

Environmental Scarcities and Violent Conflict: Evidence from Cases

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# Environmental Scarcities and Violent Conflict

Thomas F.  
Homer-Dixon

Evidence from Cases

Within the next fifty years, the planet's human population will probably pass nine billion, and global economic output may quintuple. Largely as a result, scarcities of renewable resources will increase sharply. The total area of high-quality agricultural land will drop, as will the extent of forests and the number of species they sustain. Coming generations will also see the widespread depletion and degradation of aquifers, rivers, and other water resources; the decline of many fisheries; and perhaps significant climate change.

If such "environmental scarcities" become severe, could they precipitate violent civil or international conflict? I have previously surveyed the issues and evidence surrounding this question and proposed an agenda for further research.<sup>1</sup> Here I report the results of an international research project guided by this agenda.<sup>2</sup> Following a brief review of my original hypotheses and the project's research design, I present several general findings of this research that led me to revise the original hypotheses. The article continues with an account of empirical evidence for and against the revised hypotheses, and it concludes with an assessment of the implications of environmentally induced conflict for international security.

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1. Thomas Homer-Dixon, "On the Threshold: Environmental Changes As Causes of Acute Conflict," *International Security*, Vol. 16, No. 2 (Fall 1991), pp. 76-116.

2. The three-year Project on Environmental Change and Acute Conflict brought together a team of thirty researchers from ten countries. It was sponsored by the American Academy of Arts and Sciences and the Peace and Conflict Studies Program at the University of Toronto.

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In brief, our research showed that environmental scarcities are already contributing to violent conflicts in many parts of the developing world. These conflicts are probably the early signs of an upsurge of violence in the coming decades that will be induced or aggravated by scarcity. The violence will usually be sub-national, persistent, and diffuse. Poor societies will be particularly affected since they are less able to buffer themselves from environmental scarcities and the social crises they cause. These societies are, in fact, already suffering acute hardship from shortages of water, forests, and especially fertile land.

Social conflict is not always a bad thing: mass mobilization and civil strife can produce opportunities for beneficial change in the distribution of land and wealth and in processes of governance. But fast-moving, unpredictable, and complex environmental problems can overwhelm efforts at constructive social reform. Moreover, scarcity can sharply increase demands on key institutions, such as the state, while it simultaneously reduces their capacity to meet those demands. These pressures increase the chance that the state will either fragment or become more authoritarian. The negative effects of severe environmental scarcity are therefore likely to outweigh the positive.

### *General Findings*

Our research was intended to provide a foundation for further work. We therefore focused on two key preliminary questions: does environmental scarcity cause violent conflict? And, if it does, how does it operate?

The research was structured as I proposed in my previous article. Six types of environmental change were identified as plausible causes of violent intergroup conflict:

- greenhouse-induced climate change;
- stratospheric ozone depletion;
- degradation and loss of good agricultural land;
- degradation and removal of forests;
- depletion and pollution of fresh water supplies; and
- depletion of fisheries.

We used three hypotheses to link these changes with violent conflict. First, we suggested that decreasing supplies of physically controllable environmental resources, such as clean water and good agricultural land, would provoke interstate “simple-scarcity” conflicts or resource wars. Second, we

hypothesized that large population movements caused by environmental stress would induce “group-identity” conflicts, especially ethnic clashes. And third, we suggested that severe environmental scarcity would simultaneously increase economic deprivation and disrupt key social institutions, which in turn would cause “deprivation” conflicts such as civil strife and insurgency.

Two detailed case studies were completed for each of the three research hypotheses.<sup>3</sup> By selecting cases that appeared, *prima facie*, to show a link between environmental change and conflict, we sought to falsify the null hypothesis that environmental scarcity does not cause violent conflict. By carefully tracing the causal processes in each case, we also sought to identify how environmental scarcity operates, if and when it is a cause of conflict. The completed case studies were reviewed at a series of workshops of leading experts; in light of these findings, I revised the original hypotheses, identified common variables and processes across the cases, and examined the revised hypotheses in light of the case-study evidence. The project’s conclusions were reviewed by a core team of experts. The following are four general findings of this research effort.

#### RESOURCE DEPLETION AND DEGRADATION

Of the major environmental changes facing humankind, degradation and depletion of agricultural land, forests, water, and fish will contribute more to social turmoil in coming decades than will climate change or ozone depletion.

When analysts and policymakers in developed countries consider the social impacts of large-scale environmental change, they focus undue attention on climate change and stratospheric ozone depletion.<sup>4</sup> But vast populations in the developing world are already suffering from shortages of good land, water, forests, and fish; in contrast, the social effects of climate change and ozone depletion will probably not be seen till well into the next century. If

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3. On simple-scarcity conflicts, we examined water in the Jordan and Nile River basins and the Southern African region; on environmentally induced group-identity conflicts, we focused on Bangladesh-Assam and the Miskito Indians in Nicaragua; and on economic decline and civil strife, we studied the Philippines and China. Researchers in the project also investigated the 1989 conflict in the Senegal River basin, the 1969 Soccer War between El Salvador and Honduras, the rise of the Sendero Luminoso in Peru, migration and civil strife in Haiti, and migration from black homelands in South Africa.

4. For example, see David Wirth, “Climate Chaos,” *Foreign Policy*, No. 74 (Spring 1989), pp. 3–22; and Neville Brown, “Climate, Ecology and International Security,” *Survival*, Vol. 31, No. 6 (November/December 1989), pp. 519–532.

these atmospheric problems do eventually have an impact, they will most likely operate not as individual environmental stresses, but in interaction with other, long-present resource, demographic, and economic pressures that have gradually eroded the buffering capacity of some societies.

Mexico, for example, is vulnerable to such interactions. People are already leaving the state of Oaxaca because of drought and soil erosion. Researchers estimate that future global warming could decrease Mexican rainfed maize production up to forty percent. This change could in turn interact with ongoing land degradation, free trade (because Mexico's comparative advantage is in water-intensive fruits and vegetables), and the privatization of communal peasant lands to cause grave internal conflict.<sup>5</sup>

#### ENVIRONMENTAL SCARCITY

Environmental change is only one of three main sources of scarcity of renewable resources; the others are population growth and unequal social distribution of resources. The concept "environmental scarcity" encompasses all three sources.

Analysts often usefully characterize environmental problems as resource scarcities. Resources can be roughly divided into two groups: non-renewables, like oil and iron ore, and renewables, like fresh water, forests, fertile soils, and the earth's ozone layer. The latter category includes renewable "goods" such as fisheries and timber, and renewable "services" such as regional hydrological cycles and a benign climate.

The commonly used term "environmental change" refers to a human-induced decline in the quantity or quality of a renewable resource that occurs faster than it is renewed by natural processes. But this concept limits the scope of environment-conflict research. Environmental change is only one of three main sources of renewable-resource scarcity. The second, population growth, reduces a resource's per-capita availability by dividing it among more and more people.<sup>6</sup> The third, unequal resource distribution, concentrates a

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5. Diana Liverman, "The Impacts of Global Warming in Mexico: Uncertainty, Vulnerability and Response," in Jurgen Schmandt and Judith Clarkson, eds., *The Regions and Global Warming: Impacts and Response Strategies* (New York: Oxford University Press, 1992), pp. 44-68; and Diana Liverman and Karen O'Brien, "Global Warming and Climate Change in Mexico," *Global Environmental Change*, Vol. 1, No. 4 (December 1991), pp. 351-364.

6. Peter Gleick provides a potent illustration of the effect of population growth on water scarcity in Table 3 of "Water and Conflict: Fresh Water Resources and International Security," *International Security*, Vol. 18, No. 1 (Summer 1993), p. 101.

resource in the hands of a few people and subjects the rest to greater scarcity.<sup>7</sup> The property rights that govern resource distribution often change as a result of large-scale development projects or new technologies that alter the relative values of resources.

In other words, reduction in the quantity or quality of a resource shrinks the resource pie, while population growth divides the pie into smaller slices for each individual, and unequal resource distribution means that some groups get disproportionately large slices.<sup>8</sup> Unfortunately, analysts often study resource depletion and population growth in isolation from the political economy of resource distribution.<sup>9</sup> The term “environmental scarcity,” however, allows these three distinct sources of scarcity to be incorporated into one analysis. Empirical evidence suggests, in fact, that the first two sources are most pernicious when they interact with unequal resource distribution.

We must also recognize that resource scarcity is, in part, subjective; it is determined not just by absolute physical limits, but also by preferences, beliefs, and norms. This is illustrated by a debate about the role of population growth and resource scarcity as causes of the conflict between the Sandinista government and the Miskito Indians in Nicaragua.<sup>10</sup> Bernard Nietschmann argues that the Nicaraguan state’s need for resources to sustain the country’s economic and agricultural development caused environmental degradation to spread from the Pacific to the Atlantic coast of the country. As this happened, indigenous Miskitos in the east came into conflict with the central government. Sergio Diaz-Briquets responds that the Sandinistas expropriated Miskito lands because of ideology, not scarcity. The Atlantic coastal region was largely ignored by the Nicaraguan state under Somoza. Following the revolution, the Sandinistas had ample newly expropriated land to distribute to their followers; but the new government—guided by Marxism—saw the Miskitos as a backward people with a competing worldview and a precapitalist mode of production, whose land rightfully belonged to a state that was removing impediments to the historical progress of the working class.

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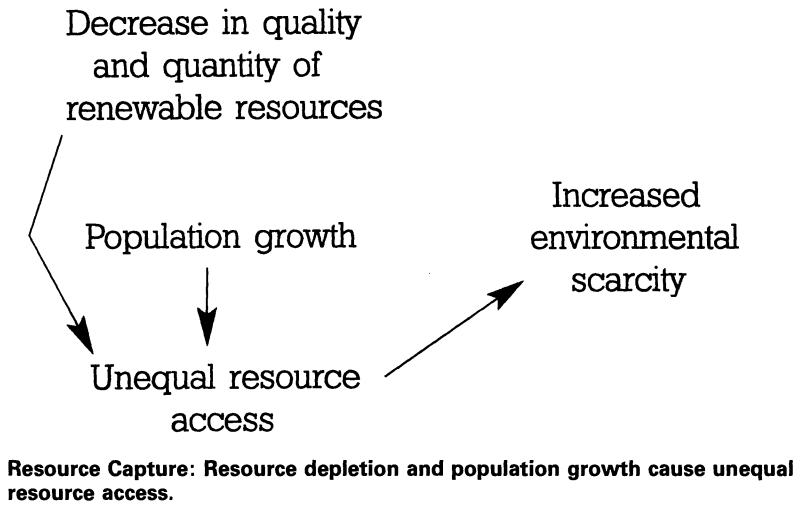
7. The second and third types of scarcity arise only with resources that can be physically controlled and possessed, like fish, fertile land, trees, and water, rather than resources like the climate or the ozone layer.

8. Since population growth is often a main cause of a decline in the quality and quantity of renewable resources, it actually has a dual impact on resource scarcity, a fact rarely noted by analysts.

9. James Boyce, “The Bomb Is a Dud,” *The Progressive*, September 1990, pp. 24–25.

10. Bernard Nietschmann, “Environmental Conflicts and Indigenous Nations in Central America,” paper prepared for the Project on Environmental Change and Acute Conflict (May 1991); and Sergio Diaz-Briquets, “Comments on Nietschmann’s Paper,” *ibid.*

Figure 1. Resource Capture and Ecological Marginalization.

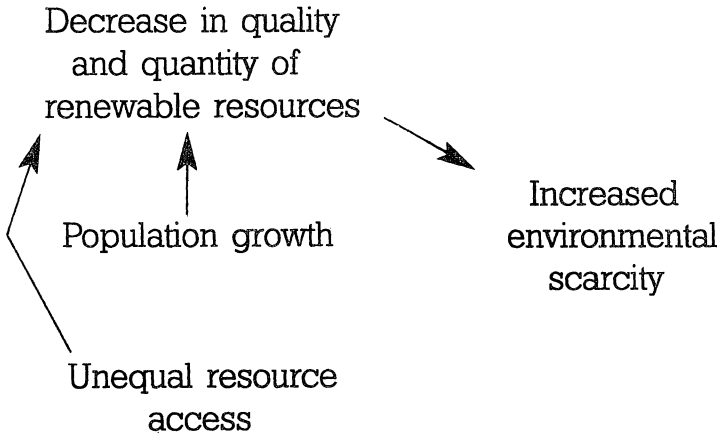


The gap between the two views can be bridged by noting that scarcity is partly subjective. Marxist ideology encouraged the Sandinistas to adopt a strategy of state-directed industrialization and resource-use; this led them to perceive resources as more scarce than had the Somoza regime.

#### INTERACTION OF SOURCES OF ENVIRONMENTAL SCARCITY

The three sources of environmental scarcity often interact, and two patterns of interaction are particularly common: “resource capture” and “ecological marginalization” (see Figure 1).

A fall in the quality and quantity of renewable resources can combine with population growth to encourage powerful groups within a society to shift resource distribution in their favor. This can produce dire environmental scarcity for poorer and weaker groups whose claims to resources are opposed by these powerful elites. I call this type of interaction “resource capture.” Unequal resource access can combine with population growth to cause migrations to regions that are ecologically fragile, such as steep upland slopes, areas at risk of desertification, and tropical rain forests. High population densities in these areas, combined with a lack of knowledge and capital to



**Ecological Marginalization: Unequal resource access and population growth cause resource degradation and depletion.**

protect local resources, causes severe environmental damage and chronic poverty. This process is often called “ecological marginalization.”<sup>11</sup>

RESOURCE CAPTURE. Events in the Senegal River valley in 1989 illustrate resource capture. The valley demarcates the border between Senegal and Mauritania in West Africa. Senegal has fairly abundant agricultural land, but much of it suffers from high to severe wind and water erosion, loss of nutrients, salinization because of overirrigation, and soil compaction caused by intensification of agriculture.<sup>12</sup> The country has an overall population density of 38 people per square kilometer and a population growth rate of 2.8 percent; in 25 years the population will double.<sup>13</sup> In contrast, except for the Senegal Valley along its southern border and a few oases, Mauritania is

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11. Jeffrey Leonard, “Overview,” *Environment and the Poor: Development Strategies for a Common Agenda* (New Brunswick, N.J.: Transaction, 1989), p. 7. For a careful analysis of the interaction of population and land distribution in El Salvador, see chap. 2 in William Durham, *Scarcity and Survival in Central America: The Ecological Origins of the Soccer War* (Stanford, Calif.: Stanford University Press, 1979), pp. 21–62.

12. Global Assessment of Soil Degradation, *World Map on Status of Human-Induced Soil Degradation*, Sheet 2, Europe, Africa, and Western Asia (Wageningen, the Netherlands: United Nations Environment Programme [UNEP], International Soil Reference Centre, 1990).

13. Nafis Sadik, *The State of the World Population 1991* (New York: United Nations Population Fund, 1991), p. 24; World Resources Institute [WRI], *World Resources 1992–93* (New York: Oxford University Press, 1992), pp. 246 and 262.



largely arid desert and semiarid grassland.<sup>14</sup> Its population density is very low at about 2 people per square kilometer, but the growth rate is 2.9 percent. This combination of factors led the Food and Agriculture Organization (FAO) and two other organizations in a 1982 study to include both Mauritania and Senegal in their list of "critical" countries whose croplands cannot support their current and projected populations without a large increase in agricultural inputs, such as fertilizer and irrigation.<sup>15</sup>

Normally, the broad floodplains fringing the Senegal River support productive farming, herding, and fishing based on the river's annual floods. During the 1970s, however, the prospect of chronic food shortages and a serious drought encouraged the region's governments to seek international financing for the Manantali Dam on the Bafing River tributary in Mali, and the Diama salt-intrusion barrage near the mouth of the Senegal River between Senegal and Mauritania. These dams were designed to regulate the river's flow to produce hydropower, expand irrigated agriculture, and provide river transport from the Atlantic Ocean to landlocked Mali, which lies to the east of Senegal and Mauritania.

But the plan had unfortunate and unforeseen consequences. Anticipation of the new dams sharply increased land values along the river in areas where high-intensity agriculture would become feasible. The elite in Mauritania, which consists mainly of white Moors, then rewrote legislation governing land ownership, effectively abrogating the rights of black Africans to continue farming, herding, and fishing along the Mauritanian riverbank.<sup>16</sup>

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14. Despite popular perception and the past claims of the United Nations Environment Programme, many experts now believe that the African Sahel (which includes southern Mauritania) is a robust ecosystem that does not exhibit extensive human-induced desertification. There is no clear southward march of the Sahara desert, and ecosystem recovery can be rapid if there is adequate rainfall and a reduction in grazing pressures. See "The Ebb and Flow of the Sahara," *New York Times*, July 23, 1991, p. B9. Overgrazing across the western Sahel, and the consequent migration of people from the region, appear to arise from the expansion of sedentary farming and population growth that together concentrate pastoralists on smaller areas of land (an example of ecological marginalization). In general, pastoralists are weak in the face of modern African states; state development since decolonization has often changed property rights at their expense. See Olivia Bennett, ed., *Greenwar: Environment and Conflict* (London: Panos, 1991), chap. 3, pp. 33–53.

15. G.M. Higgins, et al., *Potential Population Supporting Capacities of Lands in the Developing World*, Technical Report of Project INT/75/P13, "Land Resources of the Future," undertaken by the UN Food and Agriculture Organization (FAO) in collaboration with the International Institute for Applied Systems Analysis (IIASA) and the UN Fund for Population Activities (Rome, 1982), Table 3.5, p. 137.

16. Michael Horowitz, "Victims of Development," *Development Anthropology Network*, Bulletin of the Institute for Development Anthropology, Vol. 7, No. 2 (Fall 1989), pp. 1–8; and Horowitz, "Victims Upstream and Down," *Journal of Refugee Studies*, Vol. 4, No. 2 (1991), pp. 164–181.

There has been a long history of racism by white Moors in Mauritania towards their non-Arab, black compatriots. In the spring of 1989, the killing of Senegalese farmers by Mauritians in the river basin triggered explosions of ethnic violence in the two countries. In Senegal, almost all of the 17,000 shops owned by Moors were destroyed, and their owners were deported to Mauritania. In both countries several hundred people were killed and the two nations nearly came to war.<sup>17</sup> The Mauritanian regime used this occasion to activate the new land legislation, declaring the Mauritians who lived alongside the river to be "Senegalese," thereby stripping them of their citizenship; their property was seized. Some 70,000 of the black Mauritians were forcibly expelled to Senegal, from where some launched raids to retrieve expropriated cattle. Diplomatic relations between the two countries have now been restored, but neither has agreed to allow the expelled population to return or to compensate them for their losses.

We see here the interaction of two sources of human-induced environmental scarcity: degradation of the land resource and population pressures helped precipitate agricultural shortfalls, which in turn encouraged a large development scheme. These factors together raised land values in one of the few areas in either country that offered the potential for a rapid move to high-intensity agriculture. A powerful elite then changed property rights and resource distribution in its own favor, which produced a sudden increase in resource scarcity for an ethnic minority, expulsion of the minority, and ethnic violence.

The water shortage on the occupied West Bank of the Jordan River offers a similar example of how population growth and excessive resource consumption can promote resource capture. While figures vary, Israel's average annual supply of renewable fresh water is about 1,950 million cubic meters (mcm).<sup>18</sup> Current Israeli demand, including that of settlements in the occupied territories and Golan Heights, exceeds this supply by about ten percent. The deficit is covered by overpumping aquifers. As a result, water tables in some parts of Israel and the West Bank have dropped. This can cause the

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17. Jacques Belotteau, "Senegal-Mauritanie: les graves evenements du printemps 1989," *Afrique Contemporaine*, No. 152 (April 1989), pp. 41–42.

18. Miriam Lowi, "West Bank Water Resources and the Resolution of Conflict in the Middle East," Occasional Paper No. 1, Project on Environmental Change and Acute Conflict (September 1992); see also Lowi, "Bridging the Divide: Transboundary Resource Disputes and the Case of West Bank Water," *International Security*, Vol. 18, No. 1 (Summer 1993), pp. 113–138; and Natasha Beschorner, "Water and Instability in the Middle East," Adelphi Paper No. 273 (London: International Institute for Strategic Studies [IISS], Winter 1992/93).

exhaustion of wells and the infiltration of sea water from the Mediterranean.<sup>19</sup> Israel's population growth in the next thirty years, even without major immigration from the former Soviet Union, will probably cause the country's water demand to outstrip supply by at least forty percent.<sup>20</sup>

Over half of Israel's water comes from aquifers, and the rest from river flow, floodwater, and waste-water recycling. Two of the three main aquifers on which Israel depends lie principally underneath the West Bank, although their waters drain into Israel. About forty percent of the groundwater Israel uses (and therefore about a quarter of its sustainable supply) originates in occupied territory. To protect this important source, the Israeli government strictly limits water use by Jewish settlers and Arabs on the West Bank. But there is a stark differential in water access between the groups: on a per capita basis, settlers consume about four times as much as Arabs. Israel restricts the number of wells Arabs can drill in the territory, the amount of water Arabs are allowed to pump, and the times at which they can draw irrigation water. Since 1967, Arabs have not been permitted to drill new wells for agricultural purposes, although the Mekorot (the Israeli water company) has drilled more than thirty wells for settlers' irrigation.

Arab agriculture in the region has also suffered because some Arab wells have become dry or saline as a result of deeper Israeli wells drilled nearby. These Israeli water policies, combined with the confiscation of agricultural land for settlers as well as other Israeli restrictions on Palestinian agriculture, have encouraged many West Bank Arabs to abandon farming and move to towns.<sup>21</sup> Those who have done so have mostly become either unemployed or day laborers within Israel. The links between these processes and the recent unrest in the occupied territories are unclear; many political, economic, and ideological factors operate. But it seems reasonable to conclude that water scarcity and its consequent economic effects contributed to the grievances behind the *intifada* both on the West Bank and in Gaza.

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19. There appears to be an impending crisis, for example, from salinization of aquifers beneath the Gaza Strip, where the pressure on water resources is "rapidly becoming intolerable"; Beschorner, "Water and Instability," pp. 14–15. The Gaza aquifers are connected to the coastal aquifer that is vital to Israel. Salinization can cause irreversible physical changes in aquifers; even if replenished with fresh water, their capacity is reduced. See Fred Pearce, "Wells of Conflict on the West Bank," *New Scientist*, June 1, 1991, pp. 37–38.

20. Lowi, "West Bank Water Resources," p. 34.

21. Since 1967, the irrigated area on the West Bank has dropped from 27 percent of the total cultivated area to 3.5–6 percent. Beschorner, "Water and Instability," pp. 14 and 78.

**ECOLOGICAL MARGINALIZATION.** The Philippines offers a good illustration of ecological marginalization. There, inequalities in access to rich agricultural lowlands combine with population growth to cause migration to easily degraded upland areas; erosion and deforestation contribute to economic hardship that spurs insurgency and rebellion.

Spanish and American colonial policies in the Philippines left behind a grossly unfair distribution of good cropland in lowland regions, an imbalance perpetuated since independence by a powerful landowning elite.<sup>22</sup> Since World War II, green-revolution technologies have greatly increased lowland production of grain for domestic consumption, and of cash crops such as sugar, coconut, pineapple, and bananas that help pay the country's massive external debt. This has raised demand for agricultural labor on large farms, but not enough to compensate for a population growth rate of 2.5 to 3.0 percent per annum. Together, therefore, inequalities in land access and growth in population have produced a surge in agricultural unemployment.

With insufficient rural or urban industrialization to employ this excess labor, there has been unrelenting downward pressure on wages.<sup>23</sup> Economically desperate, millions of poor agricultural laborers and landless peasants have migrated to shantytowns in already overburdened cities, such as Manila. Millions of others have moved to the least productive—and often most ecologically vulnerable—territories, such as steep hillsides.<sup>24</sup> In these uplands, settlers use fire to clear forested or previously logged land. They bring with them little knowledge or money to protect their fragile ecosystems, and their small-scale logging, production of charcoal for the cities, and slash-and-burn farming often cause horrendous environmental damage, particularly water erosion, landslides, and changes in the hydrological cycle.<sup>25</sup> This has set in motion a cycle of falling food production, the clearing of new plots,

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22. The best cropland lies, for the most part, in the coastal plains of the archipelago's islands. Landowning and manufacturing elites are closely linked, and their relative economic power has actually grown since independence: the top 10 percent of the country's families controlled 37 percent of the nation's total income in 1985, up from 27 percent in 1956. See Richard Kessler, *Rebellion and Repression in the Philippines* (New Haven: Yale University Press, 1989), p. 18.

23. Using a standardized figure of 100 for 1972, average real wages dropped from 150 in the early 1950s to about 100 in 1980. Kessler, *Rebellion and Repression*, p. 26.

24. A full account can be found in Maria Concepción Cruz, et al., *Population Growth, Poverty, and Environmental Stress: Frontier Migration in the Philippines and Costa Rica* (Washington, D.C.: WRI, 1992).

25. World Bank, *Philippines: Environment and Natural Resource Management Study* (Washington, D.C.: World Bank, 1989). Erosion rates can exceed 300 tons per hectare per year, ten to twenty times the sustainable rate.

and further land degradation. There are few new areas in the country that can be opened up for agricultural production, so even marginally fertile land is becoming hard to find in many places, and economic conditions are often desperate for the peasants.<sup>26</sup>

The situation in the Philippines is not unique. Ecological marginalization occurs with striking regularity around the planet, affecting hundreds of millions of people in places as diverse as the Himalayas, Indonesia, Costa Rica, Brazil, and the Sahel.

#### SOCIAL AND TECHNICAL INGENUITY

Societies are more able to avoid turmoil if they can adapt to environmental scarcity so that it does not cause great suffering. Strategies for adaptation fall into two categories, and both depend on adequate social and technical ingenuity. First, societies can continue to rely on their indigenous resources but use them more sensibly and provide alternative employment to people who have limited resource access. For example, economic incentives like increases in resource prices and taxes can reduce degradation and depletion by encouraging conservation, technological innovation, and resource substitution. Family planning and literacy campaigns can ease population-growth induced scarcity. Land redistribution and labor-intensive rural industries can relieve the effects of unequal access to good cropland.

Second, the country might “decouple” itself from dependence on its own depleted environmental resources by producing goods and services that do not rely heavily on those resources; the country could then trade the products on the international market for the resources it no longer has at home. Such decoupling might, in fact, be achieved by rapidly exploiting the country’s environmental resources and reinvesting the profits in capital, industrial equipment, and skills to permit a shift to other forms of wealth creation. For instance, Malaysia could use the income from over-logging its forests to fund a modern university system that trains electrical engineers and computer specialists for a high-technology industrial sector.

If either strategy is to succeed, a society must be able to supply enough ingenuity at the right places and times. Two kinds are key. Technical ingenuity is needed to develop, for example, new agricultural and forestry technologies that compensate for environmental loss. Social ingenuity is needed

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26. Gareth Porter and Delfin Ganapin, Jr., *Resources, Population, and the Philippines’ Future: A Case Study*, WRI Paper No. 4 (Washington, D.C.: World Resources Institute, 1988).

to create institutions and organizations that buffer people from the effects of scarcity and provide the right incentives for technological entrepreneurs. Social ingenuity is therefore often a precursor to technical ingenuity. The development and distribution of new grains adapted for dry climates and eroded soils, of alternative cooking technologies to compensate for the loss of firewood, and of water conservation technologies depend on an intricate and stable system of markets, legal regimes, financial agencies, and educational and research institutions.

In the next decades, the need for both technical and social ingenuity to deal with environmental scarcities will rise sharply. Population growth, rising average resource consumption, and persistent inequalities in access to resources ensure that scarcities will affect many environmentally sensitive regions with a severity, speed, and scale unprecedented in history. Resource-substitution and conservation tasks will be more urgent, complex, and unpredictable, driving up the need for technical ingenuity. Moreover, solving these problems through market and other institutional innovations (such as changes in property rights and resource distribution) will require great social ingenuity.

At the same time that environmental scarcity is boosting the demand for ingenuity, however, it may interfere with supply. Poor countries start at a disadvantage: they are underendowed with the social institutions—including the productive research centers, efficient markets, and capable states—that are necessary for an ample supply of both social and technical solutions to scarcity. Moreover, their ability to create and maintain these institutions may be diminished by the very environmental stress they need to address, because scarcity can weaken states, as we shall see, and it can engender intense rivalries between interest groups and elite factions.<sup>27</sup>

### *Evidence Bearing on the Hypotheses*

The findings described above led me to revise the original three hypotheses by redefining the independent variable, “environmental scarcity.” I narrowed the range of environmental problems that were hypothesized to cause conflict, so as to deemphasize atmospheric problems and focus instead on for-

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27. For a full elaboration of the argument in this section, see Homer-Dixon, “The Ingenuity Gap: Can Developing Countries Adapt to Environmental Scarcity?” paper prepared for the Project on Environmental Change and Acute Conflict (March 1994).



ests, water, fisheries, and especially cropland. I expanded the scope of the independent variable to include scarcity caused by population growth and resource maldistribution as well as that caused by degradation and depletion. And I also incorporated into the variable the role of interactions among these three sources of scarcity.

Our research project produced the following empirical evidence bearing on the three hypotheses thus revised.

#### HYPOTHESIS 1: SIMPLE-SCARCITY CONFLICTS BETWEEN STATES

There is little empirical support for the first hypothesis that environmental scarcity causes simple-scarcity conflicts between states. Scarcities of renewable resources such as forests and croplands do not often cause resource wars between states. This finding is intriguing because resource wars have been common since the beginning of the state system. For instance, during World War II, Japan sought to secure oil, minerals, and other resources in China and Southeast Asia, and the 1991 Gulf War was at least partly motivated by the desire for oil.

However, we must distinguish between non-renewable resources such as oil, and renewable resources. Arthur Westing has compiled a list of twelve conflicts in the twentieth century involving resources, beginning with World War I and concluding with the Falklands/Malvinas War.<sup>28</sup> Access to oil or minerals was at issue in ten of these conflicts. Just five conflicts involved renewable resources, and only two of these—the 1969 Soccer War between El Salvador and Honduras, and the Anglo-Icelandic Cod War of 1972–73—concerned neither oil nor minerals (cropland was a factor in the former case, and fish in the latter). However, the Soccer War was not a simple-scarcity conflict between states; rather it arose from the ecological marginalization of Salvadorean peasants and their consequent migration into Honduras.<sup>29</sup> It is evidence in support, therefore, of our second and third hypotheses (below), but not for the first. And, since the Cod War, despite its name, involved very little violence, it hardly qualifies as a resource war.

States have fought more over non-renewable than renewable resources for two reasons, I believe. First, petroleum and mineral resources can be more

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28. Arthur Westing, "Appendix 2. Wars and Skirmishes Involving Natural Resources: A Selection from the Twentieth Century," in Arthur Westing, ed., *Global Resources and International Conflict: Environmental Factors in Strategic Policy and Action* (Oxford: New York, 1986), pp. 204–210.

29. See Durham, *Scarcity and Survival*.

directly converted into state power than can agricultural land, fish, and forests. Oil and coal fuel factories and armies, and ores are vital for tanks and naval ships. In contrast, although captured forests and cropland may eventually generate wealth that can be harnessed by the state for its own ends, this outcome is more remote in time and less certain. Second, the very countries that are most dependent on renewable resources, and which are therefore most motivated to seize resources from their neighbors, also tend to be poor, which lessens their capability for aggression.

Our research suggests that the renewable resource most likely to stimulate interstate resource war is river water.<sup>30</sup> Water is a critical resource for personal and national survival; furthermore, since river water flows from one area to another, one country's access can be affected by another's actions. Conflict is most probable when a downstream riparian is highly dependent on river water and is strong in comparison to upstream riparians. Downstream riparians often fear that their upstream neighbors will use water as a means of coercion. This situation is particularly dangerous if the downstream country also believes it has the military power to rectify the situation. The relationships between South Africa and Lesotho and between Egypt and Ethiopia have this character.<sup>31</sup>

The Lesotho case is interesting. Facing critical water shortages, South Africa negotiated in vain with Lesotho for thirty years to divert water from Lesotho's mountains to the arid South African province of Transvaal. In 1986 South Africa gave decisive support to a successful military coup against Lesotho's tribal government. South Africa declared that it helped the coup because Lesotho had been providing sanctuary to guerrillas of the African National Congress. This was undoubtedly a key motivation, but within months the two governments reached agreement to construct the huge Highlands Water Project to meet South Africa's needs. It seems likely, therefore, that the desire for water was an ulterior motive behind South African support for the coup.<sup>32</sup>

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30. Peter Gleick, "Water and Conflict," Occasional Paper No. 1, Project on Environmental Change and Acute Conflict (September 1992); and Gleick, "Water and Conflict: Fresh Water Resources and International Security," *International Security*, Vol. 18, No. 1 (Summer 1993), pp. 79–112.

31. In 1980, Egyptian President Anwar el-Sadat said, "If Ethiopia takes any action to block our right to the Nile waters, there will be no alternative for us but to use force"; quoted in Norman Myers, "Environment and Security," *Foreign Policy*, No. 74 (Spring 1989), p. 32. See also chap. 6, "The Nile River," in Thomas Naff and Ruth Matson, eds., *Water in the Middle East: Conflict or Cooperation?* (Boulder, Colo.: Westview, 1984), pp. 125–155.

32. "Pretoria Has Its Way in Lesotho," *Africa Report* (March–April, 1986), pp. 50–51; Patrick



However, our review of the historical and contemporary evidence shows that conflict and turmoil related to river water are more often internal than international. The huge dams that are often built to deal with general water scarcity are especially disruptive. Relocating large numbers of upstream people generates turmoil among the relocatees and clashes with local groups in areas where the relocatees are resettled. The people affected are often members of ethnic or minority groups outside the power hierarchy of their society, and the result is frequently rebellion by these groups and repression by the state. Water developments can also induce conflict over water and irrigable land among a country's downstream users, as we saw in the Senegal River basin.<sup>33</sup>

#### HYPOTHESIS 2: POPULATION MOVEMENT AND GROUP-IDENTITY CONFLICTS

There is substantial evidence to support the hypothesis that environmental scarcity causes large population movement, which in turn causes group-identity conflicts. But we must be sensitive to contextual factors unique to each socio-ecological system. These are the system's particular physical, political, economic, and cultural features that affect the strength of the linkages between scarcity, population movement, and conflict.

For example, experts emphasize the importance of both "push" and "pull" factors in decisions of potential migrants.<sup>34</sup> These factors help distinguish migrants from refugees: while migrants are motivated by a combination of push and pull, refugees are motivated mainly by push. Environmental scarcity is more likely to produce migrants than refugees, because it usually develops gradually, which means that the push effect is not sharp and sudden and that pull factors can therefore clearly enter into potential migrants' calculations.

Migrants are often people who have been weak and marginal in their home society and, depending on context, they may remain weak in the receiving society. This limits their ability to organize and to make demands. States play

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Laurence, "A 'New Lesotho'?" *Africa Report* (January–February 1987), pp. 61–64; "Lesotho Water Project Gets Under Way," *Africa Report* (May–June 1988), p. 10. See also Charles Okidi, "Environmental Stress and Conflicts in Africa: Case Studies of African International Drainage Basins," paper prepared for the Project on Environmental Change and Acute Conflict (May 1992).

33. See Thayer Scudder, "River Basin Projects in Africa," *Environment*, Vol. 31, No. 2 (March 1989), pp. 4–32; and Scudder, "Victims of Development Revisited: The Political Costs of River Basin Development," *Development Anthropology Network*, Vol. 8, No. 1 (Spring 1990), pp. 1–5.

34. Astri Suhrke, "Pressure Points: Environmental Degradation, Migration, and Conflict," Occasional Paper No. 3, Project on Environmental Change and Acute Conflict (March 1993).

a critical role here: migrants often need the backing of a state (either of the receiving society or an external one) before they have sufficient power to cause conflict, and this backing depends on the region's politics. Without it, migration is less likely to produce violence than silent misery and death, which rarely destabilizes states.<sup>35</sup> We must remember too that migration does not always produce bad results. It can act as a safety valve by reducing conflict in the sending area. Depending on the economic context, it can ease labor shortages in the receiving society, as it sometimes has, for instance, in Malaysia. Countries as different as Canada, Thailand, and Malawi show the astonishing capacity of some societies to absorb migrants without conflict.

Even accounting for such contextual factors, events in Bangladesh and Northeast India provide strong evidence in support of the second hypothesis. In recent decades, huge numbers of people have moved from Bangladesh to India, producing group-identity conflicts in the adjacent Indian states. Only one of the three sources of environmental scarcity—population growth—seems to be a main force behind this migration. Even though Bangladesh's cropland is heavily used, in general it is not badly degraded, because the annual flooding of the Ganges and Brahmaputra rivers deposits nutrients that help maintain the fertility of the country's floodplains.<sup>36</sup> And while land distribution remains highly unequal, this distribution has changed little since an initial attempt at land reform immediately following East Pakistan's independence from the British.<sup>37</sup>

But the United Nations predicts that Bangladesh's current population of 120 million will nearly double, to 235 million, by the year 2025.<sup>38</sup> Cropland, at about 0.08 hectares per capita, is already desperately scarce. Population density is over 900 people per square kilometer (in comparison, population density in neighboring Assam is under 300 per square kilometer). Since virtually all of the country's good agricultural land has been exploited, population growth will cut in half the amount of cropland available per capita by 2025. Land scarcity and the brutal poverty and social turmoil it engenders have been made worse by flooding (perhaps aggravated by deforestation in

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35. *Ibid.*

36. The relationship between flooding and soil fertility is ill-understood. See James Boyce, "Birth of a Megaproject: Political Economy of Flood Control in Bangladesh," *Environmental Management*, Vol. 14, No. 4 (July/August 1990), pp. 419–428, especially p. 424.

37. James Boyce, *Agrarian Impasse in Bengal: Institutional Constraints to Technological Change* (Oxford: Oxford University Press, 1987), p. 9.

38. Sadik, *The State of the World Population 1991*, p. 43.

the Himalayan watersheds of the region's major rivers); by the susceptibility of the country to cyclones; and by the construction by India of the Farakka Barrage, a dam upstream on the Ganges River.<sup>39</sup>

People have been moving around this part of South Asia in large numbers for centuries. But the movements are increasing in size. Over the last forty years, millions have migrated from East Pakistan or Bangladesh to the Indian states of Assam, Tripura, and West Bengal. Detailed data are scarce, since both India and Bangladesh manipulate their census data for political reasons, and the Bangladeshi government avoids admitting there is large out-migration, because the question causes friction with India. But by piecing together demographic information and experts' estimates, we concluded that migrants from Bangladesh have expanded the population of neighboring areas of India by 12 to 17 million, of which only 1 or 2 million can be attributed to migration induced by the 1971 war between India and Pakistan that created Bangladesh. We further estimate that the population of the state of Assam has been boosted by at least 7 million people, to its current total of 22 million.<sup>40</sup>

This enormous flux has produced pervasive social changes in the receiving regions. It has altered land distribution, economic relations, and the balance of political power between religious and ethnic groups, and it has triggered serious intergroup conflict. Members of the Lalung tribe in Assam, for instance, have long resented Bengali Muslim migrants: they accuse them of stealing the area's richest farmland. In early 1983, during a bitterly contested election for federal offices in the state, violence erupted. In the village of Nellie, Lalung people massacred nearly 1,700 Bengalis in one five-hour rampage.<sup>41</sup>

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39. Controversy surrounds the question of whether Himalayan deforestation contributes to flooding; see Centre for Science and Environment (CSE), *Floods, Flood Plains, and Environmental Myths* (New Delhi: CSE, 1991), especially pp. 68–69. On the Farakka Barrage, Ashok Swain writes: "It has disrupted fishing and navigation [in Bangladesh], brought unwanted salt deposits into rich farming soil, affected agricultural and industrial production, changed the hydraulic character of the rivers and caused changes in the ecology of the Delta." See Swain, "Environmental Destruction and Acute Social Conflict: A Case Study of the Ganges Water Dispute," Department of Peace and Conflict Research, Uppsala University (November 1992), p. 24.

40. Sanjoy Hazarika, "Bangladesh and Assam: Land Pressures, Migration, and Ethnic Conflict," Occasional Paper No. 3, Project on Environmental Change and Acute Conflict (March 1993), p. 52–54.

41. "A State Ravaged," *India Today*, March 15, 1983, pp. 16–21; "Spillover Tension," *India Today*, March 15, 1983, pp. 22–23. The 1991 Indian Census showed that Assam's population growth rate has declined; the conflicts in Assam in the early 1980s appear to have encouraged many migrants from Bangladesh to go to West Bengal instead.

In Tripura, the original Buddhist and Christian inhabitants now make up less than 30 percent of the state's population. The rest are Hindu migrants from either East Pakistan or Bangladesh. This shift in the ethnic balance precipitated a violent insurgency between 1980 and 1988 that diminished only after the government agreed to return land to dispossessed Tripuris and to stop the influx of Bangladeshis. But, as the migration has continued, this agreement is in jeopardy.<sup>42</sup>

There are important features unique to this case. Within Bangladesh, key "push" factors include inheritance practices that divide cropland into smaller plots with each generation, and national and community water-control institutions that sharply limit agricultural output and keep peasants from gaining full benefit from some of the most fertile land in the world.<sup>43</sup> On the "pull" side, the standard of living in India is markedly better, and Indian politicians have often encouraged Bangladeshi migration to garner their votes. Furthermore, in the Ganges-Brahmaputra region, the concept of nation-state is often not part of the local culture. Many people think of the region as "greater Bengal," and state borders do not figure heavily in the calculations of some migrants, especially when there are receptive family, linguistic, and religious groups across the frontier. Finally, during the colonial period, the British used Hindus from Calcutta to administer Assam, and Bengali became the official language. As a result, the Assamese are particularly sensitive to their loss of political and cultural control in the state.

While such contextual factors are important, they cannot obscure the fact that land scarcity in Bangladesh, arising largely from population growth, has been a powerful force behind migration to neighboring regions and communal conflict there.<sup>44</sup>

**HYPOTHESIS 3: ECONOMIC DEPRIVATION, INSTITUTIONAL DISRUPTION,  
AND CIVIL STRIFE**

Empirical evidence partially supports the third hypothesis that environmental scarcity simultaneously increases economic deprivation and disrupts key

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42. Hazarika, "Bangladesh and Assam," pp. 60–61.

43. Boyce, *Agrarian Impasse*.

44. See Shaikat Hassan, "Environmental Issues and Security in South Asia," Adelphi Paper No. 262 (London: IISS, Autumn 1991), pp. 42–43; P.C. Goswami, "Foreign Immigration into Assam," in B.L. Abbi, ed., *Northeast Region: Problems and Prospects of Development* (Chandigarh, India: Centre for Research in Rural and Industrial Development), pp. 35–59; and Susanta Dass, *Spotlight on Assam* (Chanderpur, India: Premier Book Service, 1989).

social institutions, which in turn causes "deprivation" conflicts such as civil strife and insurgency. Environmental scarcity does produce economic deprivation, and this deprivation does cause civil strife. But more research is needed on the effects of scarcity on social institutions.

Resource degradation and depletion often affect economic productivity in poor countries and thereby contribute to deprivation. For example, erosion in upland Indonesia annually costs the country's agricultural economy nearly half a billion dollars in discounted future income.<sup>45</sup> The Magat watershed on the northern Filipino island of Luzon—a watershed representative of many in the Philippines—suffers gross erosion rates averaging 219 tons per hectare per year; if the lost nutrients were replaced by fertilizer, the annual cost would be over \$100 per hectare.<sup>46</sup> Dryland degradation in Burkina Faso reduces the country's annual gross domestic product by nearly nine percent annually because of fuelwood loss and lower yields of millet, sorghum, and livestock.<sup>47</sup>

Vaclav Smil has estimated the combined effect of environmental problems on China's economic productivity.<sup>48</sup> The main burdens he identifies are reductions in crop yields caused by pollution of water, soil, and air; higher human morbidity from air pollution; farmland loss because of construction and erosion; nutrient loss and flooding due to erosion and deforestation; and timber loss arising from poor harvesting practices. Smil calculates the current cost to be at least 15 percent of China's gross national product, and he is convinced that the toll will rise steeply in the next decades.<sup>49</sup> Although China's economy is booming, much of the new wealth is concentrated in the

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45. Robert Repetto, "Balance-Sheet Erosion—How to Account for the Loss of Natural Resources," *International Environmental Affairs*, Vol. 1, No. 2 (Spring 1989), pp. 103–137.

46. This estimate does not include the economic costs of lost rooting depth and increased vulnerability to drought, which may be even larger. See Wilfrido Cruz, Herminia Francisco, and Zenaida Conway, "The On-Site and Downstream Costs of Soil Erosion in the Magat and Pantabangan Watersheds," *Journal of Philippine Development*, Vol. 15, No. 1 (1988), p. 88.

47. Ed Barbier, "Environmental Degradation in the Third World," in David Pearce, ed., *Blueprint 2: Greening the World Economy* (London: Earthscan, 1991), Box 6.8, p. 90.

48. Vaclav Smil, "Environmental Change as a Source of Conflict and Economic Losses in China," Occasional Paper No. 2, Project on Environmental Change and Acute Conflict (December 1992).

49. It is hard to judge gross economic activity in China and convert these figures into dollars. Perhaps because of this, the World Bank has not increased its estimates of per capita annual GNP in line with the rapid expansion of the Chinese economy. Smil suggests that the Bank's current annual figure of \$370/capita may be too low by a factor of four. This judgment is supported by recent re-evaluations of China's GNP by the International Monetary Fund. See World Bank, *World Development Report*, 1992 (New York: Oxford University Press, 1992), p. 218; and Steven Greenhouse, "New Tally of World's Economies Catapults China into Third Place," *New York Times*, May 20, 1993, p. A1.

coastal provinces, especially around Hong Kong; many other parts of the country remain terribly poor.

I originally hypothesized that scarcity would undermine a variety of social institutions. Our research suggests, however, that one institution in particular—the state—is most important. Although more study is needed, the multiple effects of environmental scarcity, including large population movements and economic decline, appear likely to weaken sharply the capacity and legitimacy of the state in some poor countries.

First, environmental scarcity increases financial and political demands on governments. For example, to mitigate the social effects of loss of water, soil, and forest, governments must spend huge sums on industry and infrastructure such as new dams, irrigation systems, fertilizer plants, and reforestation programs. Furthermore, this resource loss can reduce the incomes of elites directly dependent on resource extraction; these elites usually turn to the state for compensation. Scarcity also expands marginal groups that need help from government by producing rural poverty and by displacing people into cities where they demand food, shelter, transport, energy, and employment. In response to swelling urban populations, governments introduce subsidies that drain revenues, distort prices, and cause misallocations of capital, which in turn hinders economic productivity. Such large-scale state intervention in the marketplace can concentrate political and economic power in the hands of a small number of cronies and monopolistic interests, at the expense of other elite segments and rural agricultural populations.

Simultaneously, if resource scarcity affects the economy's general productivity, revenues to local and national governments will decline. This hurts elites that benefit from state largesse and reduces the state's capacity to meet the increased demands arising from environmental scarcity. A widening gap between state capacity and demands on the state, along with the misguided economic interventions such a gap often provokes, aggravates popular and elite grievances, increases rivalry between elite factions, and erodes the state's legitimacy.

Key contextual factors affect whether lower economic productivity and state weakening lead to deprivation conflicts. Civil strife is a function of both the level of grievance motivating challenger groups and the opportunities available to these groups to act on their grievances. The likelihood of civil strife is greatest when multiple pressures at different levels in society interact to increase grievance and opportunity simultaneously. Our third hypothesis says that environmental scarcity will change both variables, by contributing



to economic crisis and by weakening institutions such as the state. But numerous other factors also influence grievance and opportunity.

Contrary to common belief, there is no clear correlation between poverty (or economic inequality) and social conflict.<sup>50</sup> Whether or not people become aggrieved and violent when they find themselves increasingly poor depends, in part, upon their notion of economic justice. For example, people belonging to a culture that inculcates fatalism about deprivation—as with lower castes in India—will not be as prone to violence as people believing they have a right to economic wellbeing. Theorists have addressed this problem by introducing the variable “relative deprivation.”<sup>51</sup> But there is little correlation between measures of relative deprivation and civil conflict.<sup>52</sup>

Part of the problem is that analysts have commonly used aggregate data (such as GNP/capita and average educational levels) to measure individual deprivation.<sup>53</sup> In addition, more recent research has shown that, to cause civil strife, economic crisis must be severe, persistent, and pervasive enough to erode the legitimacy or moral authority of the dominant social order and system of governance. System legitimacy is therefore a critical intervening variable between rising poverty and civil conflict. It is influenced by the aggrieved actors’ subjective “blame system,” which consists of their beliefs about who or what is responsible for their plight.<sup>54</sup>

Serious civil strife is not likely to occur unless the structure of political opportunities facing challenger groups keeps them from effectively expressing their grievances peacefully, but offers them openings for violence against authority.<sup>55</sup> The balance of coercive power among social actors affects the

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50. Some of the best studies of this question have focused on the relationship between poverty and urban violence in the United States. See William Ford and John Moore, “Additional Evidence on the Social Characteristics of Riot Cities,” *Social Science Quarterly*, Vol. 51, No. 2 (September 1970), pp. 339–348; and Robert Jiobu, “City Characteristics and Racial Violence,” *Social Science Quarterly*, Vol. 55, No. 1 (June 1974), pp. 52–64.

51. People are said to be relatively deprived when they perceive a widening gap between the level of satisfaction they have achieved (usually defined in economic terms) and the level they believe they deserve. Deprivation is said to be relative to some subjective standard of equity or fairness; the size of the perceived gap depends upon the beliefs about economic justice held by the individual. See Ted Gurr, *Why Men Rebel* (Princeton: Princeton University Press, 1970).

52. Steven Finkel and James Rule, “Relative Deprivation and Related Theories of Civil Violence: A Critical Review,” in Kurt and Gladys Lang, eds. *Research in Social Movements, Conflicts, and Change* (Greenwich, Conn.: JAI, 1986), pp. 47–69.

53. *Ibid.*

54. These beliefs are grounded in historical and economic experience. See, for example, James Scott, *The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia* (New Haven: Yale University Press, 1976), pp. 1–11.

55. Homer-Dixon, “On the Threshold,” pp. 105–106 and 109–111.

probability of success and, therefore, the expected costs and benefits of different actions by the state, its supporters, and challenger groups. A state debilitated by corruption, by falling revenues and rising demand for services, or by factional conflicts within elites will be more vulnerable to violent challenges by political and military opponents; also vital to state strength is the cohesiveness of the armed forces and its loyalty to civil leadership.<sup>56</sup>

Challengers will have greater relative power if their grievances are articulated and actions coordinated through well-organized, well-financed and autonomous opposition groups. Since grievances felt at the individual level are not automatically expressed at the group level, the probability of civil violence is higher if groups are already organized around clear social cleavages, such as ethnicity, religion, or class. These groups can provide a clear sense of identity and act as nuclei around which highly mobilized and angry elements of the population, such as unemployed and urbanized young men, will coalesce. Conversely, if economic crisis weakens challenger groups more than the state, or affects mainly disorganized people, it will not lead to violence.

Factors that can influence both grievance and opportunity include the leadership and ideology of challenger groups, and international shocks and pressures such as changes in trade and debt relations and in costs of imported factors of production such as energy.<sup>57</sup> The rapid growth of urban areas in poor countries may have a similar dual effect: people concentrated in slums can communicate more easily than those in scattered rural villages; this may reinforce grievances and, by reducing problems of coordination, also increase the power of challenger groups. Research shows, however, surprisingly little historical correlation between rapid urbanization and civil strife;<sup>58</sup> and the exploding cities of the developing world have been remarkably quiescent in recent decades. This may be changing: India has lately witnessed ferocious urban violence, often in the poorest slums, and sometimes directed at new

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56. See Farrokh Moshiri, "Revolutionary Conflict Theory in an Evolutionary Perspective," in Jack Goldstone, Ted Gurr, and Farrokh Moshiri, eds., *Revolutions of the Late Twentieth Century* (Boulder, Colo.: Westview, 1991), pp. 4–36; and Goldstone, "An Analytical Framework," *ibid.*, pp. 37–51.

57. For a review of some of these factors, see Jack Goldstone, "Theories of Revolution: The Third Generation," *World Politics*, Vol. 32, No. 3 (April 1980), pp. 425–453.

58. Wayne Cornelius, Jr., "Urbanization As an Agent in Latin American Political Instability: The Case of Mexico," *American Political Science Review*, Vol. 63, No. 3 (September 1969), pp. 833–357; and Abdul Lodhi and Charles Tilly, "Urbanization, Crime, and Collective Violence in 19th-Century France," *American Journal of Sociology*, Vol. 79, No. 2 (September 1973), pp. 296–318.



migrants from the countryside.<sup>59</sup> In Egypt, fundamentalist opposition to the government is located in some of the most desperate sectors of Cairo and other cities such as Asyut.

The Philippines provides evidence of the links between environmental scarcity, economic deprivation, and civil strife. The country has suffered from serious strife for many decades, usually motivated by economic stress.<sup>60</sup> Today, cropland and forest degradation in the uplands sharply exacerbates this economic crisis. The current upland insurgency—including guerrilla attacks and assaults on military stations—is motivated by the poverty of landless agricultural laborers and farmers displaced into the remote hills, where the central government is weak.<sup>61</sup> During the 1970s and 1980s, the communist New People's Army and the National Democratic Front found upland peasants receptive to revolutionary ideology, especially where coercive landlords and local governments left them little choice between rebellion and starvation. The insurgency has waned somewhat since President Marcos left, not because economic conditions have improved much in the countryside, but because the democratically elected central government is more legitimate and the insurgent leadership is ideologically rigid.

Contextual factors are key to a full understanding of this case. Property rights governing upland areas are, for the most part, either nonexistent or very unclear. Legally these areas are a public resource, and their "open access" character encourages in-migration. Yet many upland peasants find themselves under the authority of concessionaires and absentee landlords who have claimed the land. Neither peasants, nor concessionaires, nor landlords, however, have secure enough title to have incentive to protect the land from environmental degradation. Increasing external debt encouraged the Marcos government, under pressure from international financial agencies, to adopt draconian stabilization and structural adjustment policies. These caused an economic crisis in the first half of the 1980s, which boosted

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59. Sanjoy Hazarika, "Week of Rioting Leaves Streets of Bombay Empty," *New York Times*, January 12, 1993, p. A3.

60. The Huk rebellion in the late 1940s and early 1950s provides some of the best evidence for the link between economic conditions (especially unequal land distribution) and civil strife in the Philippines. See Benedict Kerkvliet, *The Huk Rebellion: A Study of Peasant Revolt in the Philippines* (Quezon City, Philippines: New Day Publishers, 1979); and E.J. Mitchell, "Some Econometrics of the Huk Rebellion," *American Political Science Review*, Vol. 63, No. 4 (December 1969), pp. 1159–1171.

61. Celso Roque and Maria Garcia, "Economic Inequality, Environmental Degradation and Civil Strife in the Philippines," paper prepared for the Project on Environmental Change and Acute Conflict (1993).

agricultural unemployment, reduced opportunities for alternative employment in urban and rural industries, and gave a further push to migration into the uplands.<sup>62</sup>

Finally, the insurgents gained adherents because they built on indigenous beliefs and social structures to help the peasants define their situation and focus their discontent. The most successful rebellions in Filipino history have drawn on peasants' millenarian vision—rooted in their Catholicism—of “an idealized pre-Spanish condition of wholeness.”<sup>63</sup> The current insurgency has been particularly potent because it mingles “the spiritual search for liberation and the political search for independence, into the overarching quest for Filipino identity.”<sup>64</sup> This has provided peasants with an alternative moral system to the traditional patron-client relationship between peasants and landowners. The feudal norms imposed obligations on landowners, which gave peasants rudimentary economic security, but disintegrated with the commercialization of agriculture and the urbanization of elites in the early and mid-twentieth century.<sup>65</sup>

Causal processes like those in the Philippines can be seen around the planet: population growth and unequal access to good land force huge numbers of rural people into cities or onto marginal lands. In the latter case, they cause environmental damage and become chronically poor. Eventually these people may be the source of persistent upheaval, or they may migrate yet again, stimulating ethnic conflicts or urban unrest elsewhere.

The rise of the Sendero Luminoso rebellion in Peru can be attributed to a subsistence crisis caused, in part, by such a process of ecological marginalization.<sup>66</sup> The country's mountainous southern highlands are not suitable for farming. The hills are steep, and the soil is thin and dry. Nonetheless, during

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62. Maria Concepción Cruz and Robert Repetto, *The Environmental Effects of Stabilization and Structural Adjustment Programs: The Philippines Case* (Washington, D.C.: World Resources Institute, 1992). See also Francisco Lara, Jr., “Structural Adjustments and Trade Liberalization: Eating Away Our Food Security,” *PPI Research Papers* (Quezon City: Philippine Peasant Institute [PPI], 1991); and Robin Broad, *Unequal Alliance, 1979–1986: The World Bank, the International Monetary Fund, and the Philippines* (Quezon City: Ateneo de Manila University Press, 1988).

63. Kessler, *Rebellion and Repression*, pp. 24–25.

64. *Ibid.*

65. *Ibid.*, pp. 16–19. See also Reynaldo Clemena Iletto, *Pasyon and Revolution: Popular Movements in the Philippines, 1840–1910* (Manila: Ateneo de Manila University Press, 1979).

66. Cynthia McClintock, “Why Peasants Rebel: The Case of Peru's Sendero Luminoso,” *World Politics*, Vol. 37, No. 1 (October 1984), pp. 48–84; and McClintock, “Peru's Sendero Luminoso Rebellion: Origins and Trajectory,” in Susan Eckstein, ed., *Power and Popular Protest: Latin American Social Movements* (Berkeley: University of California Press, 1989), pp. 61–101.

the colonial period, Indian peoples in the region were displaced onto hillsides when Spanish settlers seized richer valley lands. In the 1970s, the Velasco government undertook a sweeping land-redistribution program. But people in the highlands benefited little, because the government was reluctant to break up large agricultural enterprises that generated much of the country's export earnings.

Natural population growth and a lack of good land or jobs elsewhere boosted population densities in the southern highlands. The department of Ayacucho saw density increase from 8.1 people per square kilometer in 1940 to 12.1 in 1980. Cropland availability dropped below .2 hectare per capita.<sup>67</sup> These densities exceed sustainable limits, given the inherent fragility of the region's land and prevailing agricultural practices. Cropland has therefore been badly degraded by erosion and nutrient depletion.

Cynthia McClintock notes that, "if population increases while the soil deteriorates, food production per-capita can be expected to decline."<sup>68</sup> Wealth in the region is almost entirely derived from subsistence agriculture. Family incomes—already among the lowest in Peru—dropped sharply in real terms in the 1970s and 1980s; in 1980, per-capita income in the Peruvian highlands was 82 percent of the 1972 level. This poverty resulted in declining caloric intake; in 1980 people in the southern highlands had less than 70 percent of the daily requirement set by the FAO. In 1983, a drought made the subsistence crisis even worse, and production of the staple crop of potatoes fell by 40–50 percent.

While government policies were partly responsible for the long-term income decline in the Peruvian highlands, the particularly harsh drop in the southern region was a result of population pressures, poor land, and the lack of alternative sources of income. The peasants' sense of deprivation was increased by the land reform in the 1970s, which raised their expectations in vain. There is thus a strong correlation between areas suffering severe poverty and areas of Sendero Luminoso strongholds: "the sine-qua-non element" of these strongholds is "the subsistence crisis in the country's southern highlands during the early 1980s."<sup>69</sup>

In terms of contextual factors, Ayacucho offered special opportunities to insurgents. It is physically remote, which reduced the government's control,

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67. McClintock, "Why Peasants Rebel," pp. 61 and 63.

68. *Ibid.*, p. 63.

69. *Ibid.*, p. 82.

and it has a major university that served as an organizational base for radicals that became the core of Sendero. The university's remoteness also meant that students were disproportionately from the peasantry, and could therefore return to their communities with ease; moreover, they were less likely to find professional jobs on graduation. The relative power of the government was also weakened, ironically, by the land reform, which caused large landowners to leave the region. The Velasco regime did not fill the vacuum with new political and security institutions, in part because an economic downturn later in the decade reduced the government's resources for the task.

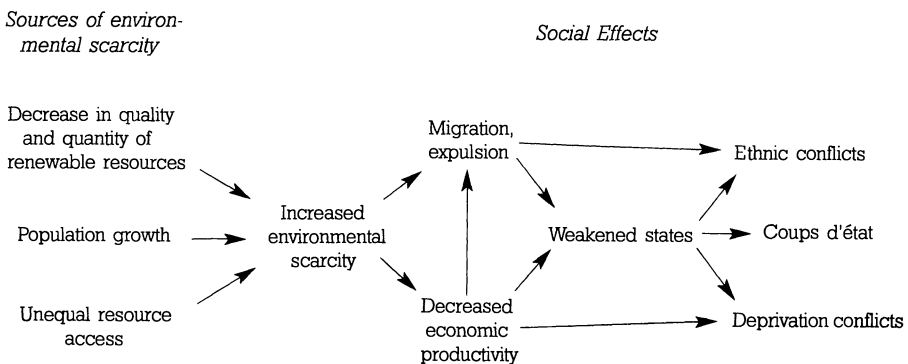
McClintock believes that the poverty of these regions condemns the country to chronic, long-term turmoil. The government may be civilian, but is unlikely to be very democratic, and will confront "virtually constant revolutionary and criminal violence."

**A COMBINED MODEL**

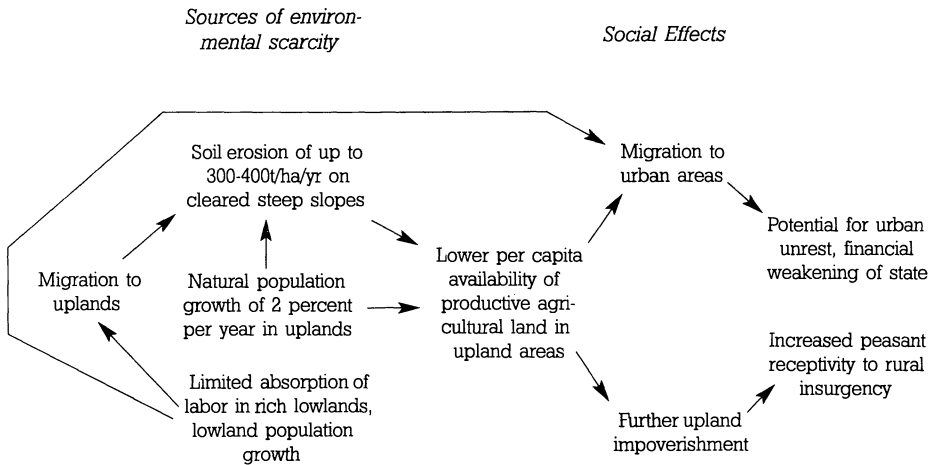
There are important links between the processes identified in the second and third hypotheses. For example, although population movement is sometimes caused directly by scarcity, more often it arises from the greater poverty caused by this scarcity. Similarly, the weakening of the state increases the likelihood not only of deprivation conflicts, but of group-identity conflicts.

It is useful, therefore, to bring the hypotheses together into one model of environment-conflict linkages (Figure 2). Decreases in the quality and quan-

**Figure 2. Some Sources and Consequences of Environmental Scarcity.**



**Figure 3. Environmental Scarcity in the Philippines.**



NOTE: The variables and linkages in Figure 3 map onto Figure 2, with the source of scarcity on the left and the forms of conflict on the right.

tity of renewable resources, population growth, and unequal resource access act singly or in various combinations to increase the scarcity, for certain population groups, of cropland, water, forests, and fish. This can reduce economic productivity, both for the local groups experiencing the scarcity and for the larger regional and national economies. The affected people may migrate or be expelled to new lands. Migrating groups often trigger ethnic conflicts when they move to new areas, while decreases in wealth can cause deprivation conflicts such as insurgency and rural rebellion. In developing countries, the migrations and productivity losses may eventually weaken the state which in turn decreases central control over ethnic rivalries and increases opportunities for insurgents and elites challenging state authority. Figure 3 shows how these linkages work in the Filipino case.

South Africa and Haiti illustrate this combined model. In South Africa, apartheid concentrated millions of blacks in some of the country's least productive and most ecologically sensitive territories, where population densities were worsened by high natural birth rates. In 1980, rural areas of the Ciskei homeland had 82 people per square kilometer, whereas the surround-

ing Cape Province had a rural density of 2. Homeland residents had little capital and few resource-management skills and were subject to corrupt and abusive local governments. Sustainable development in such a situation was impossible, and wide areas were completely stripped of trees for fuelwood, grazed down to bare dirt, and eroded of top soil. A 1980 report concluded that nearly 50 percent of Ciskei's land was moderately or severely eroded, and nearly 40 percent of its pasturage was overgrazed.<sup>70</sup>

This loss of resources, combined with a lack of alternative employment and the social trauma caused by apartheid, created a subsistence crisis in the homelands. Thousands of people have migrated to South African cities, which are as yet incapable of adequately integrating and employing these migrants. The result is the rapid growth of squatter settlements and illegal townships that are rife with discord and that threaten the country's move to democratic stability.<sup>71</sup>

In Haiti, the irreversible loss of forests and soil in rural areas deepens an economic crisis that spawns social strife, internal migration, and an exodus of "boat people." When first colonized by the Spanish in the late fifteenth century and the French in the seventeenth century, Haiti was treasured for its abundant forests. Since then, Haiti has become one of the world's most dramatic examples of environmental despoliation. Less than two percent of the country remains forested, and the last timber is being felled at four percent per year.<sup>72</sup> As trees disappear, erosion follows, worsened by the steepness of the land and by harsh storms. The United Nations estimates that at least 50 percent of the country is affected by topsoil loss that leaves the land "unreclaimable at the farm level."<sup>73</sup> So much soil washes off the slopes that the streets of Port-au-Prince have to be cleared with bulldozers in the rainy season.

Unequal land distribution was not a main cause of this catastrophe. Haiti gained independence in 1804 following a revolt of slaves and ex-slaves against

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70. Francis Wilson and Mamphela Ramphele, *Uprooting Poverty: The South African Challenge* (New York: Norton, 1989); George Quail, et al., *Report of the Ciskei Commission* (Pretoria: Conference Associates, 1980), p. 73.

71. See Mamphela Ramphele and Chris McDowell, eds., *Restoring the Land: Environment and Change in Post-Apartheid South Africa* (London: Panos, 1991); and Chris Eaton, "Rural Environmental Degradation and Urban Conflict in South Africa," Occasional Paper of the Peace and Conflict Studies Program, University of Toronto, June 1992.

72. WRI, *World Resources, 1992-93*, p. 286.

73. Global Assessment of Soil Degradation, *World Map on Status of Human-Induced Soil Degradation*, Sheet 1, North and South America.

the French colonial regime. Over a period of decades, the old plantation system associated with slavery was dismantled, and land was widely distributed in small parcels.<sup>74</sup> As a result, Haiti's agricultural structure, unique to Latin America, has 73 percent of cropland in private farms of less than 4 hectares.<sup>75</sup>

But inheritance customs and population growth have combined to produce scarcity, as in Bangladesh. Land has been subdivided into smaller portions with each generation. Eventually the plots cannot properly support their cultivators, fallow periods are neglected, and greater poverty prevents investment in soil conservation. The poorest people leave for steeper hillsides, where they clear the forest and begin farming anew, only to exhaust the land in a few years.<sup>76</sup> Many peasants try to supplement their falling incomes by scavenging wood for charcoal production, which contributes to further deforestation.

These processes might have been prevented had a stable central government invested in agriculture, industrial development, and reforestation. Instead, since independence Haiti has endured a ceaseless struggle for power between black and mulatto classes, and the ruling regimes have been solely interested in expropriating any surplus wealth the economy generated. Today, over 60 percent of the population is still engaged in agriculture, yet capital is unavailable for agricultural improvement, and the terms of exchange for crop production favor urban regions.<sup>77</sup> The population growth rate has actually increased, from 1.7 percent in the mid-1970s to over 2 percent today: the UN estimates that the current population of 6.75 million will grow to over 13 million by 2025.<sup>78</sup> As the land erodes and the population grows, incomes shrink: agricultural output per capita has decreased ten percent in the last decade.<sup>79</sup>

Analysts agree that rising rural poverty has caused ever-increasing rural-rural and rural-urban migration. In search of work, agricultural workers move

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74. Thomas Weil, et al., *Haiti: A Country Study* (Washington, D.C.: Department of the Army, 1982), pp. 28–33.

75. Anthony Catanese, "Haiti's Refugees: Political, Economic, Environmental," *Field Staff Reports*, No. 17 (Sausalito, Calif.: Universities Field Staff International, Natural Heritage Institute, 1990–91), p. 5.

76. Elizabeth Abbott, "Where Waters Run Brown," *Equinox*, Vol. 10, No. 59 (September/October 1991), p. 43.

77. Marko Ehrlich, et al., *Haiti: Country Environmental Profile, A Field Study* (Washington, D.C.: U.S. Agency for International Development, 1986), pp. 89–92.

78. WRI, *World Resources, 1992–93*, p. 246.

79. *Ibid.*, p. 272.



from subsistence hillside farms to rice farms in the valleys. From there, they go to cities, especially to Port-au-Prince, which now has a population of over a million. Wealthier farmers and traders, and even those with slimmer resources, try to flee by boat.

These economic and migration stresses are undoubtedly contributing to civil strife. In the aftermath of the collapse of "Baby Doc" Duvalier's regime in 1986, the poor unleashed their vengeance on those associated with the regime, in particular on Duvalier's gangs of enforcers, the *tontons macoutes*. During his election campaign and his short tenure as president, Jean-Bertrand Aristide reportedly encouraged poor slum-dwellers to attack Haiti's elite. Fearful of uprisings, the current military regime has ferociously oppressed the country's poor and peasantry. Even if the present political stalemate is resolved, Aristide is returned to power, and international sanctions are lifted, Haiti will be forever bear the burden of its irreversibly ravaged environment, which may make it impossible to build a prosperous, just, and peaceful society.

#### THE CAUSAL ROLE OF ENVIRONMENTAL SCARCITY

Environmental scarcity often acts as a powerful long-term social stressor, but does it have any independent role as a cause of conflict? Many analysts assume that it is no more than a fully endogenous intervening variable linking political, economic, and social factors to conflict. By this view, environmental scarcity may be an important indicator that political and economic development has gone awry, but it does not merit, in and of itself, intensive research and policy attention at the expense of more fundamental political and economic factors.

But the cases reviewed here highlight three reasons why this view is wrong. First, as we saw in the Senegal and Jordan basins, environmental scarcity can itself be an important force behind changes in the politics and economics governing resource use. In both cases, scarcity caused powerful actors to increase in their own favor the inequities in the distribution of resources. Second, ecosystem vulnerability is often an important variable contributing to environmental scarcity, and this vulnerability is, at least in part, an independent physical factor: the depth of soils in the Filipino uplands and the vulnerability of Israel's aquifers to salt intrusion are not functions of human social institutions or behavior. Third, in many parts of the world—including regions of the Philippines, Haiti, Peru, and South Africa—environmental degradation has crossed a threshold of irreversibility. Even if enlight-



ened social change removes the original political, economic, and cultural causes of the degradation, it will be a continuing burden on society. Once irreversible, in other words, environmental degradation becomes an exogenous variable.

### *Implications for International Security*

Environmental scarcity has insidious and cumulative social impacts, such as population movement, economic decline, and the weakening of states. These can contribute to diffuse and persistent sub-national violence. The rate and extent of such conflicts will increase as scarcities worsen.

This sub-national violence will not be as conspicuous or dramatic as interstate resource wars, but it will have serious repercussions for the security interests of both the developed and the developing worlds. Countries under such stress may fragment as their states become enfeebled and peripheral regions are seized by renegade authorities and warlords. Governments of countries as different as the Philippines and Peru have lost control over outer territories; although both these cases are complicated, it is nonetheless clear that environmental stress has contributed to their fragmentation. Fragmentation of any sizeable country will produce large outflows of refugees; it will also hinder the country from effectively negotiating and implementing international agreements on collective security, global environmental protection, and other matters.

Alternatively, a state might keep scarcity-induced civil strife from causing its progressive enfeeblement and fragmentation by becoming a "hard" regime that is authoritarian, intolerant of opposition, and militarized. Such regimes are more prone to launch military attacks against neighboring countries to divert attention from internal grievances. If a number of developing countries evolve in this direction, they could eventually threaten the military and economic interests of rich countries.

A state's ability to become a hard regime in response to environmentally induced turmoil depends, I believe, on two factors. First, the state must have sufficient remaining capacity—despite the debilitating effects of scarcity—to mobilize or seize resources for its own ends; this is a function of the internal organizational coherence of the state and its autonomy from outside pressures. Second, there must remain enough surplus wealth in the country's ecological-economic system to allow the state, once it seizes this wealth, to pursue its authoritarian course. Consequently, the countries with the highest

probability of becoming "hard" regimes, and potential threats to their neighbors, are large, relatively wealthy developing countries that are dependent on a declining environmental base and that have a history of state strength. Candidates include Indonesia and, perhaps, Nigeria.

Our research suggests that environmental pressures in China may cause the country's fragmentation.<sup>80</sup> This is not the received wisdom: most experts have been distracted by the phenomenal economic expansion in China's coastal areas; they have tended to project these trends onto the rest of the country and to neglect the dangers posed by resource scarcities.<sup>81</sup> The costs of misreading of the Chinese situation could be very high. China has over one-fifth of the world's population, a huge military with growing power-projection capability, and unsettled relations with some of its neighbors. The effects of Chinese civil unrest, mass violence, and state disintegration could spread far beyond its borders.

Chinese fertility rates peaked at the height of the cultural revolution between 1969 and 1972. Population growth will peak at about 17 million per year in the mid-1990s, as the babies born during the cultural revolution reach their reproductive years. In the late 1980s and early 1990s, specialists tempered their optimism about Chinese ability to bring population growth down to replacement rate.<sup>82</sup> Market liberalization in the countryside undermined the one-child policy. In rural areas state coercion seemed less effective, and peasants enriched by market reforms could more easily pay fines. In some provinces, therefore, it became common for families to have two or three children. The most recent evidence, however, suggests that Chinese authorities have renewed their commitment to controlling population growth. In response to often extremely coercive measures by low-level officials, fertility rates have fallen below two children per woman for the first time.<sup>83</sup> But

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80. Smil, "Environmental Change as a Source of Conflict and Economic Losses in China"; Jack Goldstone, "Imminent Political Conflict Arising from China's Environmental Crises," Occasional Paper No. 2, Project on Environmental Change and Acute Conflict (December 1992).

81. See, for example, Barber Conable and David Lampton, "China: The Coming Power," *Foreign Affairs*, Vol. 72, No. 5 (Winter 1992/93), pp. 133-149. In their assessment of the pressures on contemporary China, the authors devote only half a sentence to demographic and environmental stresses.

82. Griffith Feeney, et al., "Recent Fertility Dynamics in China: Results from the 1987 One Percent Population Survey," *Population and Development Review*, Vol. 15, No. 2 (June 1989), pp. 297-321; Shanti Conly and Sharon Camp, "China's Family Planning Program: Challenging the Myths," *Country Study Series*, No. 1 (Washington, D.C.: Population Crisis Committee, 1992).

83. Nicholas Kristof, "China's Crackdown on Births: A Stunning, and Harsh, Success," *New York Times*, April 25, 1993, p. A1.

experts are not sure that this accomplishment can be sustained for long, and even if it is, China's population will continue to grow well into the next century.

Only two poor populous countries in the world have less arable land per capita than China: Egypt and Bangladesh. In fact, 300 million people in China's interior have even less arable land than the Bangladeshis. China has little scope to expand irrigated and arable land, although it might be able to increase the intensity of irrigation in some places. Consequently, continued population growth and loss of cropland mean that China will have 25 percent less arable land per capita by 2010. Moreover, the remaining land will often be of declining quality: every year the country loses as much nitrogen and phosphorous from soil erosion as it applies in inorganic fertilizer. Vaclav Smil notes that many experts and senior authorities in China are frightened by the environmental situation, believing the country has already crossed key thresholds of unsustainability. Grain is a constant preoccupation of the leadership, and imports even into rich areas may soon be necessary. Already, tens of millions of Chinese are trying to migrate from the country's interior and northern regions, where water and fuelwood are desperately scarce and the land is often badly damaged, to the booming coastal cities. Smil expects bitter disputes among these regions over migration and water sharing.

Jack Goldstone has estimated the consequences of these stresses for social stability. He notes that population and resource pressures led to widespread civil violence in China during the Ming and Qing dynasties.<sup>84</sup> The current regime recognizes that such pressures will cause mounting grievances in the worst-affected regions. "The rapidly growing population of the north and west cannot be fed and employed within those regions," Goldstone writes. "There is not sufficient land, nor sufficient water, to provide for the additional hundreds of millions that will be born in the next decades."<sup>85</sup> If large-scale migration out of the region is blocked, deprivation conflicts in the northwest are likely. Coupled with merchant and worker resistance in the major cities, they would probably lead to the fall of the central government. If the migration is diverted into China's southern countryside, deprivation and group-identity conflicts are likely to result there.

The only realistic policy is to permit movement to the wealthy coastal cities. Coastal areas must therefore be allowed to continue their rapid eco-

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84. For a full analysis, see Jack Goldstone, *Revolution and Rebellion in the Early Modern World* (Berkeley: University of California Press, 1991).

85. Goldstone, "Imminent Political Conflicts Arising from China's Environmental Crises," p. 52.

conomic growth to absorb surplus labor. But, Goldstone argues, the Beijing government will have great difficulty maintaining economic and political control over this process. Economic liberalization helps to mobilize the population by dissolving long-standing social relations, and this weakens the Communist Party's ability to micro-manage Chinese society. Moreover, the Party is divided from the very non-Party elites that are rapidly expanding because of economic growth, including student, business, and professional groups. Further growth will depend on private domestic investment, which will encourage these elites, and also workers in private industry, to demand democratization and responsiveness of the regime. The Party has also been weakened by deep internal disagreements over the rate and degree of economic and political liberalization; suspicions about the reliability of the Army; and worker discontent that remains high throughout the country.

Divisions within the regime and among elites, combined with an increasingly mobilized population, create greater opportunities for challenges to central authority. But resource and population pressures force the regime to pursue policies, such as further economic liberalization, that only weaken it more. Goldstone believes that long-term stability would be more likely if China were to begin serious democratization soon, but he is not sanguine. Central authorities will probably refuse to recognize their loosening grip on the society, and this will eventually prompt secessionist movements in Moslem lands to the west and Tibet in the South. Sichuan may also seek independence. "Once the glue of unified communist rule dissolves, China may once again, as it has so often in its history following the fall of unifying dynasties, experience a decade or even century-long interregnum of warring among regional states."<sup>86</sup>

## *Conclusions*

Our research shows that environmental scarcity causes violent conflict. This conflict tends to be persistent, diffuse, and sub-national. Its frequency will probably jump sharply in the next decades as scarcities rapidly worsen in many parts of the world. Of immediate concern are scarcities of cropland, water, forests, and fish, whereas atmospheric changes such as global warm-

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86. *Ibid.*, p. 54.

ing will probably not have a major effect for several decades, and then mainly by interacting with already existing scarcities.

The degradation and depletion of environmental resources is only one source of environmental scarcity; two other important sources are population growth and unequal resource distribution. Scarcity often has its harshest social impact when these factors interact. As environmental scarcity becomes more severe, some societies will have a progressively lower capacity to adapt. Of particular concern is the decreasing capacity of the state to create markets and other institutions that promote adaptation. The impact of environmental scarcity on state capacity deserves further research.

Countries experiencing chronic internal conflict because of environmental stress will probably either fragment or become more authoritarian. Fragmenting countries will be the source of large out-migrations, and they will be unable to effectively negotiate or implement international agreements on security, trade and environmental protection. Authoritarian regimes may be inclined to launch attacks against other countries to divert popular attention from internal stresses. Any of these outcomes could seriously disrupt international security. The social impacts of environmental scarcity therefore deserve concerted attention from security scholars.