

Resource Scarcity: Responding to the Security Challenge

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Introduction

For over two centuries, the social effects of natural resource scarcity have been the subject of lively debate. On one side are those who contend that the planet's resource endowment cannot support increased consumption indefinitely. In 1798, for example, Thomas Malthus wrote *An Essay on the Principle of Population*, in which he argued "that the power of population is indefinitely greater than the power of the earth to produce subsistence for man." The imbalance between human needs and food availability, Malthus predicted, would lead to famine, disease, and war. Writing 150 years later, Fairfield Osborn (1948: 200-201) reiterated this concern: "When will it be openly recognized that one of the principal causes of the aggressive attitudes of individual nations and of much of the present discord among groups of nations is traceable to diminishing productive lands and to increasing population pressures?" More recently, updated versions of the "scarcity-conflict thesis," developed by scholars such as Paul Ehrlich (1968), Donella Meadows (1972) and Thomas Homer-Dixon (1999), have been influential in both academic and policy circles around the world.

In opposition to this claim are those who believe that the principal social effect of natural resource scarcity is that it triggers ingenuity. From Julian Simon (1998) to Bjorn Lomborg (2001) the so-called cornucopian thinkers have identified numerous ways in which technological innovations tend to disarm concerns about the negative social effects of scarcity. In particular, these scholars argue that scarcity encourages the development of technologies that allow humans to discover new reserves (a process that could ultimately lead to deep sea and deep space extraction); reduce losses during the extraction and production phases; develop substitutes (such as plastic piping that can be used instead of copper piping for many applications); overcome shortages through world trade; and recycle waste by-products and used goods.

In 1980 Julian Simon bet Paul Ehrlich that the price (a much used indicator of scarcity) of any set of natural resources the latter chose to identify would decline over time. Ehrlich selected five minerals; by the date in 1990 selected for

concluding the bet, all five had decreased in price. This outcome is consistent with a large volume of research that suggests that while the price of many natural resources is highly volatile in the short term and can rise and fall rapidly and dramatically, en masse, the tendency over longer time frames (a decade or more) has been for prices to decline (see Barnett and Morse 1963; Smith 1979).

This body of evidence has not assuaged the concerns of those who continue to build the case that natural resource scarcity has, or will have, significant negative and interactive social effects such as pauperization, mass migration, the outbreak or amplification of violent conflict, and the spread of infectious disease. Contemporary proponents of this position make several points of rebuttal that merit careful consideration:

- Globalization processes tend to concentrate the negative effects of resource scarcity along the margins of the world's economy or project them into the future, where their impacts on the world's most vulnerable communities are (or are likely to be in the near future) virulent but virtually invisible to global centers of power and wealth: invisible, that is, until they erupt in a humanitarian crisis or provide motivation for acts of violence directed towards the center—outcomes that may be poised to grow in frequency and intensity.
- Climate change, the unintended consequence of unsustainable resource use, is quickly and dramatically transforming the context in which scenarios of the future should be constructed. Consequently, the empirical evidence of the past may not be a satisfactory basis for making future-oriented policy decisions.
- The cornucopian camp has compiled compelling data that demonstrate that technological innovations can mitigate scarcity for many of the natural resources destined to be transformed into commodities such as oil, copper, or wood. But many natural resources, especially renewable ones, are also integral elements of larger service systems that are being eroded through unsustainable resource use, a situation that is having serious, negative, and worsening social effects. For example, a forest is a stock of timber that may be extended with new construction and recycling technologies, but it is also a complex element of many ecological service systems such as the global hydrological

and climate systems. These are vital areas of the global environment where new technology is less likely to be able to mitigate or resolve problems.

This paper examines each of these points from the perspectives of international and human security. It begins with a brief discussion of current thinking about resource scarcity and security. It then identifies contemporary challenges and the capacities various actors have to respond to these challenges. This discussion informs the development of several scenarios for the next twenty years. The paper concludes with a series of policy recommendations.

Concepts and Current Knowledge

Much of the political history of the past several centuries—of modernity—can be told using the burgeoning vocabulary of security. An important dimension of this story concerns the theoretical and institutional enhancements and innovations that have followed periods of great conflict and violence. Most recently, the twentieth century experience of two world wars, in which the great power of the sovereign state was deployed against subnational groups such as the Jews and the Roma, provoked efforts to integrate human rights into post-war institutions, notably the United Nations, designed to encourage and maintain world peace. The end of the Cold War triggered yet another innovation—the concept of human security—which already has informed significant governance activity.

Human security seeks, at least in some important measure, to address the problem of insecurities that arise when the state is unable to reduce threats. The concepts of human rights and human security were integral to the development of the “responsibility to protect,” the centerpiece of the UN’s 60th anniversary declaration, the World Summit Outcome Document. The concept of human security has evolved through a series of influential documents produced since the early 1990s. Boutros Boutros Ghali’s report, *An Agenda for Peace* (1992), was an attempt to take advantage of the end of the Cold War to bolster the UN’s role in preventive diplomacy, peacemaking,

peacekeeping and peacebuilding. The idea that the security services provided by states were in many cases insufficient was underscored in the United Nations Development Programme (UNDP)’s 1994 report which focused on human security and offered one of the term’s most influential definitions: “Human security... means, first, safety from such chronic threats as hunger, disease, and repression. And second, it means protection from sudden and hurtful disruptions in the patterns of daily life—whether in homes, in jobs, or in communities (22).” The 1994 Human Development Report describes in detail the problem the concept of human security seeks to resolve:

The concept of security has for too long been interpreted narrowly: as security of territory from external aggression.... It has been related more to nation-states than to people.... Forgotten were the legitimate concerns of ordinary people who sought security in their daily lives.... With the dark shadows of the cold war receding, one can now see that many conflicts are within nations rather than between nations.... In the final analysis, human security is a child who did not die, a disease that did not spread, a job that was not cut, an ethnic tension that did not explode in violence.... Human security is not a concern with weapons—it is a concern with human life and dignity (22).

After this ambitious and comprehensive statement, the UNDP report sharpens the concept by identifying seven areas of concern: the economic, food, health, the environmental, the personal, community, and the political.

Since 1994, human security has become the subject of a vigorous research agenda (see, for example, MacFarlane and Khong 2006; MacLean, Black and Shaw 2006; Stoett 2000) and the focus of both nongovernmental (for example, the International Campaign to Ban Landmines) and foreign policy initiatives (notably in Canada, Japan, and several other middle powers). Proponents of human security have launched numerous campaigns focused on small arms, children and armed conflict, internally displaced persons, and many similar issues. Surprisingly, relatively little attention has been given, by both scholars and practitioners, to global environmental change as a human security problem,

although the linkage is a compelling one and deserves further consideration.

During the post-Cold War era, several researchers have undertaken research linking natural resources to violent conflict and other modalities of insecurity. For example, studies by Paul Collier (2000) and Wenche Hauge and Tanja Ellingsen (1998) suggest a typical scenario that is highly conflict prone. It includes an economy dependent on a lucrative natural resource (gold or oil rather than water or biodiversity) to which access can be controlled; a fractious ethnic cleavage that the dominant group has been unable to resolve; low education and high infant mortality rates; inadequate dispute resolution mechanisms and corrupt governance institutions; a history of violent conflict; and a diaspora community of angry emigrants and refugees forced to leave and willing to back one side in a civil war. This scenario is sometimes described as the “resource curse,” a conflict-prone situation in which many experience scarcity because a natural resource that is relatively abundant in a particular area has been captured by a small number and is used primarily for their benefit.

The work of Thomas Homer-Dixon (1999) makes a very similar argument but focuses instead on the adverse social effects of scarcity of water, cropland, and pasture—a problem current climate change research suggests will intensify throughout much of Africa and Asia. For Homer-Dixon, scarcity results from one or more of three causes: a real decrease in the supply of a resource (for example, the depletion of a fishery due to overfishing or global warming); an increase in demand due to population growth or changes in production or consumption practices; or institutional factors (for example, the privatization of resources in a manner that benefits a few at the expense of the many). Faced with one or more form of resource scarcity, Homer-Dixon theorized that under certain social conditions violent civil conflict would be triggered or amplified. He argued that the explanatory weight of resource scarcity in violent civil conflict would likely increase over time.

Of course, as extensive research on conflict makes clear, the outcome of any cluster of variables is never assured. Why this is the case is explained, at least partially, by those environmental security

researchers who study the capacity of communities at all scales to adjust and adapt to many forms of stress, including those related to environmental change. Both the simplified, Malthusian-inspired, scarcity-conflict story and the resource curse story tend to downplay and, in some cases, explicitly deny this capacity. But recent human history identifies few Easter Islands—states confronted with severe environmental stress that have collapsed into violence and subsequently disappeared—and many Rwandas—states confronted with severe environmental stress that have experienced great violence and also found ways to survive. In fact, some recent research has pointed to the environment as a source of cooperation and peace. For example, Wolf and Delli Priscoli (2006) point out that international cooperation around water has a long and successful history, with water serving as a greater pathway to peace than to conflict in international river basins.

Conflict and cooperation, however, are somewhat idealized outcomes of environmental change. Much research is now emphasizing variability in social effects. People have different capacities to prevent, benefit from, mitigate, or adapt to environmental change, capacities that appear closely linked to inequalities embedded in political, economic, and cultural structures. For example, Nancy Peluso and Emily Harwel (2001) argue that the inequitable distribution of returns from resource extraction activities has been a factor in violence in West Kalimantan. In his analysis of land invasions in a district of Chiapas, Aaron Bobrow-Strain (2001) shows that declining agricultural production due to economic and political forces (rather than environmental scarcity), and the unequal distribution of returns from production, were important factors in land conflicts. Mohamed Suliman (1999) analyzes the different responses of people in the Fur and Boran regions of Sudan to drought and shows that land rights was an important variable in determining whether drought results in violent or peaceful outcomes, as well as the role of leaders, and institutions for resource sharing.

This growing body of literature is, in fact, an excellent example of the human security research agenda mentioned above. Environmental change affects people in different ways. Often, those who

are already vulnerable to threats because they are poor, illiterate, lack political power, or face gender or ethnic discrimination are the ones who find themselves in the front lines of the negative dimensions of environmental change. They face water and land scarcity, are displaced into marginal ecosystems where they encounter unfamiliar parasites, experience severe weather events, lose everything to floods and mudslides, and daily eke out an existence in peri-urban areas awash with human waste. In cases like the Sudan, the impacts of climate change are an additional burden on and amplifier of a situation already characterized by extensive violence and suffering. In the years ahead, the mixed effects of climate change will likely be distributed along the fracture lines of inequality—people in Canada, Europe, Australia, and the United States being the prime beneficiaries of new agricultural opportunities and access to natural resources; those in much of Africa, South Asia, Southeast Asia, Central America, and small island states finding themselves facing a barrage of storms, droughts, heat waves, and microbial invaders.

There is then a substantial body of scholarship that links resource scarcity to security issues. But it is important to underscore that there is considerable disagreement over whether this work has successfully identified causal mechanisms. Certainly, it tells some compelling stories and provides many case studies in which natural resources are prominent. Moreover, it is backed by some quantitative research (e.g., Hauge and Ellingsen 1998) that finds a significant correlation between violent conflict and some forms of resource scarcity. But much research remains to be undertaken on causal pathways, work that situates the role of natural resource scarcity into the larger context of conflict analysis, which historically has related conflict to competition for power; strategies for survival; the dynamics of group identities; and the aggressive dimensions of human nature. In each of these categories of explanation natural resource scarcity may be relevant and broad Malthusian type claims will therefore always have some analytical resonance. But more fine grained analysis testing specific hypotheses compatible with this general framework may make it easier to identify and

defend explicit roles for sustainable development and resource management in real world cases.

Against this background of a literature that is maturing and still incomplete, it is possible to suggest some notable areas of agreement and disagreement, and thus identify specific and immediate research needs. First, there is considerable agreement that resource scarcity is not a sufficient cause of violent conflict, but is a contributing factor in many cases. It appears especially significant when it can be linked to inter-group tensions and conflicts, and when there is not adequate governance capacity to stop an escalation towards violence. Moreover, communities of heightened social and economic vulnerability (minorities, women, the poor) may be particularly sensitive to resource scarcity as a security concern (Collier 2000a). Second, while there are certainly many pathways from scarcity to conflict, one causal chain that has received considerable empirical support examines migration as a key linkage. According to this pathway, scarcity pushes people into areas where they may encounter hostility from locals who feel threatened or into marginal environments where they may find themselves vulnerable to pathogens to which they have had no exposure (Homer-Dixon 1999). Third, rapid changes in access to resources appear more conducive to conflictual outcomes than gradual changes (Diamond 2004). Fourth—an emerging area of agreement—climate change impacts will affect resource availability in many areas that are susceptible to conflict for other reasons, or already engaged in conflict, and it will act as a conflict multiplier (Barnet and Adger 2007).

There are also key areas of disagreement in the field. One concerns the longstanding debate over the extent to which population growth affects outcomes, with some analysts seeing it as the major challenge facing the planet (Ehrlich 1968) and others arguing that simple linkages between more people and more problems are misleading and counterproductive as the basis for policy-making (Lomberg 2001). A second area of disagreement concerns the issue of ingenuity—is there a relative lack of it in the developing world (Homer-Dixon 2000)—or is ingenuity the diacritical feature of humankind, rich or poor (Simon 1998)? Third, there is considerable disagreement over whether and how often water scarcity,

certainly one of the most highly studied forms of resource scarcity, can be linked causally to conflict (Gleick 1993; Wolf 2006).

Insofar as immediate research needs are concerned, several areas stand out. First, it would be very useful to test concerns about climate change impacts through case study analysis. Second, it would be valuable to clarify the temporal dimensions of adaptation to resource scarcity—is there a time constraint on the production of social ingenuity? Third, research identifying areas sensitive to environmentally-induced migration flows would be of potentially great value to a range of political and civil actors.

In concluding this section, I would argue that the more general project of exploring linkages between natural resource scarcity and human security, which is just taking shape, should be encouraged and has value in at least three ways. First, it is part of a larger process, with both theory and praxis dimensions, of coming to terms with a changing security landscape, a world in which climate change may be eclipsing world war as the predominant source of misery, migration, and death.

Second, it offers an approach to studying the plight of the world's most vulnerable peoples that is complementary to the paradigm of human rights. In other words, the language of human rights tends to theorize in terms of violations to the dignity of an individual who, by virtue of being human, has certain moral entitlements. In contrast, human security encourages us to think in terms of nonmilitary threat structures that tend to be most assertive where people are most vulnerable due to factors such as poverty, corruption, illiteracy, and weak government.

Of course, at a certain level of abstraction, these may be two sides of the same coin. But it is instructive that the mine ban movement did not set its sights on those who had laid mines and failed to remove them after hostilities ceased. Instead it allowed landmines to be framed as a diffuse threat for which assigning individual responsibility or pressuring a state government to act was less important than finding the resources to dig them up, assist survivors, and encourage producers and users to cease their activities. In a similar sense, although we know that the US

produces more greenhouse gas emissions than any other country, we tend to see climate change as the result of the actions of many generations in many countries, and so, much of the focus is on seeking cooperation to reduce these emissions. It would probably be quite unproductive to think of an infectious disease as somehow morally rooted to its index case. We can appreciate, however, that in each case the world's poor are disproportionately vulnerable to these types of threat, and tend to lack the social and technological ingenuity needed to prevent or mitigate or adapt to them. Whatever else it may encompass, at a minimum, human security is about our shared responsibility to the world's vulnerable people, facing complex threat systems that they are ill-equipped to manage, and in which we are all implicated.

Third, the scarcity/human security framework creates a bridge among security, development, and human rights. People are suffering from threats for which there is often not a clear aggressor or simple solution; they are suffering in large measure because they or their governments lack capacity; their situation is dire enough to merit world attention; unless something is done, they cannot expect lives of safety and dignity; if dignity is not possible for large numbers of people, then the doctrine of human rights risks being a code of protection for elites. Human security evokes flooding in Bangladesh, AIDS in South Africa, and drought in the Sudan. In the years ahead, it is likely to be linked frequently to climate change, a fast brewing transnational threat almost certain to be most damaging to those who have the least capacity to respond.

While it is important to focus more attention on real and potential links between natural resource scarcity and human security, earlier understandings of security remain relevant and require consideration as well. This section has already examined recent work linking resource scarcity to violent civil conflict, but what about the potential for resource wars between states? After all, as Fairfield Osborne argued in 1948, were not societies mobilizing bigger and bigger militaries in large measure so they could use force to gain access to global resources? This concern has retreated, mainly because there has not been a great power war since 1945, and, in fact, interstate war has declined steadily since that time. Hence,

although not entirely absent, predictions of interstate resource wars are considerably more muted today than they were in the 1970s and earlier (see, for example, Gleick 1993; Klare 2001). Nonetheless, some analysts have interpreted the US attack on Iraq as motivated by a desire to ensure the Western world's access to cheap oil. Therefore, in the following section resource scarcity challenges to both human and international security will be explored.

Challenges

The key relationship examined in the literature that is sympathetic to the hypothesis that natural resource scarcity is positively related to conflict and insecurity can be depicted as follows:

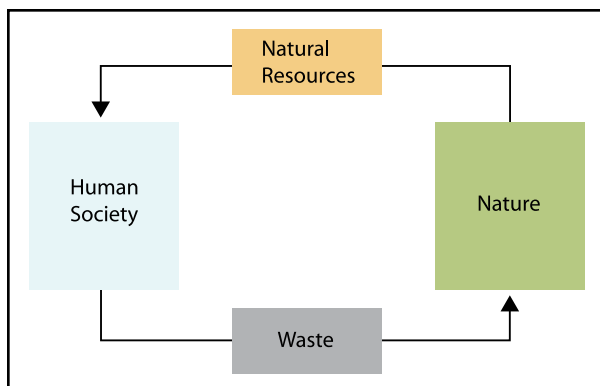


DIAGRAM A

Diagram A shows a simple circular flow relationship in which natural resources are drawn into society and waste products are vented back into the natural environment. Over time, the demands of human society and the volume of waste it produces grow, while the availability of natural resources declines (Diagram B). This may be due to increases in population size, changes in consumption patterns, or an absolute loss in the supply of the natural resource (Homer-Dixon 1999).

The growing disparity between human demand and resource supply is seen to generate one of two outcomes. Ideally, it will trigger technological innovations that will restore the balance by discovering new supplies, reducing waste during extraction and production, developing substitutes or recycling (Simon 1998; Lomberg 2001; Wolf and Delli Priscoli 2006). If not, it may trigger or

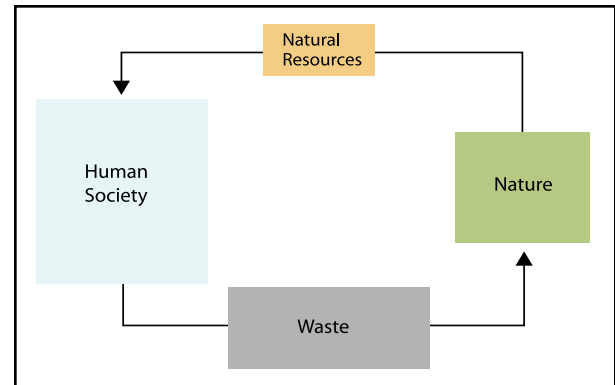


DIAGRAM B

amplify a web of interactive social problems including displacement, emigration, violent conflict, criminality, and deprivation (Myers 1993; Homer-Dixon 1999; Klare 2001; Diamond 2004).

Increasingly, however, this simple view of the social effects of resource scarcity is being replaced by a more complex—and accurate—image that places natural resources in a broader environmental context in which they play multiple roles (Diagram C).

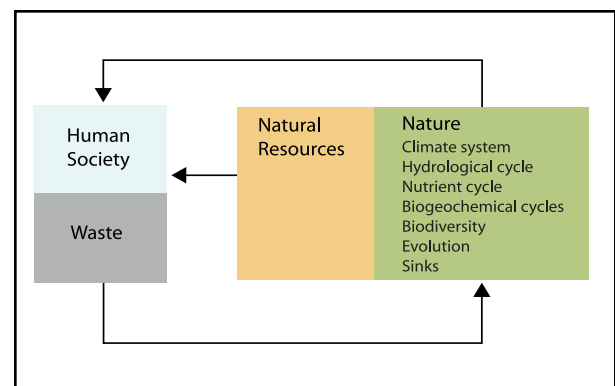


DIAGRAM C

It is this latter image that will be used here in identifying the challenges resource scarcity does or may pose to humankind (see IPCC 2007; German Advisory Council on Global Change 2008).

RESOURCE SCARCITY

Before proceeding it is important to briefly discuss the complexity of the independent variable, resource scarcity. It can refer to at least three very different situations—and many variations of these. The first, the minimalist account, concerns the availability of natural resources needed to

satisfy basic human needs for food, shelter, and energy. In his widely cited 2004 study, Jared Diamond discusses the case of Easter Island as a quintessential example of the unsustainable use of natural resources leading to scarcity at the level of basic human needs leading to social violence and disintegration. The island's forest cover—its principal source of food, shelter and energy—was completely decimated as trees were cut down at unsustainable rates, apparently to be used as rollers to move vast statues.

A second version of scarcity, the moderate account, concerns the availability of resources to satisfy consumption at current or higher levels, which is to say consumption based on real and projected demand, rather than a minimalist account of human needs. Mathis Wackernagel (et al. 2002) is associated with the concepts of “ecological footprint” and “ecological overshoot.” Wackernagel's research compares actual human use of resources to the planet's bio-productivity and shows that around 1980 humankind begins to overshoot the planet's regenerative capacity. The trend has continued since that time.

A third version of resource scarcity, the maximalist account, also considered by Wackernagel, defines scarcity in terms of the actual demand of both human and non-human species. Wackernagel's team calculates the resource demand of non-human species as equaling 12 percent of the planet's bio-productivity, which means that human overshoot of the world's resource base occurred in the early 1970s.

In principle, there is no reason to limit discussion to one account of scarcity, but it is important to point out that how scarcity is understood and measured is likely to affect analyses and policy recommendations. In public debate there is always a risk that arguments will be met with counterarguments that are rooted in different assumptions, leading to much confusion.

In any case, however one defines resource scarcity there is a compelling body of evidence that argues that having a satisfactory supply of natural resources is a growing problem for much of humankind. For example, UNEP's third Global Environmental Outlook report (2002) contends that both Europe and North America have seen gains in environmental health due to successful

pollution abatement programs, but, like much of the rest of the world, they have made little progress on sustainable resource management. Their ecological footprints are several times the world average, which is to say to maintain their current rates of consumption they must import or extract foreign resources at unsustainable rates. This is part of why the environmental trends everywhere else in the world are, according to UNEP, negative. The Global Environmental Outlook report concludes by identifying four growing divisions in the world:

- The Environmental divide
- The Policy divide
- The Vulnerability divide
- The Lifestyle divide

The most straightforward interpretation of this is that the wealthy and militarily powerful industrial states of the north have strong pollution abatement programs that are improving their air and water quality. They are faring less well as resource managers, but they are able to overshoot their indigenous resource endowments through technological innovation and trade, which maintains their sumptuous lifestyles but contributes to the vulnerability of the peoples of the south. To this one might add that the negative social effects of unsustainable extraction rates are being held in check through displacement onto the weak and projection onto the unborn.

If one accepts that (a) many people around the world have inadequate local access to the natural resources—such as forest products, fresh water, food, and energy—needed to maintain their current lifestyles or meet their basic needs, but (b) the social effects of generalized scarcity are being masked through displacement onto the poor and projection into the future, then it makes sense to consider what an unmasking might reveal. My thoughts in this regard are organized around three subjects: globalization, climate change, and ecological services.

RESOURCE SCARCITY, GLOBALIZATION, AND SECURITY

Like scarcity, globalization is another widely used but deeply contested term that has generated a vast and growing literature (on globalization, see

Held et al. 1999; Scholte 2000; Berger and Huntington 2002; Homer-Dixon 2006; on global civil society, see Wapner 1996; Keck and Sikkink 1998; and on global governance, see Murphy 2000; Keohane 2002; Wilkinson and Hughes 2002). Most accounts agree that globalization refers to planetary processes promoting interconnectedness and interdependence; that it is not a new process but rather one that has been dramatically accelerated and deepened by the technological innovations of the twentieth century in areas such as information handling, communications, and transportation; that it is evident in many spheres of human activity; and that it is having mixed and extensive impacts on the values and institutions of all humankind, enhancing welfare and freedom in some cases, but diminishing it in others.

Perhaps the most common and influential contemporary mechanism for expressing interconnectedness and interdependence is the social network. For example, the mathematician Albert-Laszlo Barabasi (2003) argues that we are experiencing a rapid increase in the number and magnitude of what he terms “scale-free networks.”¹ Scale-free networks consist of a relatively small number of hubs that serve as interchange sites for countless nodes, reducing the transaction costs of interactions even across vast spaces. For example, major airlines make air travel efficient by flying everyone to a hub where they can then typically transfer directly onto their final destination flight—as opposed to covering large distances through a series of short hops from one airport to the next. The proliferation of this type of network in recent years has prompted a number of researchers on globalization to conclude that the power and authority of the sovereign state have been greatly diminished, and the world’s countries must now focus on managing the sometimes harmful local effects of powerful transnational networks that operate beyond their control and move people, ideas, beliefs, values, money, technology, and many other forms of capital freely

in and out of their territory (Matthew and Shambaugh 2005).

In terms of resource scarcity, global networks facilitate trade and create new opportunities for identifying and accessing new supplies and developing substitutes. But they can also intensify vulnerability by reducing the time available for adaptation and mitigation while multiplying the pathways for exposure. Against this background, we can suggest several hypotheses about scarcity-security challenges related to globalization:

- Ironically, due to the uneven expansion of global networks, poor areas face higher transaction costs for importing resources and scarcity-solving technologies.
- Interconnectedness gives criminals and insurgents ready access to markets and may thus increase the incentive to plunder sought after natural resources ranging from gold and diamonds through basic forest products to endangered species.
- Interconnectedness also gives exogenous actors easier access to the natural resources of the world’s poor and vulnerable which they may be able to obtain cheaply by exploiting weakness and poverty.
- Interconnectedness can give the world’s poor opportunities to form transnational alliances and coordinate activity focused on their grievances, possibly elevating the risk of conflict.
- Interconnectedness facilitates migration, such that people facing resource scarcity can have a reasonable expectation of improving their welfare by moving elsewhere, which can amplify conflict factors.
- Interconnectedness enables criminal activity to aggregate in areas where governance systems are weak, making it more difficult for such systems to consolidate and succeed, and therefore reducing a vital component of managing scarcity—a strong state.

¹ Barabasi compares scale-free networks to random networks. In the latter case, each node has about the same number of connections as every other node in the system. For example, a family of five may be described as a network in which each member is directly related to four others. In scale-free networks, some nodes have an enormous number of connections compared to others. For example, an internet search engine like Google has millions of links, while the website of a small business may have only a few score. Scale-free networks can grow much larger than random networks without any sacrifice in the efficiency of transactions. Hence if each person in a city had five friends, connecting any two would be possible but might require hundreds of intermediary steps. In a scale-free network the connection would be very rapidly made through a hub. This means that very small actors have been empowered in a dramatic way—they now can manage massive volumes of information or reach millions of people by working through scale-free networks. Moreover, technologies have made it very difficult for states to govern scale-free networks that are transnational because the hubs are often highly mobile and therefore hard to regulate. This means it is difficult to keep information about human rights violations out of the hands of human rights watchdog organizations, but it is just as hard to keep nuclear technology out of the hands of terrorists.

RESOURCE SCARCITY, CLIMATE CHANGE, AND SECURITY

According to the German Advisory Council on Global Change's report, *World in Transition: Climate Change as a Security Risk*, "Climate change will overstretch many societies' adaptive capacities within the coming decades." (2007:1) The report identifies a set of "conflict constellations" (2) related to climate change:

- The degradation of fresh water in areas that "lack the political and institutional framework necessary for the adaptation of water and crisis management systems. This could overstretch existing conflict resolution mechanisms, ultimately leading to destabilization and violence." (2)
- The decline in food production that could lead to "regional food crises and further undermine the economic performance of weak and unstable states, thereby encouraging or exacerbating destabilization, the collapse of social systems, and violent conflicts." (3)
- An increase in storm and flood disasters, undermining crisis management systems and triggering out migration and other social problems.
- A rise in environmentally-induced migration, especially in agricultural economies where climate change contributes to drought.

These conflict constellations are speculative but largely consistent with the tenor of much scarcity-conflict literature. The report goes on to identify the regions of the world seen to be at greatest risk: North Africa, where water scarcity and population growth will undermine agricultural output and increase migratory pressures; the Sahel, where weak states will not be able to manage climate related stresses; Southern Africa, where climate change will deepen poverty; Central Asia, where climate related problems will interact with identity based civil conflict; South Asia, where the monsoon based economy will be subverted, throwing hundreds of millions into economic chaos and amplifying existing tensions; China, facing air and water pollution, drought and heat waves on truly epic scales, all subject to climate change intensification; the Caribbean and Gulf of Mexico, desperately poor and vulnerable to severe weather events; and the Andean region and

Amazonia, where the collapse of the rainforest will be accompanied by water scarcity (2-4).

Similar concerns have been expressed in the CNA Corporation's report, prepared by a group of retired generals and admirals known as the Military Advisory Board on National Security and the Threat of Climate Change (2007). This report offers three general conclusions:

- "Climate change acts as a threat multiplier for instability in some of the most volatile regions of the world." (6)
- "Projected climate change will add to tensions even in stable regions of the world." (7)
- "Climate change, national security, and energy dependence are a related set of global challenges." (7)

While this report focuses on the implications of climate change for the national security of the United States, and examines some of the negative dimensions of globalization, it is interesting that two of its five recommendations are that the "US should commit to a stronger...international role to stabilize climate change" and "to global partnerships that help less-developed nations build the capacity and resiliency to better manage climate impacts." (7) In addition to all of the problems covered in the German report, the CNA report emphasizes the potential for adverse health impacts related to climate change, and how climate change might support the growth of terrorism by further weakening fragile states and hence creating opportunities for extremism (16).

Abstracting from this and other sources, we can suggest several hypotheses about scarcity-security challenges related to climate change:

- Climate change will weaken states that are already not able to provide a minimal set of public goods including personal safety, sustainable livelihoods, the rule of law, basic human rights, literacy, and basic health care.
- Climate change will have its most immediate adverse effects on agricultural economies, which are over-represented in the poor and conflict-prone regions of the world, and therefore it will amplify conflict and insecurity.
- Climate change will create conditions of absolute scarcity on a scale that might not be

amenable to technological solutions, such as the collapse of the Amazon rainforest.

- Climate change will disrupt many existing patterns of cooperation and conflict resolution mechanisms by redistributing resources (e.g., forests will migrate northwards, glacial and snow melt fed rivers will diminish, and agreements based on earlier understandings of supply will be made problematic).
- The pace and variability of climate change will create short-term winners as well as losers, and sorely test mitigation and adaptation mechanisms, such that while it is a global problem challenging all of humankind, coordination and cooperation will be obstructed by its variable effects.

RESOURCE SCARCITY, ECOLOGICAL SERVICES, AND SECURITY

As noted earlier, the lion's share of scarcity-security analysis over the past two centuries has focused on the supply of resources required for goods such as food, energy, and shelter. But in recent decades, it has become clear to many that natural resources also have important roles in ecological service systems including the following:

- The hydrological, nutrient, and other biogeochemical cycles
- Sinks that capture carbon and other elements
- Ecosystems that harbor genetic diversity, embody the conditions for natural evolution, and serve as filters and other amenities.

The decline in forest cover, for example, does not only mean a reduced supply of timber and other forest products. It also eliminates a carbon sink and probably releases carbon into the atmosphere. It destroys habitat and thus reduces biodiversity. It affects the local hydrological and climate systems. Against this background, we can suggest several hypotheses about scarcity-security challenges related to ecological services:

- Scarcity will contribute to broader forms of global environmental change that will make predictions about things like rainfall difficult and therefore make it harder to define and implement effective resource management programs.

- Uncertainty about the character and impact of changes in ecological services will challenge the capacity of many societies to mitigate and adapt.
- Some areas of the world will become unliveable, permanent humanitarian disasters.

Capacities

How well prepared is the world to respond to the challenges outlined above? The concept of capacity has two dimensions that are relevant in answering this question—(1) what is the maximum capacity available today to a given individual, group, country, region or the world; and (2) what is the ingenuity capacity of these various entities, the capacity to study, innovate, and change? The preponderant view in the environmental arena is that the world has an enormous set of tools and systems that it can bring to bear on a problem, and, on the basis of past experience and new information, it is able to make some adjustments to the contours of existing capacity, refining and adapting tools and systems to be more effective. However, few observers believe that the world has the capacity for the planned and peaceful transformation of its basic economic, political, and cultural systems, even if new data and compelling arguments can be marshaled against the logic of capitalism or the sovereign state. In the environmental field, proponents of the need for systems level change—such as deep ecologists who are opposed to sustained economic growth, vast military defense systems, and global transportation networks—are regarded as extreme in their prescriptions. One hypothesis to consider, then, is the following:

- There is a gap between the institutional capacity of the planet and the challenges it faces that can only be bridged through the radical transformation of the former, something that is likely to be aggressively resisted because powerful elites are committed to elements of the status quo that are, from a resource perspective, problematic. Insofar as this is true, global change of social systems will require catastrophe—that may be unintentional or intentional.

Insofar as the more prevalent sense of capacity is concerned, there are many different ways of organizing assessments of capacity. Historically, in the field of international relations, scholars

have differentiated between diplomatic (bargaining), economic (bribery), and coercive (blackmail) modes of power, which measured and aggregated reveal the capacity of an actor. The US Department of Defense organizes its thinking (relevant because by any measure the US represents a considerable portion of global capacity) into four categories: diplomatic, economic, informational, and military. Many environmentalists have developed typologies of capital that may include all or some of the following: natural capital, built capital, financial capital, political capital, social capital, human capital, and cultural capital. In some measure, how one assesses capacity depends on what one measures. Further complicating matters, is the fact that there is no universally accepted set of actors whose capacity one needs to measure. Some assessments focus on the state; others regard the state as one of a set of several actors that also includes regional and international organizations (IOs) such as the EU or the UN, nongovernmental organizations (NGOs) such as Greenpeace, private corporations such as EXXON, and super-individuals such as Bill Gates. In short, assessments of capacity are complex affairs, beyond the scope of this paper. We can, however, make several observations:

1. However one regards capacity, its distribution is highly inequalitarian. Advanced industrial states, for example, comprising 1/5 of the global population, control over 85 percent of global wealth; generate and own the lion's share of new technology; have virtually universal literacy and health care systems; and, through the nuclear and conventional arsenals of the United States, possess the greatest coercive capacity in history.
2. In large measure, the expansion of capacity involves the use of natural resources—in particular, this is the predominant way in which financial and built capital grow.
3. Given that multiple forms of capacity are unequally distributed across a multitude of actors with different missions, coordinating capacity is an enormous challenge.

In short, from a bird's eye view we see a world in which a small portion of the population has enormous capacity but little incentive to alter the existing system even if it is highly vulnerable to crisis from an environmental perspective. Further obstructing the prospects of substantive change is

the fact that the capacity that exists is in large measure dependent on transforming natural resources into elements of power. And, finally, many elements of power are not easily coordinated—as numerous cases have demonstrated, it is hard enough to coordinate the various capacities of local government, the military, and NGOs around a focused disaster response (e.g., Hurricane Katrina, the tsunami in the Indian Ocean, the earthquake in Kashmir) let alone around a proactive initiative. There are, however, many promising developments taking place around the world.

For many analysts, the state is the starting point for the study of world affairs and has more capacity than any other actor. It alone collects taxes, has sovereign authority over most of the planet's land surface, makes binding laws, and is supported by both military and police forces. One obvious strategy for addressing security issues is to bolster the capacity of those states that are not effective in providing public goods—the so-called failed states. Another strategy is to facilitate coordination among states for peaceful purposes through regimes premised on a common value such as human rights or free trade. In terms of this paper, perhaps the greatest area of concern is whether the self-interest of the state and the desire to preserve sovereignty decisively mitigate against solving large complex global problems like climate change. Why should great powers share their enormous capacity to do something like address climate change effects in the Horn of Africa unless it is clearly in their immediate national interest to do so? The fear is that there exists a yet to be bridged gap between the time frames and incentive systems of global challenge and national interest.

However, a growing body of research is exploring the internationalization or globalization of the state. This has long been regarded as well-advanced on a regional basis (e.g., the European Union), but at least some prominent observers argue that even states that are thought of as very independent and self-sufficient, like the United States, are undergoing a gradual but dramatic transformation. According to Slaughter, “[n]etworks of government officials—police investigators, financial regulators, even judges and legislators—increasingly exchange information

and coordinate activity to combat global crime and address common problems on a global scale. These government networks are a key feature of world order in the twenty-first century, but they are underappreciated, undersupported, and underused to address the central problems of global governance.” (2004: 1)

The primary coordination vehicle for states is the multilateral or international organization. Historically, many of these organizations have suffered from underfunding and the willingness of states to trump their prescriptions via assertions of sovereignty, even though international organizations are universally recognized for the vital services they provide. Some, like the World Trade Organization, have adopted positions that satisfy great state imperatives but are often seen as antithetical to broader global concerns (e.g., the WTO’s tendency to regard environmental protection as contrary to free trade). Others, such as the World Bank and the United Nations Development Program, have moved well beyond coordinating the actions of states and are major actors in their own right. Two current initiatives are of special relevance to this paper. First, there is a system-wide initiative underway to document, assess, and harmonize the various conflict analysis and response frameworks that have evolved in different parts of the United Nations. This has the potential to greatly improve conflict prevention and peacebuilding programs, making it possible for different agencies and non-UN actors to contribute within the context of a shared and transparent assessment and implementation framework.

A second, and complementary, initiative is taking place within the United Nations Environment Programme (UNEP). UNEP’s Post-Conflict and Disaster Management Branch (PCDMB) has prepared fifteen assessment reports since 1995 with the objective of integrating the environment into post-conflict programs. The importance of doing precisely this has been discussed in detail in this paper. To date, PCDMB has been obliged to operate on an ad hoc basis with limited funds, but through these efforts it has developed a data set that makes possible a more systematic contribution on a scale commensurable with the importance of this work. A key to the success of this effort will be whether it is adequately funded.

The private sector has enormous capacity, global reach, considerable confidence in the ability of the market to detect trends and provide appropriate incentives for change, experience in forming strategic partnerships, and many other attributes that might be amenable to addressing global environment and security challenges, but it suffers from very short time horizons and is constrained by the imperative of creating financial gain quickly. Adding social value is not its daily or essential concern, and it tends to see the world as a fiercely competitive place. Under these conditions, what can be expected from the private sector? There are, in fact, many opportunities worth exploring.

For example, many elements of the private sector appreciate the need to manage natural resources in a sustainable manner and organizations such as the World Business Council for Sustainable Development should be encouraged. The WBCSD is especially progressive in the areas of climate change, energy use, and business leadership for development. Much of the challenge of the next decade will be to find creative ways to use market forces and incentives targeting the private sector to reduce greenhouse gas emissions. Working with the WBCSD and other organizations will be critical in this regard.

The business community also has innovative capacity that needs to be brought to bear on the problems facing that part of humanity that lives on less than two dollars per day and that is in the front lines of natural resource stress—some three billion people. Research demonstrates that for many commodities poor people overpay for inferior quality (Hart 2007). Population growth is expected to increase this segment of humankind by about 3 billion over the next century. There is an enormous need to find efficient ways to meet basic needs: food, water, energy, and shelter. If the business community can be attracted to partnerships with the public sector designed to address these needs, then huge gains will be possible in the decades ahead.

Another area in which the business sector has a potential invaluable role to play is in adaptation to climate change. The rate of change is likely to overwhelm the adaptive capacity of many poorer communities. They need relevant information delivered in a timely and accessible manner, and

low-cost, high-impact, fool-proof technologies that will give them the resilience and adaptability they currently lack.

Also outside the public realm, non-governmental organizations have considerable and growing capacity to monitor trends, respond to crisis, and effect change at all scales of social organization. From coordinating bodies such as the World Conservation Union and the International Campaign to Ban Landmines, to highly specialized entities such as Medicins Sans Frontieres and Amnesty International, NGOs have knowledge, credibility, agility, and experience that make them effective in raising awareness, lobbying, conducting interventions, and designing institutional change.

The world, then, has literally thousands of state and multilateral agencies, business firms and NGOs that represent enormous capacity. But bringing this capacity to bear on real world problems, especially those related to natural resource scarcity and security, is difficult for several reasons. First, there is no operational framework for coordinated action. Consequently, coordination is ad hoc, efforts are often duplicated, and information is variable and there is no trusted source for it. Second, institutional cultures work against close collaboration. Government agencies are focused on providing public goods, and protecting their sovereignty and accountability. Private businesses aim to generate wealth. As a general rule, they are not attracted to hot spots, failing states, and conflict zones, except in a predatory fashion. NGOs are concerned with creating social value at different scales and different situations, but they often do not trust government or business actors. Both business and

NGOs want transparency and openness, but they also want independence and freedom from government oversight and regulation.

Against this background, we can suggest three hypotheses:

- Over the next two decades, significant areas of the planet will not be able to generate and exercise the capacity to manage resource scarcity challenges, and this situation will deteriorate over time.
- A minority of the world has enormous capacity that is easy to focus on certain types of challenges—military threats, air and water pollution, disease outbreaks—but is hard to coordinate around problems that may entail systems level change and take extended periods of time to implement.
- Capacity is distributed across four distinct sets of specialized actors (state, international, private sector, NGO), but in spite of their being apparently complementary, it is very hard to bring them together to tackle global problems.

Scenarios

From the boardrooms of multinational corporations through the world's parliaments and congresses to its slums and war zones, time horizons are short—often a matter of days or months, rarely more than a couple of years. The purpose of scenarios is to give us a glimpse into plausible futures lying ten or twenty years down the road (or, in some cases, more) through combining important assertions in which we have a high level of confidence (wealth will continue to be concentrated in the countries of the north, world population will continue to increase by 100 million or so per year) with speculation about

		Scarcity-related challenges:	
		moderate	strong
Global capacity to prevent, mitigate and adapt:	moderate	Chronic pain, persistent turbulence	Converging crises, global catastrophe
	strong	One planet, many worlds	Cosmopolitan leadership, global governance

TABLE 1. Four scenarios of the social effects of resource scarcity.

areas we feel uncertain about but believe could have a major impact on our affairs (nuclear weapons will be acquired and used by non-state actors).

With the release of the 2007 cluster of IPCC reports, the world now has solid scientific descriptions of global changes likely to occur over the next twenty years or so and it is vital that scenarios begin to incorporate this unprecedented data into scenario construction. Based on the IPCC reports and a review of the extensive literature on resource scarcity and security, I have identified four scenarios for the future, organized by the unifying criteria employed for this series of papers into the 2 x 2 grid shown above.

1. CHRONIC PAIN, PERSISTENT TURBULENCE

The challenges directly (e.g., declining fish stock) and indirectly (global warming) related to resource scarcity become a “permanent” feature of world affairs. Considerable human capital is dedicated to responding to a growing stream of virulent disease outbreaks, lethal heat waves, severe weather disasters, and the like. Technological innovations, human ingenuity, and—at times—good luck provide intermittent relief, but after two decades there is no indication that the world’s ability to predict, prepare, and respond is improving appreciably, or that the challenges are reaching a plateau or being neutralized in any part of the world. In this scenario the world is held hostage by the absence of a trusted authority that can envision a compelling better future and develop a practical framework for coordinating the assets of different actors.

2. CONVERGING CRISES, GLOBAL CATASTROPHE

The challenges related to resource scarcity prove highly synergistic with other security challenges, some of which are perennial (e.g., infectious disease, poverty, and crime) and some of which are relatively new (e.g., age related chronic illness, car accidents). A common feature of the new security landscape of the 21st century is the extent to which the innovation and diffusion of powerful technologies has increased the scale of threats and the speed with which they can appear and spread. Unfortunately, a combination of political gridlock,

northern complacency, and institutional failures mitigates against concerted and optimal response efforts. Moreover, the empowerment of transnational non-state criminal and terrorist organizations weakens formal governance processes around the world. Almost without warning, a series of crises converge, interact, and dramatically alter the condition of humankind. Climate change leads to a series of almost global droughts that destroy the world’s food system causing mass migrations across borders and into new ecological spaces, which triggers a virulent and highly contagious new zoonotic disease. Wars break out, and in desperation several countries use nuclear weapons. In this scenario, too, the world is held hostage by the absence of a trusted authority that can envision a compelling better future and develop a practical framework for coordinating the assets of different actors.

3. ONE PLANET, MANY WORLDS

The challenges directly and indirectly related to resource scarcity become a “permanent” feature of world affairs, but some countries and regions are able to mitigate and adapt while others are not. Dismayed by the spiraling costs of humanitarian assistance, the areas of the world that are managing reasonably well coordinate their policies to contain areas of great upheaval and misery. In this scenario, the wealthy countries discover that for the foreseeable future they can solve most challenges they face, and decide that the actual cost of extending ingenuity and capacity to the poorer parts of the world is considerably greater than the costs of containment strategies. The wall between rich and poor becomes increasingly impermeable.

4. COSMOPOLITAN LEADERSHIP, GLOBAL GOVERNANCE

The challenges related to resource scarcity prove highly synergistic with other security challenges, some of which are perennial and some of which are relatively new. It becomes clear that the US is unwilling to play the role of world hegemon and invest its own resources heavily into solutions, or work fairly in a multilateral governance setting; instead it continues to rely heavily on meeting its domestic demands through the use of force, and provides little assistance outside its borders unless

clearly mandated by the logic of national security. However, over the years rich transnational governance networks have evolved connecting the European Union to middle powers such as Canada, Australia, and Japan, to newly emerging economies like Brazil, China, and India, and to strategic, motivated or amenable parts of the rest of the world. Through this experience, institutionalized throughout the UN system and in countless other settings, a truly cosmopolitan leadership emerges dedicated to addressing the challenges of resource scarcity and other forms of global change. Setting norms, redistributing wealth, sharing knowledge, and providing transparent and objective sites for dispute resolution and program design, this leadership begins to implement fair but forceful policies that, over the course of two decades, begin to have a positive impact on world affairs. Although at times aloof from this process, the US often cooperates in practice and a growing percentage of its public supports multilateralism. In this scenario, the wealthy countries discover that for the foreseeable future they can solve most challenges they face, and decide that they also can and must, for moral and prudential reasons, support the actual cost of extending ingenuity and capacity to the poorer parts of the world. This cost is bearable in part because the developing world has considerable ingenuity of its own, and once given adequate infrastructure quickly develops indigenous capacity to address local and regional problems.

Conclusions

Resource scarcity is and will continue to create significant challenges around the world, both in very immediate ways as people face shortages of fresh water, wood, and food, and also in more indirect ways as scarcity amplifies other social problems such as weak state institutions, internal and transboundary demographic flows, criminal behavior, and civil conflict, and as it contributes to the deterioration of ecological services such as biodiversity and carbon sinks. Climate change can be expected to have a considerable and largely negative impact on natural resources, destroying them through drought and fires; moving them due to changes in temperature and precipitation; or causing societies to use more of them to combat problems like heat waves. As many observers have

long argued, the world's enormous and diverse capacity to prevent, mitigate, adapt, and respond to these challenges is unequally distributed to the detriment of the world's poor and may not be able to be coordinated around the large scale transformational programs that some analysts believe are needed.

In conclusion, it is important to take the following steps:

RIVALRY AND RECONCILIATION

Grand narratives about the linkages between resource scarcity and security have been constructed since at least the 18th century. They are compelling and influential, and provide a preliminary basis for bringing together various stakeholders and framing this as a global challenge pertinent to everyone. But these grand narratives conflate innumerable real world cases that are very different and rival stories of the mechanisms through which this linkage occurs. To move beyond arousing concern and a sense of shared fate, the challenge needs to be discussed in increasingly concrete terms.

Recommendation 1: Encourage dialogue in international fora on the linkages among natural resources, ecosystems and climate change, and human, national and international security.

Recommendation 2: Support the UN system-wide effort to establish a common framework for conflict analysis and peacebuilding activity.

Recommendation 3: Support the effort in UNEP to integrate the environment into post-conflict assessment, disaster management, and peacebuilding.

Recommendation 4: Create safe and fair opportunities for high profile dialogue on this issue set among state, multilateral, private sector, and NGO actors.

RESEARCH AND RESOLVE

The extensive research on global climate change needs to be complemented with extensive research on different facets of the increasingly problematic nature-civilization relationship, of which resource scarcity-security is only one dimension, albeit a rich and important one. This type of research continues to be confined to very small and underfunded groups concentrated in a few countries.

Recommendation 5: Support efforts to extend research on the environment and security around the world and in different contexts (local, national, regional, global). Today, the bulk of research is being conducted by a small community concentrated in Europe and North America, but research methods and other resources need to be linked to indigenous expertise and knowledge around the world—especially in vulnerable areas.

Recommendation 6: Support research programs that study the linkages among natural resources, ecosystems, and climate change from a security perspective.

Recommendation 7: Encourage research that helps anticipate the social effects of climate change such as migration, and that downscales aggregated data to make it useful at the local level.

Recommendation 8: Encourage more research on the adaptation challenges of vulnerable communities. Vulnerability is reduced through capacity building and therefore there are many opportunities to link work on poverty alleviation and other aspects of human development to environmental security.

Recommendation 9: Identify or establish authorizing agents such as university consortia or trusted NGOs that can disseminate research findings to policymakers, business leaders and activists.

RESOURCE MANAGEMENT AND RESILIENCE

The concept of sustainable resource management, (that is, sustainable because it is fair, economically sound, and environmentally viable) needs to be customized and integrated into social systems. This should be part of a larger goal to build resilience into communities at all scales that are vulnerable to different modalities of global change. At a minimum, global change resilient and adaptive communities should have the following features:

- The capacity to study and assess threats and to disseminate knowledge.
- The capacity to prepare to respond to these threats.
- The capacity to obtain the earliest possible warnings about sudden onset problems.

- The capacity to integrate mitigation and adaptation practices and technologies into community development activities.
- The capacity to coordinate with other actors at the most efficient level—state, region, globe.
- The capacity to manage demographic change such as sudden influxes of people.

All of these attributes depend upon effective governance institutions.

Recommendation 10: Peacebuilding and development activities, which already emphasize institutional reform and good governance, should carefully assess local and regional environmental conditions and trends, and then fully integrate climate change adaptation measures and stress sustainability as a constitutive principle into their action plans.

Recommendation 11: UN agencies should work to coordinate different operational frameworks (especially related to human rights, economic development, conservation, peacebuilding, and climate change adaptation programs) to encourage transparency and mutual respect, create new synergies, reduce duplication, stress the common goal of sustainability, and reduce countervailing activities.

Recommendation 12: The enormous capacity of the private sector and NGO communities needs to be mobilized around sustainable development, conflict resolution, and peacebuilding. For example, microfinance brings capital to some 100 million of the world's impoverished people, but little effort has been made to link it to a paradigm of sustainable development. The UN could provide settings for this type of dialogue and experimentation.

Recommendation 13: Encourage the development of social entrepreneurship, which seeks to add social value and is comfortable innovating and taking risks that government and private sector actors shy away from in order to solve complex global problems.

Recommendation 14: Focus on building local and regional capacity and avoid global summits and other costly initiatives that are unable to move beyond very high levels of abstraction and inclusiveness.

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Extensively documented study of the scarcity-cooperation thesis in the water sector.

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