergent research agendas

There are concerns among traditional security analysts that the strategy of expanding the security concept to include environmental security will lead to a loss of analytical clarity; security will mean everything and nothing. These concerns have been expressed primarily in academic debate with much contention over the usefulness of environmental security as a concept and on the definition of environmental security. In this section we see that it is important for practical development policy makers and planners to take note of this academic debate as variations in definitions of environmental security have shaped the kind of research findings that have been made available to practitioners.

Some criticisms of the environmental security concept have focused on how the framing of environmental issues as security issues (i.e. “securitizing” them), potentially affects their handling by governments. Other criticisms focus on the potential for broad definitions of security – including the spectrum from food security to military threats – and make the problem too complex to usefully identify intervention points. A relatively new criticism identified in this review is the failure of conflict focussed studies to address the importance of livelihood security and health as environmentally based issues underlying unrest (Deudney, 1991; Waever, 1995; Brock, 1997). Much of this debate then extends towards a discussion of the significance of environmental degradation to people and institutions under different circumstances. It is argued that environmental problems should not be seen as security problems because they are not generally national in character, are not caused intentionally as military threats are, and are more reliably and effectively solved through the development of cooperation than through defensive or offensive military build-up. There is also disagreement over whether greater understanding of the linkages between environmental degradation and security can be achieved through concentrating efforts on a limited set of cases which result in violent conflict or on the broader set of factors and situations in which environmental degradation creates greater stress on livelihoods without necessarily resulting in conflict.

Security First Scenario

UNEP’s third Global Environment Outlook (GEO-3) report presents four possible future scenarios as the world attempts to deal with increasing environmental problems/threats. The security first scenario assumes

a world of striking disparities where inequality and conflict prevail. Socio-economic and environmental stresses give rise to waves of protest and counteraction. As such troubles become increasingly prevalent, the more powerful and wealthy groups focus on self-protection, creating enclaves akin to the present day ‘gated communities’. Such islands of advantage provide a degree of enhanced security and economic benefits for dependent communities in their immediate surroundings but they exclude the disadvantaged mass of outsiders.

Source: UNEP, 2002.

These problems with thinking about security in relation to environmental threats have a great deal to do with maintaining a distinct research tradition and the practical issue of whether lessons based on organized violence are relevant to managing environmental issues. Daniel Deudney in his essay “Environment and security: Muddled thinking” argues that environmental problems should not be viewed as security problems

normative debate but can here point to two ways in which it might be appropriate to think of well-being in the context of environmental security, as addressed in this paper. The first is that the issues of vulnerability that are taken up in this paper are largely addressed in terms of vulnerability to the loss of life and the loss of livelihoods. Not only are these threats less contested in relation to the notion of human well-being in practical terms, but they can also be thought of in more context specific terms. In other words, the issue is not the loss of this or that particular type of livelihood but about specific individuals’ and groups’ interest in protecting their own livelihoods. The second and related way of thinking about human well-being as it is used in this paper is to look at Martha Nussbaum’s (2000) and Amartya Sen’s (1999) capabilities approach. Without going into a detailed argument one can note that the capabilities approach is an attempt to *argue for* a limited set of criteria for human well-being (e.g. individuals’ bodily health and integrity) where this criteria itself is strictly limited by a commitment to the philosophical stance that comprehensive conceptions of human well-being are *rightly* contested.

because “Traditionally, the concept of national security, as opposed to national interest or well-being, has centred upon organized violence” (Deudney, 1991). Deudney also points out that “when an earthquake or hurricane causes extensive damage, it is customary to speak of natural disasters, but not to speak about such events as threatening national security” (Deudney, 1991). This may be true from an American perspective where natural disasters of this type result in largely economic costs, but in a country like Bangladesh where a hurricane can kill thousands upon thousands of people and undermine the proper functioning of economic and social infrastructure the perception may be different, especially for those groups most affected by such events. Ian Rowlands (1991:103), in his essay, “The Security Challenges of Global Environmental Change,” presents the counter argument stating:

any force that had the power to inflict such harm upon a state—kill some of its citizens and displace others, reduce its agricultural output, threaten its water supply, and destabilize its ecological balance—would be received with considerable attention...just because these particular challenges are not being issued and controlled by a national leader does not mean that they should be ignored. Indeed, the fact that they are beyond such control makes them all the more threatening and ominous.

This conceptual disagreement is reflected in the empirical work and findings reviewed in the next sections of this paper. A substantial body of work focuses on examples of conflict and organized violence while many other researchers have pursued paths that draw more attention to non-violent conflict and the connections between environmental security and sustainability.

Other authors suggest that securitizing environmental problems or, in other words, convincing state actors to view environmental problems as security issues could actually legitimise military action to protect state environmental interests (Deudney, 1991; Waever, 1995; Brock, 1997). From this perspective “securitizing” the environment is counterproductive because traditional state security institutions and responses tend not to support the cooperation that is often necessary to adequately address environmental threats (Deudney, 1991; Waever, 1995; Brock, 1997).

A major part of the justification for a narrower, conflict oriented approach to the environmental security concept has come from the work of Homer-Dixon who says, “Unfortunately, the environmental-security theme encompasses an almost unmanageable array of sub-issues, especially if we define ‘security’ broadly to include human, physical, social, and economic well-being.” (Homer-Dixon, 1995). If priorities are not set in the analysis, then the results will not be very helpful to understanding the causes and informing solutions. Instead, Homer-Dixon focuses on the links between environmental scarcity and the extreme situation of violent conflict. This approach has received a great deal of attention in recent years. It adopts the traditional approach to security as focused on violence especially military type violence, and introduces human-induced environmental degradation as a key driver in causing violent conflict. The empirical results of work by his team at the University of Toronto are addressed in the following section on empirical findings.

More recently the notion of human security has been advanced to avoid the narrow focus of the environment and violence approach while at the same time trying to address some of the criticisms levied against an overly broad environmental security concept. Human security focuses on the security of the individual or groups in terms of their well-being. Human security or insecurity is then a function of multiple factors affecting well-being as is portrayed in Table 2 from a recent OECD review of environmental security entitled “State of the Art Review of Environmental Security and Co-operation” (Dabelko *et al.*, 2000).

This approach takes the focus away from state-centred interests and highlights the multiple stresses that may cause insecurity and the types of resilience that promote security for individuals and groups. These authors (Dabelko *et al.*, 2000) justify this approach with the following statement:

Under certain conditions, such as war, the distribution and composition of force may be the most important determinant of security and insecurity. But in many other situations, security and insecurity will be most closely related to poverty or resource scarcity or social discrimination.

Table 2. Elements of human security

System	Security-Promoting Mechanisms	Insecurity-Promoting Mechanisms
Economic	Wealth Welfare Policies	Poverty Inequity
Political	Law Legitimate Force	Corruption Unlawful Use of Force
Cultural	Social Identity Justice	Discrimination Injustice
Demographic	Low Birth Rate Urbanization	High Birth Rate Rapid Population Flows
Ecological	Life Support Raw Materials	Scarcity Disease

Source: Dabelko et al., 2000.

Although this approach does demonstrate that conflict is one aspect among a host of factors influencing individuals' or group's security, it is criticised for its breadth and failing to provide much guidance in identifying which factors to consider or what types of interactions among social and environmental processes are most important.

One of the more prominent examples of empirical research in this vein is the Global Environmental Change and Human Security Project (GECHS). GECHS is a research project which was originally led by Steve Loneragan that aims to further understanding of the linkages between environmental change and human security.² This effort approaches the questions of security through investigating the opposites — insecurity and vulnerability.

GECHS addresses the problem of population displacement by examining the way environmental change and a host of other stimuli contribute to insecurity and vulnerability (Loneragan, 1998). Their research has looked specifically at the issue of environmental refugees as a key type of human insecurity arising from environmental change. The GECHS report entitled, *The Role of Environmental Degradation in Population Displacement* finds that, despite rhetoric about an epidemic of environmental refugees, it is extremely difficult to identify or isolate precisely how large a role specific environmental drivers play in causing the displacement of people (Loneragan, 1998). Instead, Loneragan suggests that there is often a complex relationship between socio-economic and environmental drivers causing migration, and that environmental degradation cannot generally be linked in a direct cause-and-effect way to migration.

Within the report on displacement, the GECHS project engages in a pilot effort to develop an "Index of Vulnerability" in which 12 indicators are used to map vulnerability in individual countries. Problem-centred environmental, social, and political indicators are used to demonstrate the interrelation of social, ecological, economic, and political processes in creating vulnerability. The indicators chosen are:

- | | |
|---|-------------------------------|
| 1. Food Import Dependency Ratio | 7. Urban Population Growth |
| 2. Water Scarcity | 8. Child Mortality |
| 3. Energy Imports as a Percentage of Consumption | 9. Maternal Mortality |
| 4. Access to Safe Water | 10. Income per capita |
| 5. Expenditures on Defence vs. Health and Education | 11. Degree of Democratization |
| 6. Indicator of Human Freedoms | 12. Fertility Rates |

Source: Loneragan, 1998

² GECHS is now led by Dr. Mike BrKlaciach.

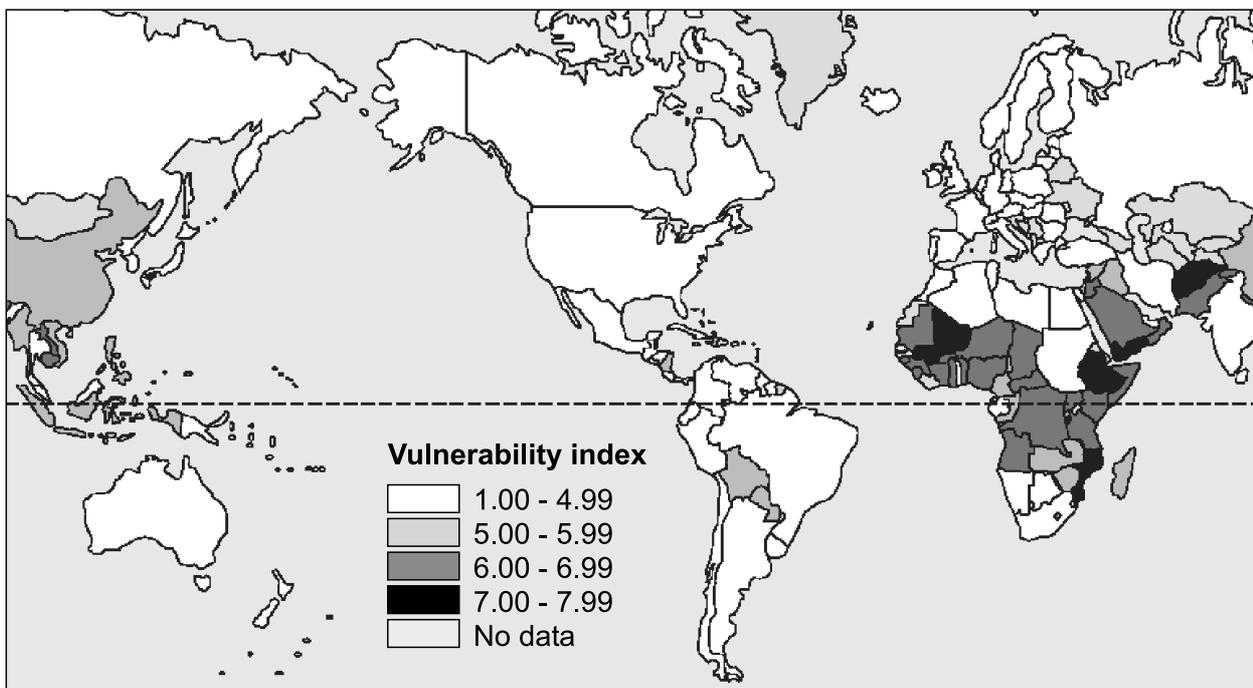


Figure 1. Vulnerability index by country
 Source: Lonergan, 1998

Lonergan finds that the majority of vulnerable countries and all the countries with the highest levels of vulnerability are found in Sub-Saharan Africa (see Figure 1). He also finds that of the top 25 countries of origin of refugees, all show up at least in the mid-level of vulnerability in the index and most are closer towards the high level of vulnerability.

Lonergan cautions against viewing this preliminary work as a demonstration of a strong correlation between the indicators and refugee problems, but does argue that the index shows that combined environmental and socio-economic drivers cause refugee problems (Lonergan, 1998). This conclusion in itself seems a bit overstated, as it is not obvious from the results that a similar type of index focused on mapping individual aspects, such as economic deprivation or health deprivation, would not arrive at similar patterns. Nonetheless, a key point to draw from the GECHS approach is that although it is difficult to clearly quantify the role of environment in creating insecurity, it is also true that in many contexts an adequate analysis of insecurity in general will require an understanding of environmental processes that contribute to these circumstances of insecurity.

Debate over the concept and definition of environmental security has been important in this field, as it has resulted in research agendas with very different foci. Criticism of the effort to broaden the security concept to include environmental threats has resulted in some research agendas focused only on how environmental degradation contributes to conflict. Those researchers who continue to advocate a wider broadening of the security concept have engaged in research agendas that address topics ranging from natural disasters to the very broad notion of human security. In the next section we make a case for using a vulnerability approach to analysis because it both addresses some of the weaknesses of past work in the environmental security field and provides a research agenda relevant to development policy and programmes that seek to address the challenges faced by poor regions and groups.

2.2 Environmental security and vulnerability analysis

Vulnerability analysis attempts to deal with the complexity of societies' reliance on the environment by focusing analysis on what makes people more or less prone to harm from changes in environmental conditions,

like hurricanes or wide-scale land degradation. By focussing on the causes of susceptibility to a limited set of environmental threats, vulnerability analysis does not need to restrict its focus to a single dimension of human well-being in order to maintain some analytical clarity. Using a vulnerability perspective provides focus in sorting out some of the confusion noted in the environmental security debate and in developing an analytically stronger environmental security concept.

Vulnerability - the degree to which a social or ecological system are likely to experience harm due to exposure to a hazard, sensitivity and limited ability to cope (sometimes called resilience).

Resilience - the capacity to absorb shocks while maintaining function.

Jon Barnett in his book “The Meaning of Environmental Security” engages in the debate on environmental security by looking at what environmental *insecurity* entails. He understands environmental security as a human welfare issue as does the GECHS study, but focuses on processes linking environment degradation and securing livelihoods. Environmental insecurity, according to Barnett (2001:17), is “the vulnerability of people to the effects of environmental degradation,” thus it “is more than the physical processes of environmental degradation.” Environmental security is understood “as a social problem, both for the way it impacts upon human welfare, and because the meta-problem of environmental degradation is a product of human behaviour” (Barnett, 2001:18). Insecurity, then, is associated with risks such as health risks and resource scarcity risks experienced by vulnerable groups such as the poor, women and children, or vulnerable regions (Barnett, 2001). For Barnett, it is the persistence of these insecurities that induces interest in environmental security and he defines environmental security as “the process of peacefully reducing human vulnerability to human-induced environmental degradation by addressing the root causes of environmental degradation and human insecurity,” which are “the impoverishment of people and the degradation of nature largely though political-economic processes.” Some may argue that the direct link between poverty and vulnerability may not be as strong as Barnett supposes, but his identification of the relationships between environmental change and socio-economic processes as the determinants of vulnerability is generally supported by research on vulnerability.

The vulnerability perspective narrows the approach to overall security by investigating specific answers to these questions: vulnerable to what threat, who or what is more vulnerable, and what processes are at work placing people in harm’s way and shaping their abilities to cope with threats. The vulnerability approach focuses on the security of vulnerable groups and high order threats to their well-being as opposed to state security interests and issues such as sovereignty, which are central to state security. The vulnerability perspective distinguishes between environmental threats that will result in costs, but ultimately also in an adaptation process within a society or a group, and environmental threats that have the potential to result in serious damage (physical, economic, social, or environmental) where that society may not be able to adapt.

Assessing environmental security from a vulnerability perspective also allows for systematic investigation of the processes at work in creating insecurity or security. A vulnerability assessment speaks directly to the multiple drivers that are at play in creating insecurity. Figure 2 depicts a vulnerability framework developed by the Sustainability Systems Project (SUST), which is a multi-institution research program that includes Clark University, Harvard University, the Stockholm Environment Institute, the Potsdam Institute, and Stanford University.

The basic structure of Figure 2 suggests that an examination of the relationships between human driving forces and environmental driving forces will pinpoint both those groups most vulnerable to environmental threats and the interactions of processes working across scales that create this vulnerability (Kasperson, J.X. and Kasperson, R.E., 2001). Environmental processes are thus not the *centre* of focus, as, for example, a society’s institutions and coping strategies can be equally important in creating or dissipating vulnerability.

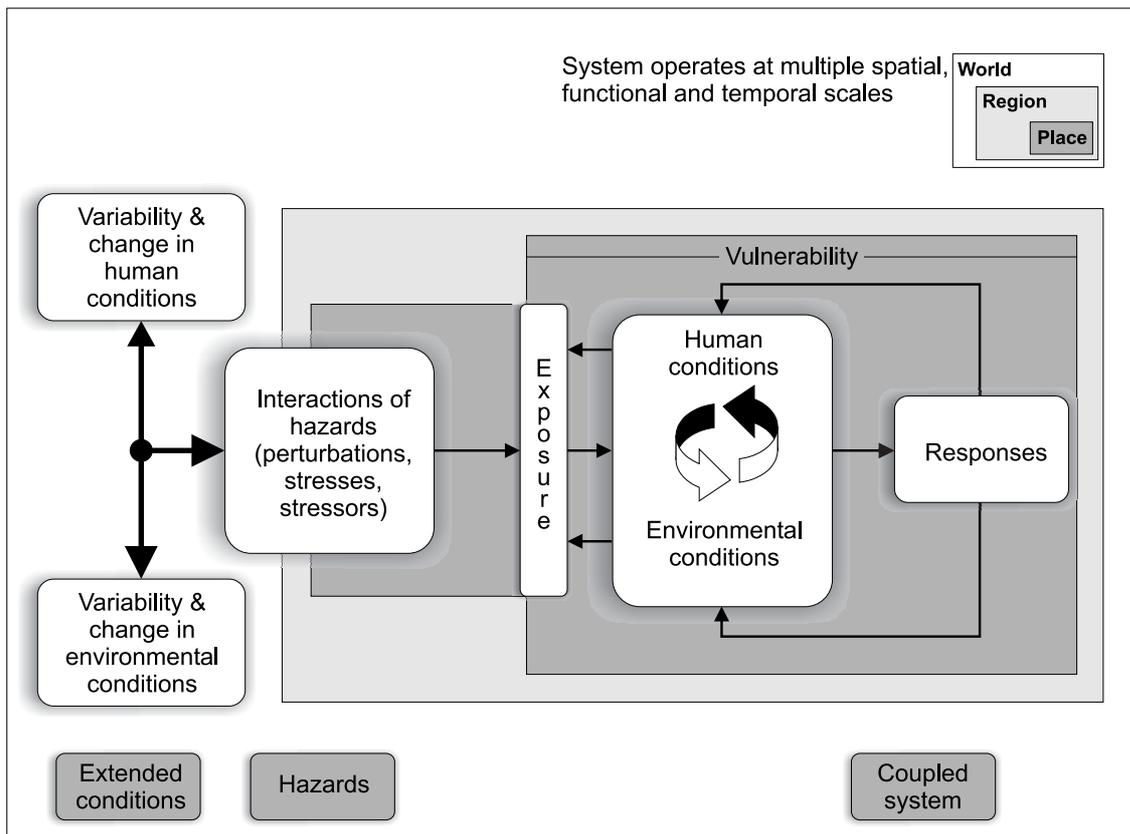


Figure 2. Basic architecture of the sustainable systems project vulnerability framework
 Source: SUST, "A framework for vulnerability analysis in sustainability science." Unpublished manuscript on file with authors.

Section 3 (following) reviews research on the relationship between environmental degradation and violent conflict. In Section 4 emerging research that incorporates the conceptual approach of vulnerability to address questions relevant to environmental security field is reviewed. The examples serve as illustrations of how a focus on vulnerability can help to develop environmental security research agendas that address some of the most important challenges faced by poor regions and groups in developing countries.

3 Findings on Environmental Degradation and Violent Conflict

Despite the recent debate over definitions of “environmental security,” and new attention to the implications for national security, research on the importance of environmental conditions to human security is not a new endeavour. The attention to environmentally motivated violent conflict as a topic of concern to nation states, which gained increasing interest in the 1990s, adds to a much more substantial body of work that has been building since, at least, *The United Nations Conference on the Human Environment* in Stockholm 1972. Over the last 30 years, narrower topics have been distinguished for attention, but at their core, discussions of environment and development are discussions of security for present and future generations (Swedish Ministry of the Environment, 2002).

In this section, we will review the contributions coming from efforts to understand the role of environmental degradation in armed conflict that have tended to dominate recent research in the environmental security field. As such this work is already supported by much case study work specifically looking at environmental security questions. In the following section (Section 4) we discuss three other prominent bodies of work addressing human security as it relates to environmental processes - livelihood security, climate change, and urban environmental health. We examine areas of consensus and active debate as well as critiques of research and major issues requiring further attention.

3.1 What is the shared understanding?

In the early 1990s the interest in environment and conflicts grew rapidly and large research programmes were initiated in Toronto and Zürich, among other places. The major efforts are based on comparative case studies. In the Swiss Environment and Conflicts Project, based at the Swiss Federal Institute of Technology, Zürich and the Swiss Peace Foundation, more than 40 cases of conflict were investigated, about half of which crossed the threshold of violent outcomes (Baechler, 1998, 1999). The Toronto team, led by Homer-Dixon, focused on more detailed case studies in eight countries (See Peace and Conflict Studies Program, 2003). At Oregon State University, Dr. Aaron Wolf leads the Transboundary Freshwater Dispute Database that takes an historic account of water conflicts cases, assesses outcomes of these conflicts, and gauges implications for future water conflicts (See the Transboundary Freshwater Dispute Database 2003).

Although the initial hypotheses were different, four common findings emerge from these research efforts. First, theorists agree that violent conflicts over *non-renewable* natural resources, such as oil and minerals, are not a new feature of human history. They argue that new types of conflicts are emerging over *renewable* resources that human beings depend on for their survival, such as fertile cropland and freshwater, and are likely to be increasingly important contributing factors in conflicts. These researchers thus limit their analysis to renewable resources (See Homer-Dixon, 1999a). Second, there is a general agreement that environmental degradation is not a single or direct cause of conflict (see for example Myers, N. and Myers,

N.J., 1996:23). Third, there is some consensus that many environmentally induced conflicts will be played out in developing countries due to their relative dependency on renewable resources, and especially in countries where other tensions already exist (See Baechler, 1998). Fourth, conflicts tend to persist over long periods of time and be spread over large areas, within subnational levels (Homer-Dixon, 1994; Baechler, 1998).

Water Wars

Some research into the prospect of “water wars” shows that no war over water has ever been fought, and only a handful of minor water “skirmishes” can be identified for the past century, while during this period 145 water related treaties have been signed. However, it is noted “there is ample evidence that the lack of clean freshwater has led to occasionally intense political instability and that, on a small scale, acute violence can result.”

Source: Wolf, 1998.

3.2 What is under debate?

The body of findings still under debate is much larger than the scope of consensus because investigators used different research frameworks and focussed on different elements in their explanations. These debates centre around 3 topics that, while unresolved, suggest situations that deserve careful consideration in applied development and management efforts. The first issue, addressed in comparative cases only by the Swiss team, is that not all conflicts become violent. The second of these is typologies of conflict, or identifying combinations of actors, resources, environmental conditions, and institutions that are commonly found in conflict situations. There appear to be widely varying types of conflicts and tensions and these are accounted for differently. The third area of debate centres on identifying the major pathways of causation leading up to conflict.

Conditions in which conflict crosses into violence. The Swiss project included cases of violent and non-violent conflicts allowing further analysis into the factors separating them. In their sample of forty, they found that approximately half led to violence while the rest did not cross that threshold. Other efforts to compile lists of conflicts, such as Peter H. Gleick’s (2000) “Water Conflict Chronology: Environment and Security Water Conflict Chronology,” suggest that in disputes where water resources are not treated as military targets, a peaceful resolution may be the more common outcome. Another effort that compiled a list of transboundary freshwater conflicts documented only six cases in which conflicts became violent. In order for a conflict caused, triggered, or facilitated by environmental degradation to cross the threshold of violence, it was found that some of the key situations outlined in Table 3 must coincide.

Table 3. Five key situations when environmental conflicts become violent

In the Swiss Environment and Conflicts Project it was concluded that environmentally-induced conflicts result in violence only if and when some of the following five key situations coincide:

- *Inevitable environmental conditions.* Group survival is dependent on degraded resources for which no substitutes are apparent and eventually the group faces an inevitable and therefore desperate environmental situation
- *Scarcity of regulatory mechanisms and poor state performance.* When a political system is incapable of producing certain social and political conditions, goals, such as sustainable resource use, become unattainable. The scarcity is either due to a lack of state outputs regarding resource management and livelihood security or due to a disruption of social institutions designed to regulate access to resources
- *Institutionalising the environment.* The environment is instrumentalised or manipulated by dominating actors to pursue specific group interests so that environmental discrimination becomes an (ideological) issue of group identity
- *Opportunities to build organizations and find allies.* Actors organize themselves in political settings – often behind a strong leader – and gain allies either from groups affected by similar problems, from certain (fraternizing) factions of the elite, or from foreign groups such as I(N)Gos
- *Spillover from a historic conflict.* Environmental discrimination occurs within the context of an existing (historic) conflict structure and, as a result, the conflict receives new impetus

Source: Baechler, 1999: 32-33

Typologies of conflict. These typologies draw out patterns in scale of conflicts, actors involved, and environmental conditions. The Swiss empirical examination resulted in the identification of seven types of environmental conflicts, centred at different organization levels and involving different sets of actors: centre-periphery conflicts, ethno-political conflicts, internal migration conflicts, cross-border migration conflicts, demographically caused migration conflicts, international water conflicts, and global environmental conflicts. In general, they found intra-state environmental conflicts are more common and migration is an important link between degradation and conflict (Baechler, 1998, 1999). This work also engages with efforts to identify basic patterns in environment – society relations termed “syndromes,” which dominate the conflict (Biermann, 1999).

Some examples of intrastate environment and conflict case studies

Type of Conflict	Country	Syndrome	Intensity of violence
Ethno-political	Rwanda	Overexploitation/abandoning traditional land use forms	War
Ethno-political	Sudan (North-South)	Overexploitation of marginal lands	War
Center-periphery	Botswana	Large scale infrastructure development leading to different loss of access to natural resources	None
Center-periphery	Brazil (Amazon)	Overexploitation of marginal lands	Low
Center-periphery	Senegal (Cassamance)	Overexploitation of marginal lands and degradation associated with industrialized agriculture	War
Internal migration	Algeria	Abandoning traditional land use forms	War
Internal migration	China	Abandoning traditional land use forms	None

Sources: Baechler, 1999; Biermann, 1999.

Secondly, they found that violent conflicts that are in part caused by environmental degradation are more likely to occur in marginal vulnerable areas, typically arid plains, mountain areas with highland-lowland interactions, and transnational river basins (Baechler, 1999).

The findings of the comparative case study efforts in Toronto were organized according to three broader categories of conflicts and the notable trends in scale and actor involvement were addressed within these categories:

- Simple-scarcity conflicts among states – It was found that inter-state conflicts are normally concerned with non-renewable resources. An exception to this finding is water and river basin conflicts; but, the review indicated that water conflicts are more common within countries, rather than between them.
- Group-identity conflicts – This type of conflict proved to be most common. Environmental scarcity is more likely to cause migration of people due to perceived ‘push’ and ‘pull’ factors rather than a refugee situation which is motivated solely by ‘push’ factors. This difference is attributed to the often long-term and gradual change in living conditions that environmental degradation causes. Large-scale migration, then, may cause violent conflict if the capacity to absorb migrants is insufficient. The movements of people with cultural backgrounds different than those in receiving areas may result in ethnical and religious dimensions contributing to conflict situations. In general these movements of people can deepen social segmentation (e.g. based on class or race) and ‘we-they’ cleavages can emerge.

- Deprivation conflicts such as civil strife and insurgency – Partial evidence was found for the hypothesis that environmental scarcity causes this type of conflict through increasing economic demands on the state to deal with the impacts of, for example, water, soil and forest loss on socio-economic systems. These new demands on government spending may hurt both elites and marginal groups, and the state may be pressured to make compensatory investments to address these groups' demands causing serious distortions in markets. Where environmental scarcity also decreases revenue, governments may increasingly falter in meeting the demands of various segments of society, thus setting the scene for this type of conflict (Homer-Dixon, 1999a, 1999b).

An interesting commonality is that environmentally induced conflicts are more likely to be intra-state than inter-state. A subnational perspective promotes the identification of different societal groups, defined in economic, ethnic, religious, or regional terms. Even where conflict is or has the potential to become inter-state, many of the underlying drivers of environmental degradation are regional in character (Kasperson *et al.*, 1995). These results are compatible with vulnerability analysis where groups rather than states are the most useful unit of analysis. Also significant is that migration appears as a key element in many of the cases reported here, although the nature of the connection between large population movements and group-identity conflicts differs between these research groups. Homer-Dixon notes religious and ethnic dimensions exacerbating the situation while Baechler (1999) suggests that migration is linked to different kinds of conflict, such as socio-economic conflicts between highland and lowland producers and conflicts between rural and urban dwellers.

Patterns of causation behind violent conflict. In hypothesizing about the causal processes behind conflict, researchers emphasize different elements in the social dynamics of the situations. According to the Swiss team, the typical causal pathway to conflict involves dependency on natural capital and discriminatory practices, in terms of unequal access to natural resources, causing marginalization of a group, which in turn stimulates population movement (Baechler, 1998, 1999). Environmental discrimination is the key mechanism and it is often related to a modernization and development process with uneven distributive implications (Baechler, 1998, 1999).

The Toronto approach centres on notions of supply, demand, and environmental scarcity as the basis for investigating the linkages between environmental degradation and violent conflicts. In this perspective, environmental scarcity arises when the quality and quantity of renewable resources decreases (supply-induced scarcity), population grows (demand-induced scarcity) and/or resource access becomes more unequal (structural scarcity). More specifically, degradation of renewable resources and population growth that cause unequal access to resources leads to a situation of 'resource capture' in which elites gain control over scarce resources. 'Ecological marginalization' occurs when unequal resource access and population growth combine to drive further degradation of renewable resources. Environmental scarcity, in turn, can produce five types of social effects: constrained agricultural productivity; constrained economic productivity; migration of the affected people; greater segmentation of society, usually along existing ethnic cleavages; and disruption of institutions, especially the state.

3.3 Criticisms of findings

The critiques of the environment and conflict research findings cover the research design, methods, and conclusions drawn. Gleditsch (1998) raises the point that in some cases environmental degradation leads to cooperation rather than conflict outcomes, and argues that the case studies sampled in the Toronto group's work are biased since only violent conflict outcomes have been studied.

Baechler emphasizes the role of 'socio-political discrimination' and Homer-Dixon argues that environmental scarcity is multidimensional rather than concerned with the environment only. This is also one of the main arguments of the critics - "the environment-security nexus is but one example of how

various factors or threats are coupled with the structural features of inequality and impoverishment” (Dabelko *et al.*, 2000:24). Some researchers call for more quantitative analysis of multiple variables that weigh the influence of environmental measures against economic and political variables. The economic and political circumstances of conflict are reported to be more significant in some studies (Dabelko *et al.*, 2000). This suggests that analysing the linkages between environmental, social, economic, and cultural variables should be as important as analysing the variables themselves.

Critics have contested conclusions, arguing either that environmental degradation simply has not proven to be significant or that this type of inquiry is not productive since the multi-factor causality is too complex. For example, Brock states, “environmental factors are densely intertwined with political, economic, social, and cultural factors, so that there are very few if any conflicts that could be strictly defined as environmental conflicts” (Brock, 1999:22). Indeed, the case study experiences of both the Swiss and the Toronto teams seem to have emphasized the socio-political dimension of degradation and conflict, as well as pointed to the role of social institutions for managing conflict. The question is, then, what weight to attach to their findings. Brock and Baechler conclude that the empirical evidence does not support an alarmist view (Brock, 1999; Baechler, 1999). Levy goes further and argues that the results are trivial, since no one ever questioned that environmental degradation could be a contributing factor to violent conflict (Levy, 1995). However, at the very least, this research has sparked an academic debate and placed environment and conflict on the political agenda. Focus has been placed on questions of pinpointing when cooperation can resolve environmentally related conflict and which cases tend to break out into violence. It should also be noted that, ultimately, the disagreement over the significance of the findings boils down to the criteria we use for assessing whether a potentially causal relationship is significant or not. How direct must the effect be and how strong?

3.4 Implications for sustainable development policies and programmes

What can we learn from the environment and conflict research? How are the research findings relevant to development policies and programmes and the goal of sustainable development? We note that there are several points of agreement between the work by Homer-Dixon and the Swiss team (Baechler, 1998, 1999; Homer-Dixon, 1999a, 1999b). Environmental degradation is acknowledged in both research efforts as a legitimate exogenous, independent variable in the causal pathway leading to conflict, although the role may be indirect. Furthermore, environmental scarcity is differentiated from simple economic scarcity, which can be mitigated by redistribution, as a consequence of its external influence. Finally, uneven access to natural resources is seen as a key mechanism in transforming the environment to an issue of conflict.

The investigations reviewed thus far have also identified several interesting hypotheses about points for consideration in applied efforts. But, as noted in the criticisms, they are also selective in their analysis and, as a result, other relevant factors, such as poverty, have received less direct attention. The criticisms are justified, but to a large extent may be more relevant at an academic than at a practical level. For policy purposes, is it useful to enter deeply into the debate on criteria for evaluating the significance of causal relationships and methodological flaws in an area where prediction is very difficult? It may be a better precautionary stance to consider that, under some circumstances, environmental degradation can play a role in many violent conflicts and that this potential should be considered on a case-by-case basis using the information on contributing factors distilled in these studies. A choice to strategically take on further investigation where warning signs are present can be supported by undertaking a more focused vulnerability approach to significant stresses and potential coping options.

4 Livelihoods and Poverty: The Emerging Environmental Security Agenda

As a response to some of the research by the Toronto and Swiss teams, the International Peace Research Institute in Oslo has called for an inclusion of the poverty dimension in the study of the environment and conflict. It is suggested that Homer-Dixon's model can be extended by adding poverty as a factor affecting the level of grievance in society and the opportunity structure for violent collective action. Concrete recommendations are to study further the links to international political economy (mainly structural adjustment issues), gender, and health (Percival, 1997). This recommendation fits well with a vulnerability approach that looks at livelihoods and poverty as key dimensions in understanding the environmental basis of security. However, from a vulnerability perspective a renewed focus on livelihoods and poverty expands the focus of analysis from violent conflict and brings to the fore other security issues central to the lives of vulnerable groups. Prevalent examples discussed in this paper are the security of livelihoods themselves and health security.

There is a body of work that focuses on these alternate types of research agendas, such as livelihood analysis. A common definition used in current thinking about sustainable rural livelihoods for vulnerable groups is that from Chambers and Conway who say "a livelihood comprises the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living..." (Chambers and Conway, 1992). Ian Scoones (1998) in "Sustainable Rural Livelihoods:

Natural capital – the natural resource stocks and environmental services (hydrological cycle, pollution sinks, etc.) from which resource flows and services useful for livelihoods are derived.

Economic or financial capital – the capital bases that are essential for the pursuit of any livelihood strategy.

Human capital – the skills, knowledge, ability to labour, good health, and physical capability important for the successful pursuit of different livelihood strategies.

Social capital – the social resources (networks, social relations, affiliations, etc) upon which people draw when pursuing different livelihood strategies requiring coordinated actions.

Physical capital – the store of human-made material resources.

Source: Scoones, 1998

a Framework for Analysis" describes five broad types of capital entailed in a livelihood. It is access to, control of, and combinations of these forms of capital that ensures livelihoods, and when these forms of capital are not available people's livelihoods are progressively threatened. Livelihood analysis looks directly at the multiple stresses threatening security, and there are clear difficulties posed by the broad scope that livelihood analysis suggests. Note that although poor people have capabilities to deal with stresses in their lives, there is a substantial overlap between those who are poor and those who are vulnerable.

Figure 3 (see following page) is a model developed by Carney that shows how researchers are attempting to link vulnerability and livelihoods analysis. Here what are called shocks, trends, and seasonality from physical or social systems are the drivers that impact on the five forms of capital identified above. Thus, for

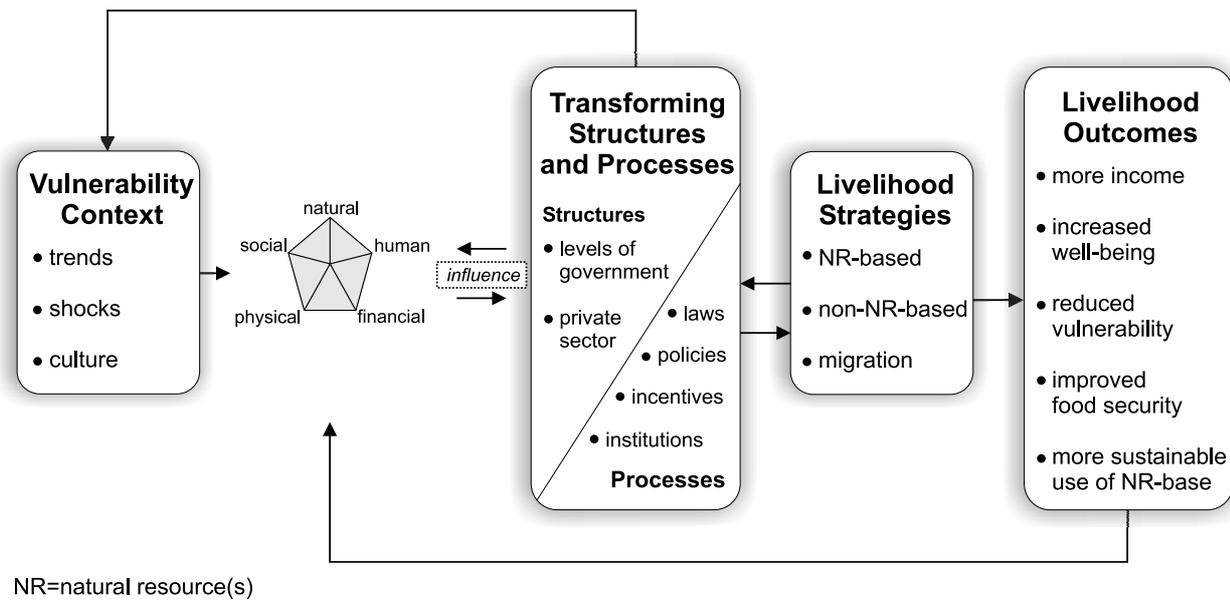


Figure 3. Sustainable rural livelihoods: a framework
 Source: Carney (1998). See also www.livelihoods.org

example, social and economic features such as institutional capacity, emergency coping establishments, or even macro-economic trends can both create and interact with environmental trends in significantly divergent patterns resulting in widely different outcomes in terms of capital resources.

One of the key benefits of this approach is that it “allows an escape from the earlier misleading categorization of people as “farmer,” “herdsman,” or “housewife”, when the reality is that most people and households have many sources of support” (Douglas *et al.*, 1994). As well, the concept of livelihoods is particularly important when examining environmental security and poor groups in developing countries. Importantly the reader should note that the livelihoods approach as described above only presents a framework for thinking about livelihood threats and does not describe specific paths of causality. Likewise, the notion of “capital” in the livelihoods approach needs to be specified with a focus on unpacking the details of each form of capital noted, explaining the relationships between various types of capital, and working out the precise linkages to vulnerability in a causal model.

The importance of addressing the environmental basis of livelihood security is powerfully addressed in Folke’s *et al.* paper entitled “Resilience and sustainable development: Building adaptive capacity in a world of transformation” (Folke *et al.*, 2002). The authors highlight that environmental and social systems are linked systems, and that livelihoods are dependant on “ecosystem goods such as food, timber, genetic resources, and medicines, and services such as water purification, flood control, carbon sequestration, pollination, seed dispersal, soil formation, disease regulation, nutrient assimilation” (Folke *et al.*, 2002:9). Folke *et al.* argue that it is the erosion of resilience, such as diversity, that creates vulnerability and the potential for abrupt changes in linked ecological and social systems. The erosion of resilience thus causes vulnerability in livelihoods, and in the worst cases groups faced with new shocks and stresses will be unable to “replenish coping resources” thus pushing “a region and its people to increasing criticality” (Folke *et al.*, 2002:15).

Leif Ohlsson (2000) in his paper “Livelihood conflicts: Linking poverty and environment as causes of conflict” provides a practical example of how livelihood analysis can contribute directly to the work on scarcity and conflict already established in the environmental security field. The following section discusses his analysis. By addressing livelihoods in a more concrete way his work is also more firmly connected to the development agenda. He argues that it is often the rapid loss of livelihoods that is the main environmentally

linked driver for conflict and internal wars in developing countries. In particular, he contends that when young men as a group experience rapid loss of livelihoods they are much more susceptible to being mobilized into the types of domestic conflict and violence identified in the work of Homer-Dixon. Where rapid loss of livelihoods occurs, he suggests that poverty and environmental degradation are usually associated problems; an argument that poverty is a causal factor in causing conflict does not negate or contradict an argument that environment is a causal factor or *visa versa*. Most often, in his analysis, these two elements will both be present in circumstances with rapid loss of livelihoods.

Ohlsson singles out the agricultural sector as the most significant area where environmental degradation can send poor groups into rapid loss of livelihoods. He focuses on scarcities of arable land and water in explaining how environmental conditions can lead to the rapid loss of livelihoods. As the agriculture sector is the “*single largest source of livelihoods*” in developing countries, when this sector is unable to expand its labour demands to meet a growing population because of resource (land and water) scarcity and/or declines due to environmental degradation, the risk of rapid livelihood loss for poor groups is high. The thesis of the work is that when land and water are increasingly scarce livelihoods become insecure and young men can be co-opted into militias and eventually into wars. This path offers the promise of wages and looting spoils, which may be the only opportunity for young men to achieve the livelihood standards they expect and are expected to achieve. His argument thus maintains that many analysts focus too heavily on ethnic tensions as the cause of conflict in internal wars such as the Rwanda massacres, without acknowledging how the loss of livelihoods, in part due to environmental driving forces, creates an environment where ethnic tension can be exploited (Ohlsson, 2000). With secure livelihoods, Ohlsson (2000:7) argues, “No presumptive warlord, however charismatic or ruthless, could ever hope to gain a substantive following of the necessary number of foot-soldiers....”.

The implications of this analysis for the development agenda are that it is essential to recognize the wider implications of environmental degradation when it threatens the livelihoods of certain segments of society. Ohlsson’s work is primarily theoretical at this stage, and an initial problem for his approach, when case studies are attempted, may be to demonstrate the proposed causal link between decreases in the agricultural sector’s ability to take in labour, and environmental degradation as a key driver of this decrease in labour demand in the sector. For instance, it is well established that the move of agricultural labour to urban areas is often driven to a large extent by productivity improvements within the agricultural sector itself, such as mechanization. This is not to say that environmental degradation is not also a key driver of labour reduction in the agricultural sector, only that other important drivers are at play, and simply demonstrating the presence of both environmental degradation and decreases in labour in the sector is not sufficient to demonstrate causality. As such Ohlsson’s approach faces similar challenges to those found in other examples of environment and conflict work in that it needs to demonstrate that environment is in fact a strong determinant in creating problems of agricultural labour, which in turn leads to the rapid loss of livelihood and circumstances ripe for conflict.

Ohlsson’s work brings livelihood analysis into the scarcity and violence work that has dominated environmental security thinking, and thus links this work with the broader sustainable development agenda. At the same time, other research agendas that grow out of vulnerability and livelihood analysis identify a useful focus for an environmental security field that goes beyond the question of conflict. In the following subsections we review research agendas that demonstrate how an expanded environmental security conceptualization can produce results that are directly linked to the broader aims of sustainable development and the work of development agencies and programmes. The significance of the environment to securing livelihoods and health entails a much wider body of literature than that on violent conflict. Many investigations examine the ways in which livelihood strategies depend on environmental resources in everyday situations and during times of emergency. We will look at 3 major areas of investigation into the livelihoods and health of poor people: impacts of hydropower dams, impacts of climate change on health, and health for urban dwellers.

4.1 Large dams

Looking at specific cases where livelihood and environmental security thinking converge, it becomes clear that much of the focus is on practical problem solving for vulnerable groups. Large-scale hydropower projects have frequently become well-documented cases of a human induced environmental change that can impact on the livelihoods of vulnerable groups. Analyses of dam impacts also demonstrate how environmental and socio-economic drivers in combination influence people's vulnerability. In particular, growing attention is being paid to persistently divergent impacts that predictably result in negative impacts for certain groups in developing countries.

The World Commission on Dams (WCD) in their report *Dams and Development: A New Framework for Decision Making* (2000: 83), observes "In Africa, the changed hydrological regime of rivers has adversely affected floodplain agriculture, fisheries, pasture and forests that constitute the organizing element of community livelihood and culture". The WCD concludes that "the poor, other vulnerable groups, and future generations are likely to bear a disproportionate share of the social and environmental costs of large dam projects without gaining a commensurate share of the

In the case of the Bakolori dam, field surveys showed a 50% reduction in flooding after dam completion. Of the 19,000 hectares of floodplain cultivated prior to the dam, 7,000 hectares of rice area and 5,000 hectares of dry-land cultivation were lost after dam completion. Examples of impacts in specific villages include a reduction of households performing dry-season cultivation from 100% to 27%, a reduction fields used for rice cultivation from 60% to 14%, and area cropped reduction of 82% to 53% in one village.¹ In the decades following dam completion effective irrigation was often not a feasible solution for any but the largest farms, while in recent years the introduction of small petrol pumps for irrigation may be improving circumstances.

Sources: Adams 1985, 1992, 2000a, 2000b.

economic benefits" (WCD, 2000:130). The differential effects are most severely felt by indigenous groups and minorities dependant on natural resources for livelihoods, poor people who are physically displaced or whose livelihoods have been threatened, and women within vulnerable groups (WCD, 2000:130).

A systematic account of the impacts on vulnerable groups in the years leading up to dam construction and resettlement does not appear to be well addressed in the literature, while there are plenty of anecdotal accounts. Much of the research on the security of vulnerable groups in dam projects focuses on problems associated with the resettlement of people out of the reservoir areas, inadequate resources for affected groups, and conflicts between state authorities and local residents, especially indigenous groups. This is clearly an important area of research for vulnerability analysis, especially in understanding the level of vulnerability for groups when the eventual resettlement process begins. Similarly the evidence of negative livelihood security impacts of dams is more often than not anecdotal, and the long run security impacts on communities are often not flushed out.

More evidence is available documenting conflict, sometimes violent conflict, associated with dam projects, migration impacts, and problems resettlement packages. The security implications of these impacts are much more direct, immediate, and visible. The WCD finds that from 40-80 million people have been physically displaced by dams, and that "many of the displaced were not recognized...when compensation was provided it often proved inadequate...those who were resettled have rarely had their livelihoods restored" (WCD, 2000:129). In India for example 75% of the people displaced have not had their livelihoods restored (WCD, 2000:108).

Health impacts are another key issue for vulnerable groups in dam construction. Health threats associated with environmental degradation or changes again are a more direct security issue than threats to livelihoods. Patrick McCully (1996) in his book *Silenced Rivers: The Ecology and Politics of Large Dams*, identifies several cases where large dam projects have caused problems with schistoamiasis and malaria (McCully, 1996) and the WCD report comments on high levels of mercury in some reservoir fish and increased incidence of HIV/AIDS transmitted by incoming migrant workers (WCD, 2000). The WCD report notes that "The issue of equity – in terms of pre-existing nutritional and health conditions of the population and the capacity

to resist new health problems – is at the root of the adverse health impacts of dams” (WCD, 2000:118). Vulnerable groups that are already food insecure or lack basic services will be impacted more severely than any other group from, for example, increased risk of malaria infection.

More work needs to be done to trace the longer term impacts on a community, for example, when their ability to practice a traditional form of floodplain agriculture is eliminated by dam construction. How can the process of rebuilding livelihoods be better supported? Such research can highlight the socio-economic factors that, together with environmental change, create vulnerability.

4.2 Climate change

The Intergovernmental Panel on Climate Change (IPCC) notes increasing problems with infectious disease incidence, food security, air pollution, and impacts associated with migration as examples of health threats likely to be associated with climate change (IPCC, 2001). The IPCC states that vulnerability to the health effects of climate change are related to individual, community and geographical aspects, and that “Determinants of population vulnerability to climate-related threats to health include level of material resources, effectiveness of governance and civil institutions, quality of public health infrastructure, access to relevant local information on extreme weather threats, and pre-existing burden of disease” (IPCC, 2001). More specifically, climate change’s effect on various forms of disease is often noted in vulnerability analysis. Analysts observe that malaria, schistosomiasis, and dengue are sensitive to temperature and weather change and thus will likely be affected by climate change. It is expected that with rising temperatures there is a potential for growth of the regions where these diseases are prevalent and expansion of the transmission seasons for the diseases (Kjellén, 2001; Kovats *et al.*, 2000). The IPCC notes that,

Evidence is emerging that many ecosystems on the African continent carry risks of climate-driven threats to human health. Predisposing factors include geographic location, socioeconomic status, and knowledge and attitude toward preventive measures (IPCC, 2001).

Thus the IPCC points out that the vulnerability to changing disease patterns resulting from climate change is not simply a case of environmental change, but that socio-economic factors play a key role in determining which groups will experience negative health effects from environmental change. This assessment of vulnerability coincides with other health issues important in a developing country context, such as links between urban environmental degradation of disparate health impacts.

4.3 Urbanization

There is a clear body of work on the tremendous differences in environmental health risks experienced by different segments of urban populations in developing countries. The incidence of ill health, in general terms, tends to decrease in urban areas due the higher concentration of services and infrastructure. For example, in ACP countries, urban dwellers are twice as likely to have basic water and sanitation services in comparison with rural dwellers (McGranahan *et al.*, 1999). Nonetheless, low-income groups in urban areas of developing countries face clear health threats associated with environmental degradation. Studies on environmental and health threats in developing countries show that the key environmental threats to health in low-income urban contexts are: difficult access to safe water, poor sanitation, contaminated food, uncollected waste, smoky kitchens, and a range of insect vectors (McGranahan *et al.*, 1999). Some of the health impacts caused by these environmental threats are: increased risk of infectious disease (e.g. diarrhoeal, cholera, tuberculosis), respiratory disease, and malaria (McGranahan *et al.*, 1999; Kjellén, 2001).

Hardoy *et al.* in *Environmental Problems in an Urbanizing World*, use a vulnerability perspective to help demonstrate the divergent threats to health from environmental problems experienced by different social groups. The authors identify four characteristics that influence vulnerability to environmental hazards: income and assets, economic and social roles that heighten exposure to environmental hazards, the amount

of resources dedicated to healthcare, and available coping mechanisms (individual, household, or community) (Hardoy *et al.*, 2001:161).

Young children are particularly susceptible to health threats associated with environmental hazards due to, for example, under developed immune systems. In cities that are not characterised by environmental threats the mortality rate for children under five years of age is less than 1 in 100, with environmental hazards not being a major cause of mortality. In cities characterised by extensive environmental hazards, mortality rates for children under the age of five may be between one in four and one in ten, with environmental hazards being the chief causes of death. Additionally, in cities characterised by extensive environmental hazards, there can be a 10 to 20 times difference between the mortality rates of children under five in wealthy districts and poor districts (Hardoy *et al.*, 2001:161).

Although Hardoy *et al.* (2001:169) do not use the language of security itself, their conclusions are directly relevant to the environmental security debate. They say,

In most urban areas of Africa, Asia, and Latin America, low-income groups have very little chance of obtaining a healthy legal house or apartment within a neighbourhood where environmental risks are minimized, ie one with sufficient space, security of tenure, services, and facilities, and on a site not prone to flooding, waterlogging, or landslides.

This message of disproportionate impacts is a key message in the environment and urban health discussion and in the vulnerability approach to environmental security. Within the dams, climate change and urbanization sections, we see that the degree to which environmental threats are also security threats to people depends a great deal on the degree to which they are vulnerable to the environmental change. As such, a host of socio-economic factors are identified as fundamental in understanding the impacts of environmental problems. In terms of development plans and policies the implications are that in addressing environmental challenges in a developing country context, the multiple environmental, social, and economic stressors will have to be addressed in relation to each other in order to effectively address the most serious threats to vulnerable groups.

5 Conclusions

This review of environmental security has raised many important questions for planning sustainable development. Foremost is the question of what is meant by environmental security. Far from being a purely academic debate, the decision to adopt a narrow definition focused on violent conflict is a choice to restrict our search for understanding to a scope that is perhaps more easily managed in research, but does not encompass the concerns for livelihood, health, or future generations envisioned in sustainable development. Nor does this focus lead to attention on the great number of conflicts that are solved through negotiation. While violent conflict is a major concern, it cannot be the only concern in addressing the environmental basis of security.

Efforts to understand the linkages between environmental security and violent conflict have highlighted specific types of situations where this tragic outcome is more likely, but in doing that the analysis has pointed back to other more diverse and established lines of development inquiry. According to major comparative investigations, concern over conflict arises more commonly where other tensions already exist and not all conflicts lead to violence (Baechler, 1998, 1999; Homer-Dixon, 1999a). This paper identified four common findings in the comparative investigations on environment and violent conflict:

- Emerging conflicts over *renewable* resources
- Environmental degradation is not a single or direct cause of conflict
- Environmentally related conflict is more likely to occur in developing countries
- Environmentally related conflict is more likely to occur at the subnational level

Circumstances including migration coupled with group identity conflicts; displacement of social institutions, such that rural poor are displaced and control of environmental resources becomes concentrated in the hands of a few; weak political systems that are incapable of producing the basis for creating sustainable resource use; and threats to survival due to degradation of key resources, are recognized as central problems even when they do not lead to violent conflict. Analysis of these conflicts has suffered from its limited engagement with efforts to understand the role of poverty and sources of vulnerability in the lives of participants and with limited attention to the role of efforts to avoid conflicts.

In this paper we selected three among the major approaches to understanding and analysing threats posed by environmental degradation - livelihood security, health threats, and vulnerability analysis. These are examples of other avenues of investigating security that tend to engage actively with broader development goals. While we do not dismiss violent conflict as a concern, we do see other profitable avenues to pursue less obvious but substantial threats as well as solutions that are more oriented to the overarching goals of sustainable development. These alternative approaches frame the conflict definition of environmental security

within a broader livelihood context. As such, they engage concretely with the more extensive set of goals for human development than does a focus on national interests. They aim first to understand how people's health and livelihoods depend on environment conditions and second to analyse approaches to local and larger institutional strategies for coping with increasing pressures on the environment.

In addition we argue, in the same vein as Ohlsson, that these approaches have particular value in uncovering reasons why citizens might become participants in violent conflicts. Examining the clashes and livelihood implications of major hydropower projects presents one set of cases where the details of environmental change and of livelihoods affected by these changes points to the importance of alternative solutions. We also favour the focus vulnerability analysis offers through looking at the distribution of consequences of key threats and through integrating the role of institutions in shaping those outcomes.

Vulnerability can be thought of as the opposite of security, and asking about vulnerability to a specific outcome of concern provides greater focus to the analysis. Key issues identified through the vulnerability perspective:

- Multiple socio-economic drivers in combination with environmental change interact over time to create insecurity
- There are patterns of persistent and predictable differential impacts, and environmental change/degradation tends to create the greatest threats to identifiable vulnerable groups
- The existence of thresholds or major disjunctions that can lead to abrupt deterioration of security
- Development policies and programmes informed by a vulnerability analysis will be better able to identify and mitigate the environmental security threats suffered by affected groups.

Throughout this discussion, we have suggested that the most productive path to follow in considering environmental security is the one that engages with the overarching goals of sustainable development. Building on what has been accomplished both under the title of "environmental security" and under other titles with sympathetic intent, three topics offer particularly productive next steps.

First, efforts towards understanding the environmental basis of violent conflict have established that, in some circumstances, environmental scarcity contributes to the escalation of conflict. A first generation of warning signs of potential violence has emerged from this work. But, if we can recognize those situations, can we also work towards identifying effective strategies to diffuse them? Greater engagement with diverse, ongoing efforts to build civil society, establish more effective environmental management regimes, improve approaches to environmental negotiations, foster conflict resolution, improve property rights institutions, and create more equitable policy solutions offers a second set of analytical insights and practical pathways to peaceful resolution.

Second, while it is essential to pursue strategies for peaceful resolution, the current indicators of potential violence do not represent a full understanding of the underlying causes. As was suggested by current critiques, there is a great need at the level of individual participation in violent conflict to better grasp the role of poverty and livelihood pressures leading to involvement. Where can interventions alleviate these pressures? At a political level, what pressures combine to move an environmental issue to the forefront of a policy agenda? In order to understand which environmental changes are more likely to be viewed as threats and why, more attention is needed to the character of societal-environmental connections across scales.

Finally, there is an ongoing need for focused attention on risks to livelihoods offered by vulnerability analysis. More comparative case studies aimed at uncovering the elements of successful cross-scale coping strategies can collect important lessons about how to share societal capabilities with those most needing

supportive resources. Changes in lifestyles, living situations, employment opportunities, community, and family relations are altering the basis for traditional “safety nets.” As societies change, some institutions that provided security weaken, and new strategies for providing security are created. For reasons of lack of resources and lack of access, it is often the poor and the marginalized that are first to lose and last to gain access to newer sources of support. The immediate health threats of urban slum conditions and the potential health threats of climate change are two matters which require cross-cutting institutional strategies, extensive societal resources, and institutional innovation to assure that people have the basic health level necessary to participate effectively in improving their lives.

In the next generation of environmental security studies, we should ask: How do we create institutions that can respond effectively to a variable environment and the shifting needs of the most vulnerable in a changing society? Maintaining the environmental basis of security as the challenges and means of livelihoods evolve requires considering how societal institutions might better respond to that process of change. Adaptive environmental management strategies now under development are aimed at planning for surprises, building resilience, and monitoring changing conditions. While these strategies encompass broad management goals, they can be designed to give particular attention to improving security for the most vulnerable. Such advancement will need to be supported by analytical development in understanding linkages between vulnerability, environmental degradation and insecurity. This paper has pointed to several areas of potential focus such as better understanding of causality in vulnerability models, formulation of typologies of environmental threats to security, or expanding on classes of security effects associated with environmental degradation.

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