ENVIRONMENTAL SCARCITY AS A CAUSE OF VIOLENT CONFLICT

A Monograph
By
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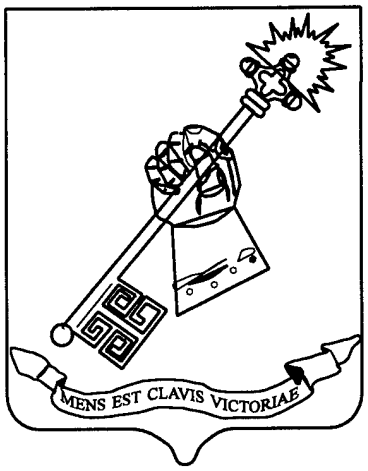
Military Intelligence



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Abstract

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Gulf War images of oil soaked birds and burning oil wells continue to generate academic research on the environment as both a victim and a weapon of war. The resulting literature has sensitized policy makers and military leaders to the environmental costs of conflict and military preparedness. Regrettably, this narrow focus obscures a potentially more ominous role for the environment as a cause of conflict. Within the complex web of causality, the increasing scarcity of renewable resources such as fresh water, forests, and arable land portends to be the leading cause of conflict in the 21st century.

This monograph proves that environmental scarcity is a cause of violent conflict. Using the Modified Conflict Causality Model and six case studies, the monograph shows that scarcity generates adverse social effects which, in turn, cause violent conflict. After proving causality, the monograph looks at three implications. First, recent Operations Other Than War in Somalia, Rwanda, and Haiti treated the symptoms of scarcity without solving the underlying environmental problems. Consequently, conflicts in those countries are likely to recur, rendering the long-term outcomes of the operations as failures. Second, conflicts arising from environmental scarcity will occur more frequently in the future, threatening U.S. national security interests. Third, doctrine reveals that the Army is unprepared intellectually to contend with scarcity as a cause of violent conflict.

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Chapter One
Introduction

SYRIA AND IRAQ INVADE TURKEY

ANKARA, Turkey--Syrian and Iraqi military forces invaded Turkey shortly before midnight Wednesday. Initial reports from the Turkish capital indicate that aircraft bombed airfields, bridges, and hydroelectric facilities in the Anatolia region in southeast Turkey and that armored units attacked across the border at four locations. Turkish Prime Minister Kayam stated that "Syrian forces were in the vicinity of the Ataturk Dam on the Euphrates River and Iraqi forces were rapidly approaching the Tigris River." Military analysts believe that the Syrian-Iraqi alliance intends to control key dams on the rivers and gain territory to trade for concessions on water rights after a ceasefire is implemented.

Both rivers originate in the mountains of eastern Turkey. The Euphrates flows through Syria and Iraq, whereas the Tigris flows directly through Iraq. Population growth in Syria and Iraq has resulted in serious water deficits since 1999. The two nations formed an alliance in 2001 after Turkey announced plans to expand its Greater Anatolian River Project. The invasion follows Turkey's announcement yesterday to stop the flow of the Euphrates River for 30 days to fill a reservoir behind the newly completed Ozal dam. (Thursday, May 23, 2002 The Leavenworth Observer)

Gulf War images of oil soaked birds and burning oil wells continue to generate academic research on the environment as both a victim and a weapon of war.[1] The resulting literature has sensitized policy makers and military leaders to the environmental costs of conflict and military preparedness.[2] Regrettably, this narrow focus neglects a potentially more ominous role for the environment as a cause of conflict. Although historians rarely agree on the causes of conflict, the fictitious newspaper article offers a scenario in which environmental factors play a significant and previously neglected role in causing conflict. In the article, competition for the most basic of all natural resources--water--degenerated into a conflict in which Syria and Iraq saw their survival threatened by Turkey's development schemes.[3]

Conflicts over natural resources are not new phenomena. After all, few states are self-sufficient in all of the natural resources that they require for survival or desire for continued development. For example, Upper Egypt invaded Lower Egypt in 3200 BC to secure additional arable land for its growing population.[4] More recently, Israel conducted airstikes against Syria in April 1967 to destroy water diversion facilities on the Jordan River, Israel's primary source of fresh water.[5] Although such cases are not unique, historians often have failed to recognize the importance of environmental factors. Recent research efforts are reversing this oversight, revealing an alarming trend: the number of wars, revolutions, guerrilla movements, and other forms of violent conflict in which the environment is a contributing cause are increasing in frequency and scope.[6] Lester Brown, Project Director at the Worldwatch Institute, noted: "archaeological sites on every continent are littered with the remains of civilizations that were unable to cope with the forces of environmental degradation. The difference today is the rate and scale: pressure that once accumulated over centuries, or even millennia, are [sic] now compressed into decades."[7] The sporadic and limited conflicts typified by Upper Egypt's expansion and Israel's act of self-preservation may yield to a future fraught with conflicts more akin to the fictitious invasion of Turkey.

In 1994, when the U.S. was disengaging from Somalia, deploying to Rwanda, and preparing for Haiti, an Atlantic Monthly article portrayed a world in which such conflicts would become commonplace. Robert Kaplan's "The Coming Anarchy" offers a vision of a future beset with collapsing state authority. The primary villain in his analysis is environmental degradation. Kaplan contends that security analysts and the media often

ascribe violent conflicts to ethnic and religious discord, disregarding the role of the environment.[8] Kaplan's article provides an alternative vision to Samuel Huntington's "The Clash of Civilizations," which offers cultural differences as the foremost cause of future conflict.[9] Although no less dire in its outlook, Kaplan's article considers the environmental factors that give rise to ethnic and religious conflict. Consequently, clan warfare in Somalia and tribal conflict in Rwanda may be manifestations of environmental problems.

The most significant environmental problem is the increasing scarcity of renewable resources. Renewable resources include fresh water, forests, fertile soils, and the earth's ozone layer. Scarcity results from three factors: a decline in the quality or quantity of a resource, population growth, and the unequal distribution of the resource. As explained by Thomas Homer-Dixon, a professor at the University of Toronto, a "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."[10] The resulting scarcity may generate social effects such as population migration, economic deprivation, and institutional disruption which, in turn, may cause violent conflicts.[11]

The hypothesis of this monograph is that environmental scarcity is a cause of violent conflict. As a result, military operations may treat the symptoms of environmental scarcity without addressing the underlying problems. For example, Operations Other Than War (OOTW) may reduce migration or starvation without correcting the scarcity which led to such conditions. Thus, the U.S. may expend lives and resources to achieve short term successes only to witness long term failures. Since conflicts caused by

environmental scarcities may dominate the future, the Army should consider the implications for OOTW and doctrine.

This monograph argues that the Army is unprepared for the implications of environmental scarcity as a cause of violent conflict. The proof follows in the next three chapters. Chapter Two provides a conceptual model for examining the causal relationship between environmental scarcity and violent conflict. It shows causation by answering two questions. First, does scarcity cause specific social effects, such as population migration and poverty? Second, do the social effects that result from scarcity cause violent conflict? Six case studies reveal that environmental scarcity is not a necessary and sufficient cause for violent conflict. However, scarcity often figures prominently in the complex web of causality as a contributing cause, an aggravating factor, or a catalyst for conflict. Chapter Three considers the implications of the findings in Chapter Two. First, will some OOTW provide short lived successes due to a failure to address the problem of environmental scarcity? This chapter shows that recent OOTW treated the symptoms of scarcity without solving the underlying problems. Consequently, violent conflicts in those countries are likely to recur, rendering the long term outcomes of the operations as failures. Second, what does causality portend for future conflicts? This chapter concludes that conflicts arising from environmental scarcity will occur more frequently in the future and threaten U.S. national security interests. Third, does doctrine address conflicts caused by environmental scarcities? The doctrinal review reveals that the Army does not recognize environmental scarcity as a cause of conflict. Chapter Four synthesizes the findings from the preceding chapters, showing that the Army is intellectually unprepared for conflicts

caused by environmental scarcity. The monograph ends with two recommendations. First, the Army should recognize environmental causes of war in its doctrine. Second, the Army should adopt the Modified Conflict Causality Model as a doctrinal tool for predicting and evaluating future conflicts.

Chapter Two
The Case for Causality

"Man stalks across the landscape, and deserts follow in his footsteps."[12]

Humans adversely affect the environment. Contaminated water, deforestation, soil erosion, and the depletion of fisheries are but some of the outcomes. Although few people would disagree with the causation between human activities and environmental degradation, their reactions place them in one of two categories: cornucopians or neo-Malthusians. Cornucopians do not worry about protecting any single natural resource. They believe that human ingenuity will always allow the substitution of more abundant resources to produce the same products and services. Neo-Malthusians put less faith in ingenuity, arguing that "renewable resources" is a misleading term. As an illustration, neo-Malthusians distinguish between resource capital and its income. The capital is the resource stock that continuously generates an income. The income is available for human consumption. As long as humans do not deplete or degrade the capital, the resource is considered renewable. However, increasing demands on resources have exceeded the income and the rate of renewal. Consequently, humans are living off the capital, running up a debt to the environment that may bankrupt future generations.[13]

The divergence between cornucopians and neo-Malthusians enters into the debate concerning the causes of conflict. Cornucopians remain prisoners of the industrial revolution. They assume that there are only social causes for social and political changes, neglecting the role of nature. However, Robert Kaplan noted: "nature is coming back with a vengeance, tied to population growth. It will have incredible security implications."[14] Neo-Malthusians realize that humans cannot separate themselves from

nature. The following causality analysis adheres to the neo-Malthusian perspective. Therefore, it takes a holistic approach toward causality, combining conflict studies and the study of the physical environment. After providing a conflict causality model, this chapter uses six case studies to prove that violent conflicts can arise from environmental scarcities.

Modified Conflict Causality Model

This monograph uses the Modified Conflict Causality Model (MCCM) to determine if environmental scarcity causes violent conflict (see Appendix 1). The model is based on one proposed by Professor Homer-Dixon in 1991 and modified to include elements from his original model, Rand's revised and expanded models, and the Combined Conflict Causality Model (see Appendix 2). The original model (see Figure 1, Appendix 2) is the theoretical framework used by the Project on Environmental Change and Acute Conflict. Professor Homer-Dixon chaired the Project from 1991 to 1994. Rand further refined the Homer-Dixon model. The revised model (see Figure 2, Appendix 2) labels the intervention feedback loops used by Homer-Dixon. The expanded model (see Figure 3, Appendix 2) adds three features to the original model. First, it considers other causes of conflict such as political and economic problems. Second, it adds a feedback loop to account for the effects of a conflict that can, in turn, compound the initial environmental problem. Third, it looks at intervention points to determine where and how to break the causality between scarcity and conflict. Rand developed both models prior to the Toronto Project's final report. The Combined Conflict Causality Model (see Figure 4, Appendix 2) summarizes the results of the Toronto Project.[15]

The MCCM performs three functions (see Appendix 1). First, it examines the factors that produce a scarcity. The three primary factors are a decrease in the quality and quantity of renewable resources, population growth, and unequal resource access. The consumption of resource capital combined with population growth reduces the per capita availability of a resource. The resource access factor accounts for shifts in the distribution of the resource that concentrate the supply in the hands of the few, subjecting the rest to extreme scarcity.[16]

Second, the model determines if scarcity causes adverse social effects. The main social effects are decreased economic productivity, migration or expulsion, and a weakening of the state. In most developing countries, economic productivity relies almost exclusively on renewable resources, leaving those states especially vulnerable to environmental degradation. Lester Brown notes:

> The depletion of natural capital--of forests, rangelands, topsoil, underground aquifiers [sic], and fish stocks--and the pollution of air and water have reached the point in many countries where the economic effects are becoming highly visible, including a loss of output, of jobs, and of exports. Some countries have lost entire industries.[17]

Large-scale population movements may result from expulsion or migration. Expulsion is an involuntary action, resulting from a dominant group's ability to deny resource access to another group. Migration is a voluntary action, stemming from a deliberate decision to leave one place in search of better conditions in another. Both actions can create ethnic conflicts as migratory groups clash with indigenous populations. The United Nations refers to these people as environmental refugees, defining them as:

> those people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption (natural and/or triggered by people) that jeopardized their existence and/or seriously affected the quality of their life. By 'environmental disruption' in this

> definition is meant any physical, chemical, and/or biological changes in the ecosystem (or the resource base) that render it, temporarily or permanently, unsuitable to support human life.[18]

The weakening of the state is the most important social effect. The combination of economic decline and large population movements weakens the capacity and legitimacy of the state, particularly in poor countries. Scarcities increase the financial and political demands on the state. The elite, who benefit most from the resource, expect restitution when the resource becomes scarce. Also, the scarcity may cause rural poverty, displacing people into the cities where they demand food, shelter, and jobs. In response, the state fixes prices, allocates capital to provide short-term relief, and introduces subsidies that drain the treasury. All of these actions further hinder economic productivity.[19]

Third, the model ascertains if adverse social effects cause violent conflict. The model looks at three types of conflict. Simple scarcity conflicts result when states rationally calculate their interests in a zero-sum or negative-sum situation such as might arise from resource scarcity. The fictitious invasion of Turkey illustrates a simple scarcity conflict. Group-identity conflicts result when large-scale population movements bring different ethnic groups into contact under situations of deprivation and stress. Relative-deprivation conflicts result when a disenfranchised group acts against other groups seen as the agents of their misery or benefiting from an unfair economic system.[20] Thomas Homer-Dixon summarizes the model's functions:

> Decreases in the quality or quantity 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.[21]

The MCCM increases the quality of the analysis in two respects. First, it considers the role of political, economic, and social institutions and practices. Institutions can inhibit conflict by helping society to adjust to adverse social effects. For example, a society may continue to rely on its indigenous resources but use them more sensibly while institutions provide alternative employment to people most affected by the scarcity. Also, the state may shift to the production of goods and services that do not rely on scarce resources, using trade revenue to acquire resources that it has exhausted. In short, violence is a sign of institutional failure.[22]

Second, the MCCM looks at the political, economic, and social problems that may contribute to social effects and conflict. The model precludes linear analysis by considering the role of other factors in causing adverse social effects and conflict. As noted in Chapter One, environmental scarcity is not a necessary and sole cause of conflict. Rather, scarcity may function as a contributing cause, aggravate other causes, or serve as a trigger for conflict where other tensions already exist. Thus, the model considers the likelihood of conflict absent any environmental causality or catalytic role.[23]

The MCCM provides the analytic framework for six case studies. The case studies are El Salvador-Honduras, Ethiopia, Senegal-Mauritania, Somalia, Rwanda, and Haiti. This chapter summarizes the results of the MCCM for each of the case studies. Each summary addresses the three functions described above, including the role of political, economic, and social factors, and concludes with an overall assessment of the conflict.

El Salvador-Honduras

Neo-Malthusians cite the war between El Salvador and Honduras as a classic example of a scarcity induced conflict. On July 14, 1969, El Salvador's armed forces invaded Honduras, beginning a war that lasted only 100 hours. The war killed several thousand on both sides, produced 100,000 refugees, destroyed much of El Salvador's oil infrastructure, and crippled the Central American Common Market (CACM). Because the invasion followed three soccer games between the two countries in the qualifying rounds for the 1969 World Cup, the conflict became known as the Soccer War.[24] Most scholars concede that the massive emigration of Salvadorans to Honduras caused the conflict. However, the MCCM reveals that the conflict was not simply a demographic war. Rather, environmental scarcity was a contributing cause that aggravated other factors.

The scarcity central to the conflict was the lack of arable land. The sources of the shortage were population growth, erosion, and unequal land distribution policies. El Salvador's population growth made it the most densely populated country in the Western Hemisphere. Its growth rate of 3.7 percent was one of the highest in the world and resulted in a population density of 158 people per square kilometer. In contrast, Honduras' population density was only 22 people per square kilometer with a growth rate of 3.5 percent.[25] Growing populations in both countries strained the natural resource base, destroying virtually all indigenous natural habitats. Intensive farming on marginal lands and deforestation in the highlands caused widespread erosion. In El Salvador, erosion had degraded the agricultural output of over 77 percent of the land.[26] Honduras experienced similar degradation. The expansion of commercial agriculture increased land

value in both countries, forcing poor peasants to move to marginal lands. The growing numbers of poor farmers on steep hillsides further aggravated deforestation and erosion. Land tenure practices placed additional strains on limited land resources as rural families further subdivided plots among male heirs. Available cropland per person in El Salvador fell by two-thirds from 1950 to 1969. Almost one-half of the farmers were restricted to only five percent of arable land and the average land holding was less than one and a quarter acres.[27]

Land scarcity caused distinct social effects in both countries. The appeal of cheaper land in Honduras attracted about 300,000 Salvadorans in the 1950s and 1960s, or about one of every eight persons in Honduras in 1969.[28] Initially, the Salvadorans migrated because small and expensive farm plots made Honduras more appealing than their homeland. Accordingly, almost half of the Salvadoran migrant population of 1969 was already in Honduras by 1955, most of whom settled in contested border areas. After 1955, Salvadorans continued to migrate to Honduras. However, the cause was a land shortage created by competition with commercial agriculture.[29]

The migration of the Salvadorans aggravated the dynamics of land scarcity already operating in Honduras. Commercial logging and agriculture competed with small scale farmers for the most productive land. The competition forced subsistence farmers into marginal areas where they joined throngs of Salvadorans. By the mid-1960s, peasants of both nationalities joined together against the encroachment of commercial enterprises and demanded land reform. In response, large landowners formed the National Federation of Agriculturists and Cattle Ranchers of Honduras (FENAGH). In the year prior to the

Soccer War, peasant groups reclaimed land from FENAGH, leading to violence that required government mediation in 68 cases.[30] Thus, land scarcity pitted subsistence farmers of both nationalities against large scale landowners in Honduras.

Violent conflict erupted soon after the Honduran government sided with the FENAGH and the military issued 30 day eviction notices to about 20,000 Salvadoran landowners on May 3, 1969. The FENAGH and other large landowners argued that foreign usurpers were causing agrarian problems in Honduras. In effect, they contrived an immigration issue. Durham summarized the changing character of the agrarian conflict, stating that:

> On the one hand, [the landowners] pressured for the removal of Salvadorans...so that the land they occupied could be used for agrarian reform, avoiding the invasions of the landowners' private property; presenting the conflict in terms of nationality, they obtained a polarization of public opinion in favor of their interests. On the other hand, the emphasis placed on the Salvadoran invaders permitted the redefinition of agrarian conflict: it was then a question not of land redistribution in favor of peasants and agricultural workers, but rather of removing a minority of foreign nationals that had usurped public lands and of redistributing these lands among Hondurans.[31]

The military began the expulsions on June 15, 1969. In response, El Salvador closed its borders to force Honduras to relocate these people, broke relations with Honduras, and charged human rights abuses by the Honduran army. When these efforts failed to stop the expulsions, El Salvador invaded Honduras to "defend the rights of their countrymen and put an end to what it termed Honduran genocide."[32]

The scarcity of arable land caused both the migration and expulsion of the Salvadorans which, in turn, served as contributing causes to the war. The war was a relative-deprivation conflict because it was a response to a relative rather than an absolute scarcity. The relative scarcity resulted from the growth of large estates at the expense of

small landowners. Population growth alone was not enough to produce the scarcity. Rather, economic competition made less land available for a growing population.[33]

Land scarcity alone was not a sufficient cause of the war. The model revealed at least three other causes. First, the two countries contested their common border. The dispute had raged for 130 years and there were several border clashes leading up to the war. Second, the governments were at odds over the effect of CACM on their respective economies. El Salvador saw its balance of trade within Central America increase markedly as it began producing industrial goods for export. Honduras enjoyed a favorable balance of trade outside of Central America, but its import of regional goods surpassed the demand of other regional states for Honduran exports.[34] Honduras came to resent the fact that it was effectively providing a subsidy for the industrial development of El Salvador. Third, El Salvador benefited from the yearly migration of ten percent or more of its low-income inhabitants. Durham summarizes the perspective from El Salvador:

> Reduced population pressure...eased political and economic development problems that would otherwise have been considerably worse. But once the expulsion of migrants began, the Salvadoran government could plainly see the threat of having those benefits reversed all at once. Internal documents indicate that national advisors were greatly worried about the social and political consequences of great numbers of landless and unemployed refugees.[35]

Thus, the MCCM shows that land scarcity figured prominently as a contributing cause of the conflict and aggravated other causes.

Ethiopia

The overthrow of Ethiopian Emperor Haile Selassie in 1974 was the first time environmental reasons were primarily responsible for ousting a government. Once revered as Ethiopia's savior for rallying his countrymen against Mussolini's invading forces,

Selassie fell victim to a more onerous threat, the scarcity of arable land. The Provisional Military Government of Socialist Ethiopia (the Dergue) that deposed Selassie failed to improve conditions. Consequently, large migrations of Ethiopians into a contested region on the Somali border precipitated the Ogaden War in 1977 and the degeneration of the Dergue into a one-man dictatorship under Mengistu Haile Mariam.[36]

The roots of the coup d'état and the Ogaden War lay in the soil. Population growth, deforestation, and inequitable land-tenure systems caused massive soil erosion. The country's traditional farming area consists of 470,000 acres of which 90,000 acres are in the northern highland region. This area is densely populated by peasants engaged in subsistence farming.[37] The area is home to 88 percent of Ethiopia's population which increased from 20 million in 1950 to 31 million by 1970.[38] The terrain is characterized by high elevation plateaus, gorges, mountain peaks, and deep chasms, features that contribute to erosion. The growing population denuded the region of vegetative cover through overgrazing by cattle and lumbering for fuel, cropland, and wood exports to pay the country's foreign debts. The decline in soil fertility accelerated as farmers burned dung and crop residues in place of fuelwood, rather than using them to sustain the soil.[39] Land tenure practices made matters worse. Oxfam, the U.K.-based environmental advocacy organization, noted that "most rural Ethiopians lived in conditions similar to those of European peasants during the Middle Ages."[40] The average peasant owned 2.5 acres before the revolution while tens of thousands of square kilometers of arable land owned by medieval-style landlords lay uncultivated. The peasants complicated the situation by having large families and dividing their plots between their sons. By the early 1970s, the

region was losing one billion tons of soil a year through erosion, as compared with 2.8 billion tons in the United States from a cropland twenty times as large.[41] The region was postured for a major environmental disaster which arrived in the form of the drought and famine of 1972-1973.

Land scarcity caused all three social effects found in the MCCM. The decline in soil fertility and agricultural productivity led to large scale food shortages and spiraling prices. Unable to pay its foreign debts, the government defaulted on its loans. The lack of trade revenues denied the government the resources needed for the emergency. In 1974, riots broke out in the cities and the military intervened to impose order. Selassie fled the country and the Dergue instituted sweeping land reforms, dismantling the feudal landlord system and restructuring the economy. The Dergue nationalized industry, took ownership of large tracts of land, and launched collective farming programs. Government control of the economy was intended to stabilize the domestic situation and bolster trade, providing more goods and services.[42] However, political corruption and a lack of export revenues to buy food and services led to other social effects. The Dergue became more repressive, using the military to squelch uprisings. The combination of the Dergue's repressive actions and the lack of arable land caused the displacement of more than five million people. More importantly, almost one-half million peasants migrated to neighboring countries, including the Ogaden region which straddles the border with Somalia.[43]

Two types of conflict occurred in Ethiopia. First, the coup that deposed Haile Selassie was a relative-deprivation conflict. The peasants and poor urban dwellers were the disenfranchised groups. The peasants suffered from relative land scarcity because of

an inequitable land distribution system that forced growing numbers of people to live on smaller tracts of land while large landowners held vast uncultivated areas. The urban poor suffered because rising food prices exceeded their incomes. Both groups joined forces to riot against the government, encouraging the military to step in under the pretense of supporting the popular rebellion. Second, the Ogaden War was a group-identity conflict. The Ethiopians who migrated to the Ogaden region competed with Somalis for the same scarce land and water resources. Since both countries claimed the region, tensions mounted as rival tribes demanded interference by their respective governments. Weakened by internal turmoil, both governments used the crisis to strengthen their hold on their respective countries, leading to open hostilities in 1977.

Land scarcity was the primary cause of the coup and a contributing cause to the Ogaden War. Population growth, unequal resource access, and a decrease in the quality and quantity of arable land were the sources of land scarcity. Land scarcity caused a drop in land fertility and economic productivity which, in turn, undermined the legitimacy of the Selassie regime and created mass migrations. Political, economic, and social institutions and practices did nothing to ameliorate the problems. Rather, they intensified the scarcity and encouraged negative social effects. The coup was a direct result of land scarcity, whereas the Ogaden War emanated from a combination of land scarcity and political, economic, and social problems in both countries.

Senegal-Mauritania

The scarcity of arable land was a contributing cause of the violent dispute between Senegal and Mauritania in 1989. The conflict focused on the Senegal River valley which

demarcates the border between the two West African countries. In the Spring of 1989, the killing of Senegalese farmers by Mauritanians in the river basin triggered an explosion of ethnic violence in both countries which left several hundred people dead, destroyed thousands of businesses, and nearly brought the two countries to war.[44]

In the 1980s, the United Nations Food and Agriculture Organization added Senegal and Mauritania to its list of countries whose croplands cannot support their populations.[45] The causes of land sarcity were population growth and desertification. In 1989, Senegal's population density was 380 people per square kilometer and its growth rate was 2.7 percent. Senegal had relatively abundant arable land, although much of it suffered from erosion, nutrient loss, salinization through extensive irrigation, and soil compaction caused by intensive farming. In contrast, Mauritania was largely arid desert and semiarid grassland, supporting only 20 people per square kilometer and a growth rate of 2.8 percent.[46] Mauritania's agricultural production depends almost entirely on the Senegal River basin. Desertification is the final stage of soil degradation which ends with the destruction of the soil's fertility. For decades, the Senegalese and Mauritanians had plowed highly erodible soil, overpumped aquifers for irrigation, increased salinization of the soil through overirrigation, overgrazed rangelands, and deforested watersheds.

The resulting social effects were decreased economic productivity, migration, and expulsion. Although larger tracts of land were under cultivation, agricultural yields were plummeting because of population growth and desertification.[47] Recognizing the need to expand available arable land, the governments of Mauritania, Senegal, and Mali secured financing for the construction of two dams. The dams would provide hydropower, expand

agriculture by raising water levels during dry seasons, and allow year round navigation from the Atlantic Ocean to Mali, thereby increasing trade.[48] The plan had two major consequences. First, Black Mauritanians migrated to the region in anticipation of better farming conditions. Second, Mauritania's predominantly White Moor leadership rewrote legislation governing land ownership, terminating the rights of Black Mauritanians to farm, herd, and fish along the riverbank.[49]

The dispute between the countries was a group-identity conflict. The killing of Senegalese farmers by Mauritanians in the river basin caused ethnic violence in both countries. In Senegal, mobs destroyed almost 17,000 shops owned by Moors and deported the owners to Mauritania. Mauritania activated the new land laws, declaring that black Mauritanians who lived along the river were actually Senegalese and expelling about 70,000 of them to Senegal. External mediation prevented escalation to war, but neither side allowed repatriation or compensated those expelled for their losses.[50]

Land scarcity was a contributing cause of conflict that aggravated other causes. Population growth, desertification, and unequal resource access produced land scarcity which, in turn, caused migration, expulsion, and a decline in agricultural productivity. These social effects caused the violent conflict. However, institutions and other problems also played a role by increasing the scarcity and heightening tensions associated with the social effects. The Mauritanian government clearly made the land scarcity problem more volatile. Mauritania's powerful elite changed property rights and resource distribution in its favor, producing a sudden increase in resource scarcity for the Black African minority. Economic problems led to the dam project which raised land values and encouraged

migration. Social cleavages between Black Africans and White Moors added an ethnic dimension, giving both governments an excuse for polarizing the land distribution issue along ethnic lines. In particular, the elite Moor regime turned a land scarcity issue into a nationalistic-ethnic issue much as El Salvador had done in 1969.

Somalia

The civil war that erupted in Somalia in 1991 seemed to support the post-Cold War notion that tribalism and nationalism would be among the leading causes of violent conflict. However, the MCCM reveals that land scarcity was as important as clan politics in causing the civil war that followed President Siad Barre's overthrow in January 1991. The fall of the state brought a Hobbesian world to Somali society. Violence and looting prevented economic production or food distribution, creating a widespread famine that killed hundreds of thousands.[51] The absence of government control unleashed historical clan and subclan rivalries. Clan warfare focused almost entirely on the control of basic resources, especially grazing areas, arable land, and watering holes. By mid-1992, over 850,000 Somali refugees lived in camps in Ethiopia, Kenya, and Djibouti, representing about one-sixth of the entire Somali population. Another 700,000 Somalis were internally displaced.[52] More than 3,000 people died daily from starvation in 1992.[53]

The sources of scarcity in Somalia were population growth, desertification, and unequal resource distribution based on clan affiliation. Rapid population growth overburdened the resource base, causing heavy soil erosion, overgrazing, and severe deforestation. Most of Somalia was deforested, forcing people to use dung and crop wastage as fuel rather than fertilizer. Desertification had cut available arable land by

one-third since the late 1970s.[54] The 1992 harvest was about 40 percent lower than normal, leaving 60 percent of the population in need of food aid.[55] Clan politics made land and food scarcity more pronounced which, in turn, heightened clan rivalries. For example, the northern region produced surplus livestock, accounting for the largest share of Somali export earnings before 1991. Since Siad Barre was from a southern clan, few of the profits returned to the northern region. Not surprisingly, the rebellion to overthrow him started in the north and set the pattern for distributing resources along clan lines.[56] As Siad Barre retreated south, his forces destroyed crops, animals, and homes of rival clans in Somalia's heartland.

The social effects that stemmed from land and food scarcity were the collapse of the state and the economy, migration of people to the cities in search of food, and the expulsion of clan minorities from areas dominated by rival clans. Without a legitimate central government to regulate clan relationships, each clan sought to consolidate its power base and control resources. Since the economy had collapsed, minority clans had to compete with larger clans for access to dwindling resources. In the south, larger clans expelled members of other clans who represented a burden on limited resources. Many of these people ended up in the already swollen cities, further straining clan relations.

These effects caused a group-identity conflict as rival clans fought for control of territory and resources in the midst of a nationwide famine. Depending on their clan affiliation, people felt the effects of the famine disproportionately. Clans in the north and center fared better than those in the south.[57] In the south, lawlessness, anarchy, and famine were most pronounced because no single clan was dominant.

The model also shows how other factors contributed to the civil war. Two examples are particularly noteworthy. First, external assistance from the U.S. and the World Bank hastened the depletion of Somalia's natural resource base. These actors encouraged Somalia to shift its agricultural base from subsistence farming to the production of bananas, sugar, and livestock for export. However, commercial agriculture depleted the soil in the river valleys and led to overgrazing and desertification in already arid lands. As a result, unsustainable development fueled the conflict between herders and farmers over access to water and grazing land, playing into clan rivalries.[58]

Second, Siad Barre introduced artificial institutions to the traditional pastoral Somali existence. Prior to 1969, Somali society was decentralized and community oriented. Kinship was the key to all political, economic, and social relationships. Combined with the heer, an unwritten but loosely accepted pan-Somali code of conduct, kinship provided the mechanism to deal with disputes. Islam reinforced heer by forcing all Somalis to view one another as members of a single fraternity.[59] Terrence Lyons and Ahmed Samatar, researchers at The Brookings Institute, noted that "this structure suited pastoral, subsistence production and allowed the Somali to survive and live with dignity in the harsh conditions of northeast Africa."[60] Siad Barre dismantled much of the traditional pastoral system in an effort to consolidate his power. He used patronage to gain support, encouraged animosity between rival clans, and repressed popular uprisings. After insurgents finally forced him from power, the people found themselves in a Hobbesian world without the benefits of their pastoral traditions.[61]

The MCCM reveals that scarcity triggered the conflict, aggravated other problems, and caused economic decline, migration, and expulsion. These adverse social effects ignited a civil war which lingers today. However, the model also showed that scarcity alone was not enough to cause the social effects and resulting conflict. Rather, economic factors such as the shift to commercial farming made the scarcity more acute by further degrading the environment, reducing land available to subsistence farmers, and pitting farmers against herders for dwindling resources. Also, Siad Barre's reforms left the Somali people without a mechanism for conflict resolution. Social effects that might have been kept under control by the traditional pastoral system exploded into civil war.

Rwanda

The Rwandan genocide that occurred between April and July 1994 was not merely a power struggle between the Hutu and Tutsi tribes. Although ethnic violence claimed the lives of over 500,000 Rwandans, tribal tensions were symptomatic of desperate economic conditions. These conditions created fear, jealousy, and hatred that antagonized historical differences between the tribes. Consequently, focusing on the ethnic nature of the conflict neglects a more important cause of the violence, land and water scarcity.

The MCCM shows that population growth, land tenure practices, and environmental degradation led to land and water scarcity. Rwanda was the most densely populated country in Africa in 1994. Its growth rate of 3.7 percent was one of the highest in the world, increasing the population from 2.5 million in 1950 to 8.8 million in 1994. Rwandan women each had an average of eight children in 1992, the highest in the world.[62]

To feed itself, Rwanda steadily expanded the amount of land under cultivation until virtually all arable land was in use. In 1994, the average land holding per person was less than 0.03 hectares, equivalent to a square plot about 17 meters on each side.[63] The average family plot was less than half a hectare and continued to shrink. Paul Harrison, a former researcher for the United Nations Population Fund, looked at a typical example of land tenure in Rwanda:

> Alphonse Njaagu farms a third of a hectare on the shores of Lake Kivu in Rwanda, under the louring [sic] cone of volcano Nyiragongo. His father had a hectare of land--just about enough to live on. But on his death this was divided between three sons. Alphonse in turn has three sons aged between sixteen and twenty. I asked him if he would give them any land when they married. 'I can't even give them a plot to build a house,' he said, shaking his head. 'They'll have to look after themselves.'[64]

The expansion of cropland severely degraded the environment. Erosion decreased the land's productivity because much of the arable land was on steep slopes. Also, the small size of plots kept farmers from allowing fields to remain fallow and manure was in short supply as fertilizer because most farms were too small to provide fodder for cattle.[65] Increased demands on freshwater for irrigation and consumption complicated the problem. Hydrologists declared Rwanda one of the world's 27 water scarce countries. In spite of increasing the number of acres under cultivation, crop output per person declined by almost one-half between 1960 and the early 1990s.[66]

Land and water scarcity produced agricultural decline, migration, and a weakening of the state. The model also shows that Rwanda's colonial history promoted negative social effects. Agricultural decline led to political protests by both Hutu and Tutsi farmers against the Hutu regime of President Juvenal Habryarimana in the early 1990s. The lack of land encouraged migration. In particular, cities swelled with unemployed and hungry

Hutu and Tutsi. The government quickly lost legitimacy because it lacked the resources to help its people. Interested in self-preservation, the government searched for a scapegoat, finding one in Rwanda's colonial history.

Rwanda's colonial past had often pitted Tutsi against Hutu. Prior to the 1959 revolution that led to Rwandan independence, the Tutsi owned cattle and served as feudal lords. In exchange for meat and milk, Hutu farmers were obliged to provide the Tutsi with a share of the crop.[67] The Tutsi also had a higher social standing than the Hutu due to European prejudices. Europeans favored the lighter complexioned Tutsi, providing them with better educational and business opportunities. However, the revolution swept away the colonial system, leaving the Hutu in power.[68] Reeling from their loss of privilege, the Tutsi tried to reassert their authority. The government responded by using ethnic differences to consolidate its power.[69] Typically, it used deliberate campaigns of ethnic hatred against all Tutsi to rally Hutu behind the regime.[70] The first campaign was in 1959, leading to twenty years of civil unrest and the mass exodus of Tutsi from Rwanda. Most refugees moved to Uganda where they organized the Rwanda Patriotic Front (RPF) consisting of about 10,000 rebels. Uganda refused to naturalize the refugees and Rwanda closed the border. Consequently, the RPF staged frequent attacks into Rwanda.[71]

Against this social setting, the Hutu government was confronted by large, hungry mobs of protesters in the 1990s consisting of both Tutsi and Hutu farmers. Cleavages formed between Hutu elite and the rest of the population. Turning to a method employed in prior decades, the government encouraged ethnic hatred against Tutsi to unite the Hutu. The assassination of President Habyarimana on April 6, 1994, unleashed a group-identity

conflict characterized by the uncontrolled slaughter of Tutsi by government forces and civilian death squads. However, poor members of both tribes did a significant part of the killing, attacking wealthy members of the same tribe.

The MCCM provides abundant evidence that Rwanda's genocide resulted from long standing tensions that mounted as the relationship between all Rwandans and the land on which they depended deteriorated. Severe scarcity manifested itself economically on a scale that had social and political consequences. In short, the people were impoverished due to the lack of arable land and the government had inadequate resources to compensate them. Decades of social and political turmoil left Rwandan society without the resilience to avoid violent conflict. As Lester Brown noted, on the eve of the genocide there was:

> The quiet desperation that comes to an agrarian society when population growth overwhelms the carrying capacity of the land. Just as a lightning strike in forests in the American West is more likely to turn into an uncontrolled conflagration when it is unbearably hot and dry, so too are ethnic conflicts more likely to erupt when there are underlying tensions about food and the ability to earn a living.[72]

Haiti

Haiti is the most recent example of the causal relationship between environmental scarcity and violent conflict. Violent conflict in Haiti continued almost unabated from the collapse of Jean Claude "Baby Doc" Duvalier's regime in 1986 until the U.S. brokered return of Jean-Bertrand Aristide as president in 1995. The chief conflict was between the elite, represented by the military, and the rest of society. The elite consisted largely of economically prominent families of mulatto heritage, whereas most Haitians were poor and of Black African heritage. After Duvalier's fall, gangs of peasants took vengeance against the elite. The military intervened to restore order and to protect their own

interests. In 1991, Aristide became Haiti's first constitutionally elected president. However, his reforms threatened to undermine the elite, so a military junta ousted him. These events led to nationwide political and economic turmoil, causing the deaths of at least 1800 people in 1992 and over 1000 in 1993. Haiti was poised on the edge of civil war and the lack of land was a major cause.[73]

The sources of Haiti's land scarcity were population growth, deforestation, and inheritance customs. Its growth rate increased from 1.7 percent in the mid-1970s to over 2 percent, yielding a population of almost seven million by 1994.[74] Haitian farmers unwittingly sowed the seeds of their own demise by deforesting large tracts of land for cropland. Unable to afford building materials and fuel for cooking, the farmers compounded the problem by cutting down trees for their homes and making charcoal.[75] Since over 70 percent of the arable land was mountainous and over 98 percent was deforested, erosion had claimed over fifty percent of the arable land, leaving it eroded down to bare rock.[76] As noted by Essam El-Hinnawi, a professor at the National Research Center in Cairo, "The eroded countryside, with its reddish- coloured soil, looks as though the earth has been scratched away until it bleeds. The contour of every hill and valley is revealed in all its nudity: the land has no latent power left unexploited."[77] Inheritance customs and population growth accelerated deforestation. Unlike the previous case studies, most of Haiti's cropland belonged to private farmers. However, as noted by Thomas Homer-Dixon:

> 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 forest and begin farming anew, only to exhaust the land in a few years. Many peasants try to

supplement their falling incomes by scavenging for wood for charcoal production, which contributes to further deforestation.[78]

The social effects of land scarcity were decreased economic productivity and migration. Grain production declined by one-third from the mid-1970s to the early 1990s. As a result, grain availability per person plummeted.[79] With the drop in domestic food production, there was a rapid increase in the demand for food, fuel, and basic necessities that the military junta was unable to provide. By 1993, hunger and malnutrition were claiming the lives of 1000 children every month.

The inability to survive off increasingly smaller and unproductive plots caused large scale migration. Many farmers made their way to the cities to find work. Haiti's capital doubled its population from 1984 to 1994, increasing by seven percent a year. More than half of the city's population lived in the peripheral slums.[80] Population movement was not limited to internal migration. At least one million Haitians left their homeland by 1994, most of them illegally entering other Caribbean nations.[81] The American Embassy in Haiti estimated that if the U.S. relaxed its immigration laws, another million Haitians would flee to the U.S.[82]

Decreased economic productivity and migration caused a relative-deprivation conflict in the form of civil strife. The people had exhausted their alternatives. They were hungry, their land was unproductive, and the government continued to exploit them. The slums became the breeding ground for revolution, forcing the government to become more repressive to protect the privileges of the elite. However, international sanctions, world opinion, and the threat of U.S military intervention forced the military junta to accept the return of Aristide, thereby defusing an explosive situation.

Land scarcity was a contributing cause of civil strife that aggravated other factors and triggered the slide toward civil war. Haiti's political, economic, and social problems stemmed from the severe environmental degradation that all but destroyed the natural resource base. Although the people were dissatisfied with the ruling elite, they accepted the regime as long as they maintained a reasonable standard of living. However, land scarcity forced the people to confront an unsympathetic government. The resulting turmoil pitted the privileged elite against the poor who had no alternative but violence. Unfortunately, as noted by Lester Brown, "Haiti will forever bear the burden of its irreversibly ravaged environment, which may make it impossible to build a prosperous, just and peaceful society."[83]

Findings

The MCCM proved that environmental scarcity was a contributing cause of violent conflict in all six case studies. Five findings support this conclusion. First, various sources of insufficience combined in each case to yield a scarcity which, in turn, caused adverse social effects. Land scarcity was the dominant problem. However, the sources of scarcity varied by degree in each case. For example, Haitian and Rwandan farmers had access to almost all available arable land, but rampant population growth and apocalyptic despoliation made it unproductive. In contrast, Honduran and Mauritanian farmers were denied access to arable land because of commercial interests or government policies.

Second, social effects such as decreased economic productivity, migration, and expulsion caused violent conflict. Economic decline brought farmers into conflict with Honduran, Ethiopian, and Haitian regimes. Migration led to conflict in Honduras,

Ethiopia, Mauritania, Somalia, and Haiti. Expulsion brought violence to Honduras, Mauritania, Senegal, and Rwanda.

Third, the most important social effect was the weakening of the state. The cases showed that economic decline, large population movements, and the persistence of environmental scarcities undermined regime legitimacy. In every case, preservation of the regime was a consideration prior to the outbreak of violent conflict.

Fourth, political, economic, and social institutions and practices often compound the scarcity and the resulting social effects. For example, political elite in Mauritania made scarcity worse by enacting laws to reduce access to resources. Economic schemes in Honduras and Somalia attempted to shift from subsistence farming to commercial agriculture only to find that export earnings were insufficient to import food. Similarly, commercial interests in Honduras and El Salvador discouraged their governments from legislating land reform, leaving large areas uncultivated in the face of hunger and poverty. Also, land tenure practices in every case except Mauritania-Senegal further exacerbated land scarcity and encouraged migration.

Fifth, environmental problems cannot be separated from political, economic, and social problems. Although the case studies demonstrate that scarcity is not a necessary and sufficient cause of conflict, scarcity is often a major factor. Scarcity may aggravate other causes, function as a contributing cause, and serve as the catalyst for the conflict. For example, ethnic problems in Mauritania, Ethiopia, and Rwanda compounded the effects of migration, economic decline, and the weakening of states. In each case, the volatile combination led to violent conflict.

Chapter Three
Implications

We are entering the century of 'not enough,'
and we will bleed for things we previously could buy.[84]

Ralph Peters, a U.S. Army officer and intelligence analyst, succinctly captures the basic implication for the next century that arises from the role of scarcity as a cause of conflict. However, from the Army's perspective, the causes of conflict are seldom as important as the conflict itself. After all, the Army usually becomes involved after the conflict begins. This chapter explains why the Army must concern itself with the linkage between scarcity and violent conflict. To this end, this chapter looks at three implications of the findings in Chapter Two. First, will some OOTW provide only temporary successes because of a failure to address environmental scarcity? Second, what does causality portend for future conflicts? Third, does doctrine address scarcity induced conflicts?

Environmental Scarcity and Operations Other Than War

The U.S. Army deployed to Somalia, Rwanda, and Haiti to conduct OOTW. Chapter Two proved that scarcity was a contributing cause of violent conflict in all three cases. Unfortunately, these OOTW are destined to become long-term failures for three related reasons. First, the operations treated the social effects caused by scarcity because they were amenable to short-term solutions. Operation RESTORE HOPE in Somalia illustrates the focus on short-term solutions. The Army deployed to Somalia in December 1992 following passage of United Nations Resolution 794 which called for "a secure environment for the delivery of humanitarian relief."[85] Media images of starving children and reports that up to two million Somalis faced starvation captured world attention,

leading to the U.S. deployment. President Bush explained his decision to send troops, stating that "our mission is humanitarian, but we will not tolerate armed gangs ripping off their own people, condemning them to death by starvation."[86] Hence, the Army's primary mission was to ensure the delivery of emergency supplies to starving people. The Army succeeded because it saved hundreds of thousands of lives by getting food and medical attention to the most vulnerable people in the Mogadishu-Bardera-Kismayu triangle.[87] Similarly, the Army enjoyed short-term success conducive to favorable media coverage by providing food and water in Rwanda and restoring some basic services in Haiti.

Second, the operations did not solve the scarcities that caused adverse social effects because the linkage was not apparent and the scarcities required long-term solutions. As noted in Chapter Two, the relationship between environmental scarcity and violent conflict is seldom clear. However, ethnic animosities are easily identifiable and thus draw considerable attention. Witness the media portrayal of the conflict in Somalia as clan warfare and the violence in Rwanda as tribal genocide. Although ethnic cleavages were partially responsible for the violence in both countries, land scarcity was a major contributing cause.[88] Army operations in Somalia became fixated on clan fighting at the expense of a more thorough understanding of the causes of the conflict.[89]

Violence will return to Somalia because the underlying sources of land scarcity remain and require long-term solutions. The real culprits are population growth, unequal resource distribution, and environmental despoliation. These problems are not amenable to short-term solutions. Yet, OOTW are geared toward immediate relief of life threatening conditions. There is much less understanding of the need for long-term

solutions.[90] While military planners may argue that OOTW create conditions in which international relief agencies can operate, these agencies also tend to concentrate on short-term solutions. In general, most international aid programs focus more on aid and less on development. Nowhere is this more evident than at the United Nations where the budget for the High Commissioner for Refugees is almost equal to that of the Development Program.[91]

Violence will return also to Rwanda and Haiti. In Rwanda, soaring population growth and environmental degradation are consuming the country's natural resource capital. The U.S. Army's efforts to provide food and water in 1994 served as a bandage on a hemorrhaging artery. Likewise, operations in Haiti restored the government and a few basic services. However, as noted by political scientist Jessica Tuchman Mathews, "until Haiti is reforested, it will never be politically stable."[92] In short, Somali, Rwanda, and Haiti suffer from sources of scarcity that condemn them to futures of violence. As three of the poorest nations on earth, they are unable to pursue long-term solutions. Since OOTW and international aid programs focus on short-term solutions, the U.S. Army may return to those countries in the future to conduct new OOTW for old problems.

Third, U.S. casualties and money spent represent sunk costs that will not be recovered when conflicts recur in Somalia, Rwanda, and Haiti. In Somalia, eighteen soldiers died and 84 were wounded, casualties that contradict the low cost expected during OOTW.[93] In addition, the military component of the operation cost American taxpayers 1.3 billion dollars in 1993.[94] These losses were a high price to pay for a short-term solution. Three examples support the argument that short-term solutions

actually cost more in the long term. First, the military intervention in Somalia cost ten times as much as an agricultural program that could have alleviated the sources of land scarcity.[95] Second, a similar program may have averted the costly operation in Rwanda. In the words of J. Brian Atwood, head of the U.S. Agency for International Development, "just the other day we made a decision to contribute $35 million additional [in aid] to handle this disaster [Rwanda]. One wonders if we had had that $35 million in the previous years [for development] whether we could have done something to avoid the killing."[96] Third, Florida spent more on Haitian refugees in 1992-1993 than the U.S. allocated in foreign aid to Haiti.[97] These examples reveal that it is easier to save lives than societies, but efforts to save societies through long-term solutions may reduce the need for costly OOTW that offer only short-term answers. Granted, long-term solutions may be beyond the military's purview. However, the military's unique resources and the frequency of environmentally induced OOTW suggest that the Army may play an increasingly important role in pursuing long-term solutions. The Army's transition from short to long-term solutions in OOTW merits further research.

Environmental Scarcity and Future Conflict

Regarding the future, environmental consultant Norman Myers commented that "we face a host of unknown unknowns."[98] He made the comment in reference to the 1972 Stockholm Conference on the Human Environment where there was no mention of acid rain, global warming, and ozone-layer depletion, items that now rank at the top of the environmental agenda.[99] Although the future remains an unknown, the findings from the MCCM provide an azimuth for assessing the future. Therefore, this section makes two

predictions. First, the case studies foreshadow the type of conflicts that will become commonplace in the 21st century. Second, water scarcity will join land scarcity as a cause of conflict.

Trends in the three sources of scarcity strongly suggest that environmentally induced conflicts will be prevalent in the future. First, the earth's population will climb from 5.5 to 10 billion people over the next fifty years.[100] Almost 95 percent of the increase will be in the poorest regions of the world.[101] George Mitchell, the former U.S. Senate Majority Leader, recognized the implications of such staggering growth:

> Here is the prospect for parts of the Third World in forty years...India, overburdened even now by the crushing weight of overpopulation, will double in human numbers by 2030. To its population of 800 million will be added another billion, making it 40 percent larger than China today. Bangladesh, that environmentally ill-starred nation clinging to a flood-ridden river delta, will nearly triple in population. From its present 104 million it will grow to 342 million, all of them crammed into a space the size of Wisconsin, on a flatland battered alternately by flood and drought. Ethiopia's 46 million will swell by four times. Nigeria, just over 100 million today, will more than quadruple to 529 million. Mexico will double in size from its more than 80 million. Kenya's 17 million, far too many already for its sparse supply of arable land, will have quintupled by the end of the four decades.[102]

Furthermore, the nations most affected by population growth lack the resources to stop environmental decline and show the least resilience to adverse social problems. Rampant population growth will increase scarcities as more people compete for fewer resources.

Rachel Carson's famous bestseller Silent Spring brought long overdue attention to the second cause of scarcity, environmental despoliation. Since the book's debut in 1962, an avalanche of research has confirmed her worst fears: humans are destroying the earth.[103] In particular, environmental degradation is causing a decrease in the quality and quantity of renewable resources. Lester Brown noted:

> In country after country, demands for crops and for the products of grasslands, forests, and fisheries are exceeding the sustainable yield of these systems. Once this happens, the resource itself begins to shrink as natural capital is consumed. Overstocking grasslands, overcutting forests, overplowing, and overfishing are now commonplace. Every country is practicing the environmental equivalent of deficit financing in one form or another.[104]

Clearly, there are thresholds for renewable resources. Therefore, the scope and frequency of scarcities are likely to increase as soaring populations encounter these thresholds.

Unequal resource access is the third source of environmental scarcity. As noted in the El Salvador and Mauritania case studies, government policies and commercial interests often generate scarcities for select groups within society even though additional resources exist. This tendency is likely to continue given the political, economic, and social practices of developing states. As suggested by the fictitious invasion of Turkey, there is an increasing likelihood of disputes based on unequal resource access within a particular region. However, there is a more ominous trend. A. J. Fairclough, an environmental consultant, addresses the changing magnitude of the problem:

> In the past nations have often been in conflict--and even gone to war--over resource issues: minerals, shared water resources, energy resources, and land. Then, they usually were disputing the sharing of what were, globally, relatively plentiful resources. Now, the situation is totally different: we face growing global deficits in some of the basic resources that we need to sustain our life-styles--and even life itself. In such a situation the potential for conflict, especially between the 'haves' and 'have nots,' is self-evident and likely to grow.[105]

The alarming trends in population growth, environmental degradation, and resource access foreshadow a future rife with violence stemming from environmental scarcities.

The second prediction is that water scarcity will join land scarcity as a cause of violent conflict. Benjamin Franklin astutely observed that "when the well's dry, we know the worth of water."[106] The sources of scarcity noted previously also are responsible for drying up the earth's well. Population growth is the primary source of water scarcity.

Sandra Postel, a researcher with the Worldwatch Institute, notes that one of the clearest signs of water scarcity is the increasing number of countries in which the population has exceeded available water supplies.[107] The list of water-scarce countries currently numbers 26 and may rise to 30 by 1999.[108] In water-scarce nations, the lack of water constrains food production, hinders economic development, and undermines ecological systems.

Water is also decreasing in quantity and quality. Theoretically, water is a highly renewable resource because natural and human processes can recharge stocks. Yet, as noted by Norman Myers, "all too often, it is utilized as a non-renewable resource."[109] For example, nine countries in the Middle East withdraw more than 100 percent of their annual renewable supply.[110] The human activity which makes the greatest demands on water is agriculture. Currently, food production accounts for 75 percent of global water use. Unfortunately, as Malin Falkenmark of the Natural Sciences Research Council in Stockholm observed, "it is not uncommon that 70 percent or more of the water withdrawn from rivers or aquifers for irrigation never reaches the crop."[111] Water pollution magnifies the problem of decreasing quantities of fresh water.

Inequities in global water distribution contribute to water scarcity. States obtain most of their water from rivers, lakes, and underground aquifers. Of these sources, rivers provide the largest percentage and cause the most problems for resource access. Michael Renner, a researcher at the Worldwatch Institute, summarizes the problem:

> Because they form a natural barrier, rivers play an important role in territorial demarcation. As a consequence, however, watersheds frequently fall under the jurisdiction of several hostile states. An estimated 40 percent of the world's population depends for drinking water, irrigation, or hydropower on the 214 major river systems shared by two or more countries; 12 of these waterways are shared by five or more nations.[112]

The fictitious invasion of Turkey illustrates the problem of access to water and is typical of potential conflicts along the Euphrates, Tigris, Jordan, Nile, Ganges, and Colorado rivers.

Environmental Scarcity and Doctrine

U.S. Senator Sam Nunn once declared that in the future the U.S. armed forces may find themselves being mobilized to fight such foes as global warming and deforestation.[113] His comment typifies the ongoing debate regarding environmental security. Although the debate is beyond the scope of this monograph, there are important considerations for doctrine. This section has three purposes. First, it shows that scarcity induced conflicts can affect U.S. interests. Second, it demonstrates that the 1995 National Security Strategy (NSS) recognizes the importance of the environment, but that the National Military Strategy (NMS) does not explicitly support that aspect of the NSS. Third, this section reviews current and emerging doctrine, revealing that the Army is unprepared intellectually for violent conflicts caused by scarcity.

Gro Harlem Brundtland, the former Prime Minister of Norway, predicted in 1983 that "the environmental problems of the poor will affect the rich...transmitted through political instability and turmoil."[114] Her prescription accurately captures the nature of the global environment in which interdependence makes the U.S. fiscally, economically, and militarily vulnerable to developments beyond its borders.[115] Clearly, the U.S. expended considerable resources to contend with Haitian refugees. However, the Haitian refugee situation was minor compared with other scenarios. Janet Brown, an environmental researcher and consultant, provides some examples:

> Americans have concrete economic and security interests at stake in resolving environmental, resource, and population problems in the developing world. United States trade with these countries has rapidly increased: today

> more than a third of our overseas markets...are in Latin America, Asia, and Africa. United States firms have investments throughout the developing world. U.S. banks and U.S. taxpayers hold a disproportionately large share of developing world debt. And United States national security depends on the stability, growth, and self-confidence of numerous key nations in Latin America, Asia, and Africa.[116]

The NSS does not equivocate on the importance of environmental issues. It states that "...environmental degradation, natural resource depletion, rapid population growth and refugee flows...have security implications for both present and long term American policy.[117] These implications impact directly on the three objectives of the NSS. First, enhancing U.S. security necessitates the promotion of regional and global stability. Second, promoting democracy focuses on strengthening democratic processes in other nations. Third, promoting prosperity requires "a vigorous and integrated economic policy designed to stimulate global environmentally sound growth and free trade."[118] As demonstrated in Chapter Two, environmental scarcity threatens regional security by undermining emerging democracies and causing economic decline. The NSS summarizes the environmental threats to regional and international security:

> Increasing competition for the dwindling reserves of uncontaminated air, arable land, fisheries and other food sources, and water, once considered 'free' goods, is already a very real risk to regional stability around the world. The range of risks serious enough to jeopardize international stability extends to massive population flight from man-made or natural catastrophes, such as Chernobyl or the East African drought, and to large-scale ecosystem damage caused by industrial pollution, deforestation, loss of biodiversity, ozone depletion, desertification, oceanic pollution and ultimately climate change.[119]

The NMS should complement the NSS. However, the NMS is devoid of explicit references to environmental challenges to U.S. national security objectives. One of the NMS objectives is to promote stability, a likely heading under which to address environmental threats. Yet, the NMS references only economic issues, avoiding

discussions of environmental threats entirely.[120] Furthermore, the NMS does not recognize environmental degradation as a regional threat. This omission is particularly noteworthy since peacetime engagement and conflict prevention are two components of the strategy that depend on regional security and strong alliances.[121] In fairness to the military, the NSS applies to all government entities. Consequently, the military may not be the lead agency for contending with the environmental problems that cause conflicts. Furthermore, the NMS mentions humanitarian assistance operations, indicating that it recognizes the symptoms of environmental problems rather than the environmental causes of conflict.

References to environmental threats are sparse in current doctrine. The Army's capstone doctrinal manual, Field Manual (FM) 100-5, Operations, makes no explicit remarks about environmental threats. This oversight is alarming because of the findings in Chapter Two and the emphasis afforded to environmental threats in the NSS. However, the manual makes one indirect reference to the environment:

> Army forces are extremely well-suited for postconflict operations. The Army has the skills and staying power to...provide humanitarian assistance and support the social needs of the civilian population, provide emergency restoration of utilities and other civil affairs, and perform other required humanitarian assistance activities. During the postconflict state, commanders emphasize those activities that reduce postconflict or postcrisis turmoil and help stabilize the situation until other U.S., international, interagency, or host nation agencies assume control.[122]

This reference suggests that the Army recognizes its unique capabilities for improving the conditions of environmental scarcity. However, it also implies that the Army considers itself a short-term solution to such conditions. Nonetheless, operations in Somalia, Rwanda, and Haiti show that the environment is a major factor in OOTW.

FM 100-5's failure to address environmental threats is understandable for two reasons. First, the 1993 version of FM 100-5 predates both the NSS and NMS by two years. Second, FM 100-5 supports prevailing attitudes on the role of the military. The NMS reflects the military's contribution to the NSS. Even if the NMS had been available prior to the writing of the 1993 version of FM 100-5, the manual would not have included references to environmental threats. Unless the NMS directs the military to increase its role in combating environmental problems, FM 100-5 is unlikely to include long-term solutions to environmentally induced conflicts. Nonetheless, the next revision of FM 100-5 will benefit from the availability of the NSS and NMS, as well as the ideas found in emerging doctrine.

Surprisingly, FM 100-23, Peace Operations, also fails to acknowledge the importance of environmental scarcity. Ironically, the seventh principle of humanitarian action in armed conflict says:

> Effective humanitarian action should encompass a comprehensive view of overall needs and of the impact of intervention. Encouraging respect for human rights and *addressing the underlying causes of conflict are essential elements* [emphasis added].[123]

The irony lies in the importance placed on the underlying causes of conflict. As shown in Chapter Two, environmental scarcity is a cause of violent conflict and aggravates other causes. However, the manual highlights the importance of understanding causal relationships without noting that the environment is one of the major contributors to conflict in situations requiring peace operations.

Military Intelligence (MI) doctrine also fails to address environmental causes of conflict. FM 34-130, Intelligence Preparation of the Battlefield, and FM 34-3, Intelligence

Analysis, provide exceptional methodologies for examining conventional threats. The primary tool for threat evaluation is Intelligence Preparation of the Battlefield (IPB). IPB "is a systematic, continuous process of analyzing the threat and environment in a specific geographic area. It is designed to support staff estimates and military decision making."[124] Although IPB looks at key elements such as demographics, terrain, weather, and infrastructure, it does not look at how these elements contribute to scarcity and adverse social effects. Likewise, the area study files advocated by FM 34-3 fail to include environmental data or address the linkages between the environment and political, economic, and social institutions.[125] As in the case of FM 100-5, these manuals predate the NSS and NMS. However, the addition of environmental considerations would make both manuals exceptional references for analyzing scarcity induced conflicts.

Emerging doctrine acknowledges the importance of environmental problems and the role of adverse social effects as causes of instability. However, it does not admit causation between environmental scarcity and violent conflict. Training and Doctrine Command (TRADOC) Pamphlet 525-5, Force XXI Operations, provides the Army with an intellectual stepping stone to future editions of FM 100-5. As such, it describes the Army's conceptual foundations for war and OOTW in the early 21st century. TRADOC Pam 525-5 makes two statements about environmental problems. First, it recognizes the importance of demographics and environmental risks, noting that:

> Population growth, particularly in the less-developed world, will strain the resources and social structures of the states affected. Because much of the world's population growth occurs in areas prone to natural disasters and famine, such events can cause mass migrations of refugees... Conditions that pose serious environmental risks may add to future instability. Natural disasters and changes in climate or environment can ruin a region's economy and send the populace across borders as refugees. Man-made crises may also cause tension. Cross

> border pollution will cause tension, both within regions and between developed and less-developed nations [126]

This statement comes closer to complementing the NSS than current doctrine, suggesting that the Army is aware of the sources of scarcity and the resulting adverse social effects. Second, it relates environmental problems to military responses. Under the heading of phenomenological threats, the pamphlet states that:

> ...nonmilitary threats resulting from human occurrences and experiences may require military response. These phenomena can include environmental disasters, health epidemics, famine, and major population dislocations, and illegal immigration.[127]

In spite of the Army's effort to be forward looking, it remains unprepared intellectually for a future in which scarcity induced conflicts will be prevalent.

Chapter Four
Conclusion and Recommendations

The two previous chapters proved that environmental scarcity is a cause of violent conflict and that causality carries enormous implications for OOTW, future conflict, and U.S. Army doctrine. Chapter Two used the Modified Conflict Causality Model (MCCM) to demonstrate causality (see Appendix 1). The MCCM showed that there are three primary sources of environmental scarcity: population growth, unequal resource access, and a decrease in the quality and quantity of renewable resources. These sources interact to produce scarcities as evidenced by the shortage of arable land in the case studies.

After establishing the existence of a scarcity, the MCCM answered two questions. First, does scarcity cause specific adverse social effects? Second, do the social effects that arise from scarcity cause violent conflict? Using the six case studies, the model proved that scarcity causes three important social effects: decreased economic activity, migration or expulsion, and weakened states. These social effects, in turn, cause three types of violent conflicts: simple scarcity, group-identity, and relative-deprivation conflicts.

The MCCM added rigor to the analysis by looking at the causal relationship between scarcity and violent conflict within a holistic context. The model considered the effects of political, economic, and social institutions on the sources of scarcity and the resulting social effects. The case studies showed that institutions can be powerful inhibitors of conflict by ameliorating adverse social effects. However, the studies also revealed that the countries in which scarcities are most burdensome have the least resilient institutions, thereby exacerbating the problem. Furthermore, the model weighed the relative contribution of problems other than scarcity on the social effects and the resulting

violent conflict. The analysis revealed that environmental scarcity is not a necessary and sufficient cause of conflict. However, scarcity figures prominently as a contributing cause, a trigger for conflict, and an aggravator of other causes.

Using the findings from the MCCM, Chapter Three examined three implications stemming from the proof of causality. First, OOTW conducted in Somalia, Rwanda, and Haiti are destined to become long-term failures in spite of their short-term successes. They will fail for three reasons. First, the operations treated the social effects created by scarcity because they were amenable to short-term solutions such as food aid. Second, the OOTW failed to address root causes because they were not apparent or they required long-term solutions. In the latter case, the solutions were incompatible with attainable military objectives or U.S. policy over a long period. Third, U.S. casualties and expended resources represent costs that will not be recovered when the conflicts recur.

The second implication is twofold. First, environmentally induced conflicts will be prevalent in the future. The evidence showed that alarming trends in population growth, resource access, and environmental degradation are likely to spawn more frequent and larger scale conflicts in the future. Second, these sources of scarcity are likely to produce a second and potentially more explosive scarcity--a shortage of fresh water. In particular, the world's 214 shared watersheds are likely flashpoints for future conflicts.

The third implication is that the Army is unprepared intellectually for violent conflicts caused by scarcity. Although the NSS specifically cites environmental problems as a threat to national security objectives, the evidence showed that the NMS fails to acknowledge the threat. This failure carries over into Army doctrine. Current doctrine

makes almost no mention of environmental problems as a cause of conflict. Emerging doctrine offers some evidence of an appreciation for the environment, but the attention afforded to the subject is not commensurate with its importance for future conflicts. In general, the Army is innocent of consciously ignoring environmental threats. Rather, it is in the process of understanding the nature of future conflict and assessing the implications.

Recommendations

The Army should take two steps to prepare for the future. First, it should immediately recognize the environment for what it is becoming: *a major security issue for the 21st century*. Then, the Army must capture this recognition in its doctrine. The military's ability to contend with multiple conflicts and fight concurrent wars is limited. Accordingly, Kent Hughes Butts, an Associate Professor at the Army War College, notes that "there is an increasing need for the United States to become proactive in addressing the causes of conflict before they occur, significant among them environmental issues."[128] He adds that:

> In the 20th century, international environmental problems have contributed significantly to international instability and conflict, and therefore have the potential to involve U.S. combat forces. As the current environmental crises in Haiti and Somalia make clear, DOD has a vested interest in mitigating environmental problems before they evolve into difficult-to-manage state or regional conflicts...By participating on a preventive basis in the resolution of environmental issues that could lead to such conflict, DOD can forestall Somalia-like involvements before they occur--an action that is extremely cost effective.[129]

His remarks show that the military's role in combating environmental threats may expand beyond short-term responses.

Kent Hughes Butts is not without his critics. Most of the them focus on the tradeoffs between the military and the environment. For example, Norman Myers, argues

that money spent on the military would be better spent on development and aid programs.[130] He states that:

> We cannot launch fighter planes into the sky to resist global warming, we cannot dispatch tanks to counter the advancing desert, we cannot fire the smartest missiles against the rising sea.[131]

Similarly, Michael Renner adds that:

> Technologically sophisticated though they may be, military means cannot reverse resource depletion or restore lost ecological balance...Not only do military means contribute nothing to achieving environmental security, they detract from it in a variety of ways.[132]

Both of these critics miss the point. Granted, pursuing military security at the cost of the environment in developing countries is, as noted by Michael Renner, "akin to dismantling a house to salvage materials to erect a fence around it."[133] However, as demonstrated in Somalia, Rwanda, and Haiti, the U.S. military plays a crucial contributing role in establishing the conditions in which aid and development programs work. This military role is likely to increase because, as remarked by Robert Kaplan:

> The savagery of the fighting points to a truth that we lack the stomach to contemplate: a large number of people on this planet, to whom the comfort and stability of a middle-class life is utterly unknown, find war and a barracks existence as a step up.[134]

The international aid agencies in Somalia recognized the truth of Kaplan's observation and, consequently, most agencies welcomed the presence of U.S. armed forces.

The Army should adopt the MCCM as its second step to prepare for the future. The model would serve two purposes. First, it would assess the environmental dimensions of current conflicts. Second, it would determine when and where resource-related conflicts are likely to arise. MI doctrine is one of the logical places for the model, providing analysts with both an assessment and a predictive tool.[135] Special Forces, Engineer, Civil Affairs, and Health Support doctrine are also appropriate locations for the

model. These two recommendations would help to prepare the Army intellectually for the future, providing doctrinal tools to contend with the complex web of conflict causality.

Modified Conflict Causality Model

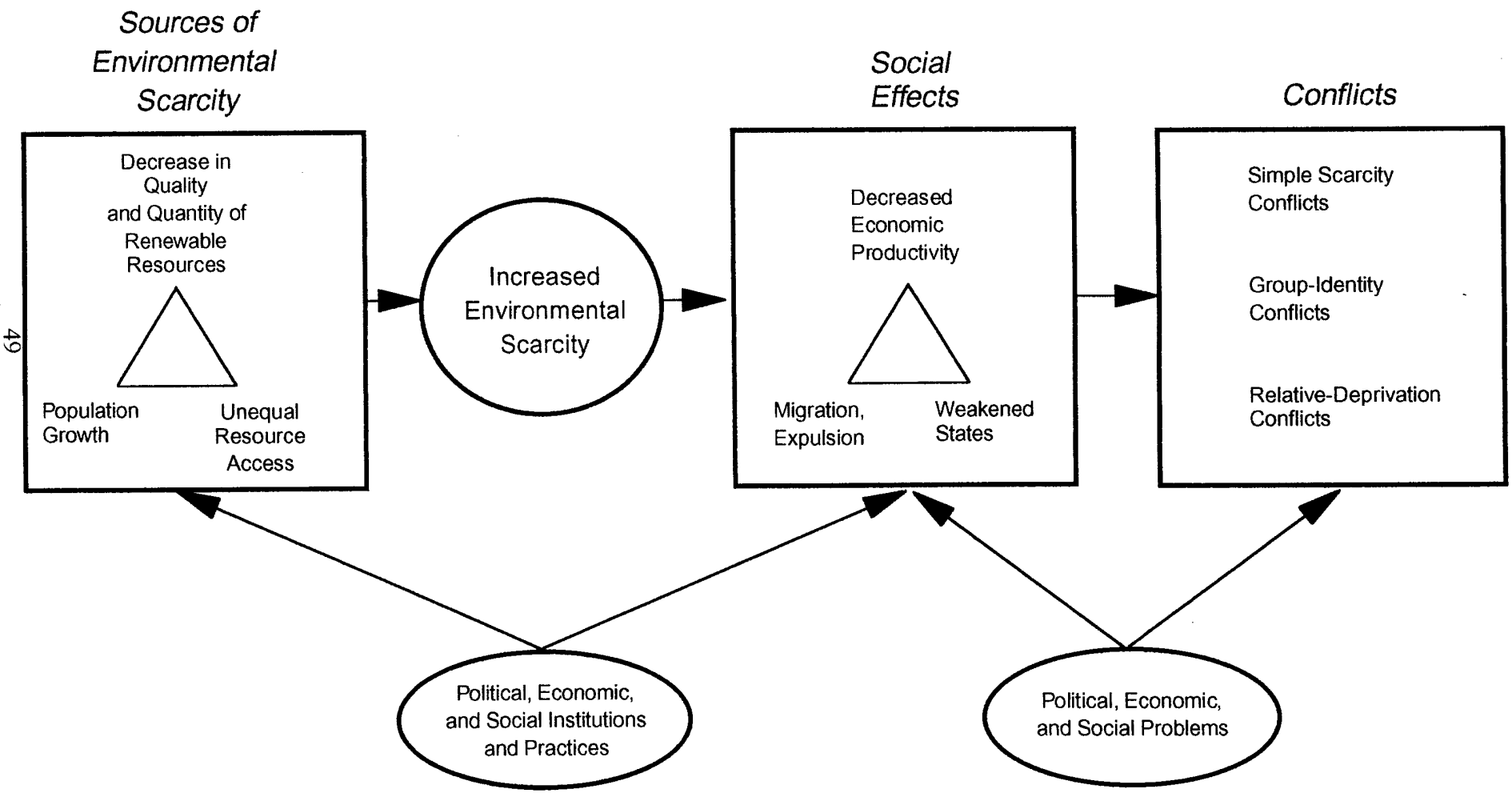
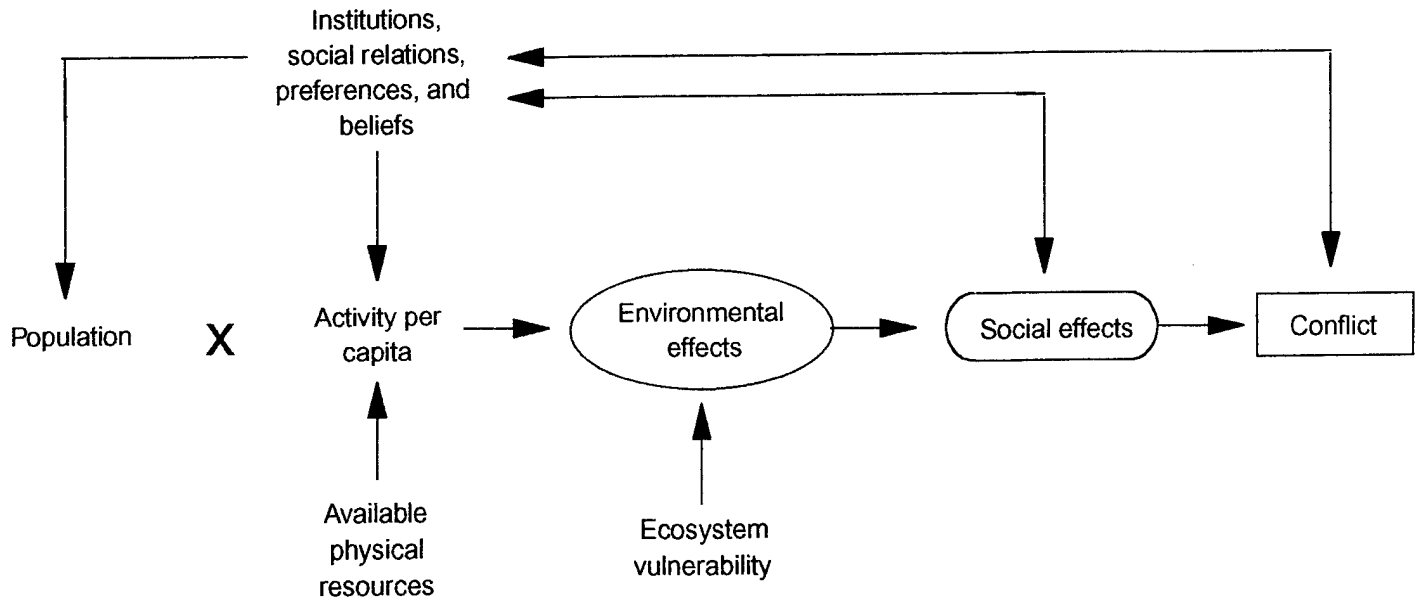
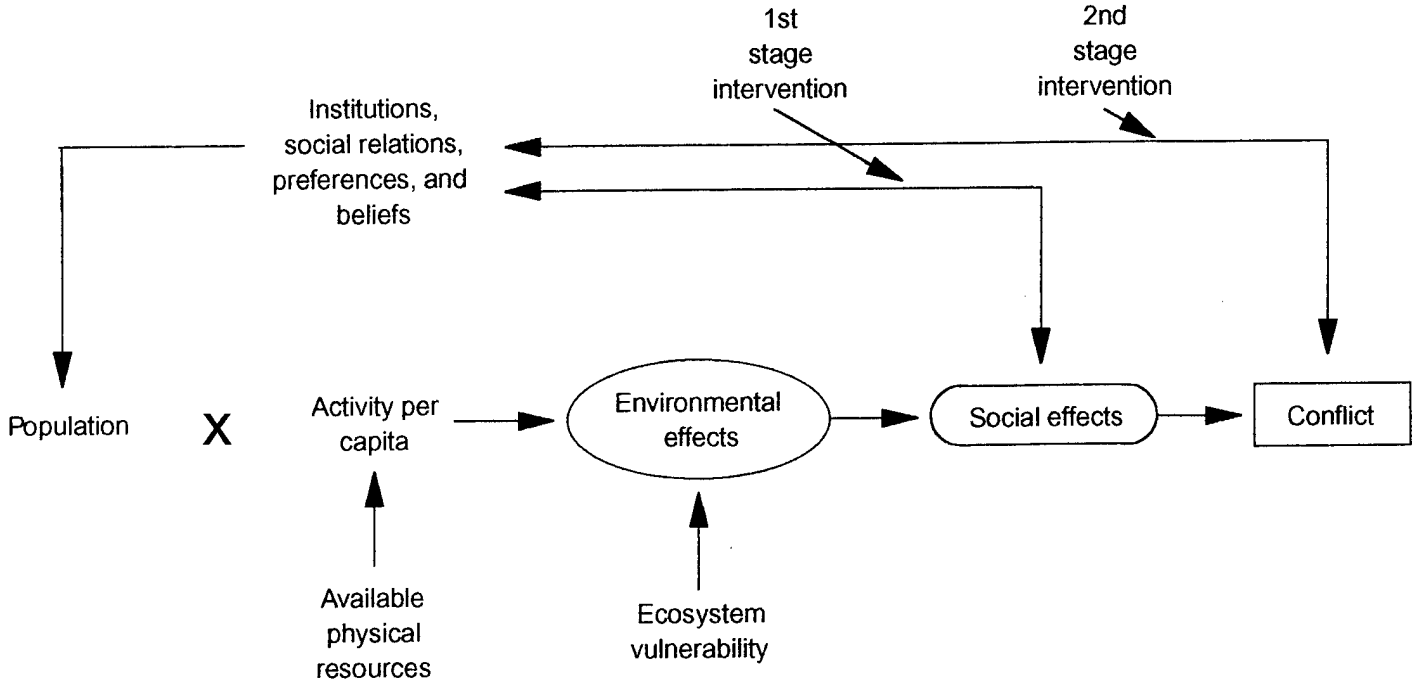


Figure 1: Homer-Dixon Conflict Causality Model



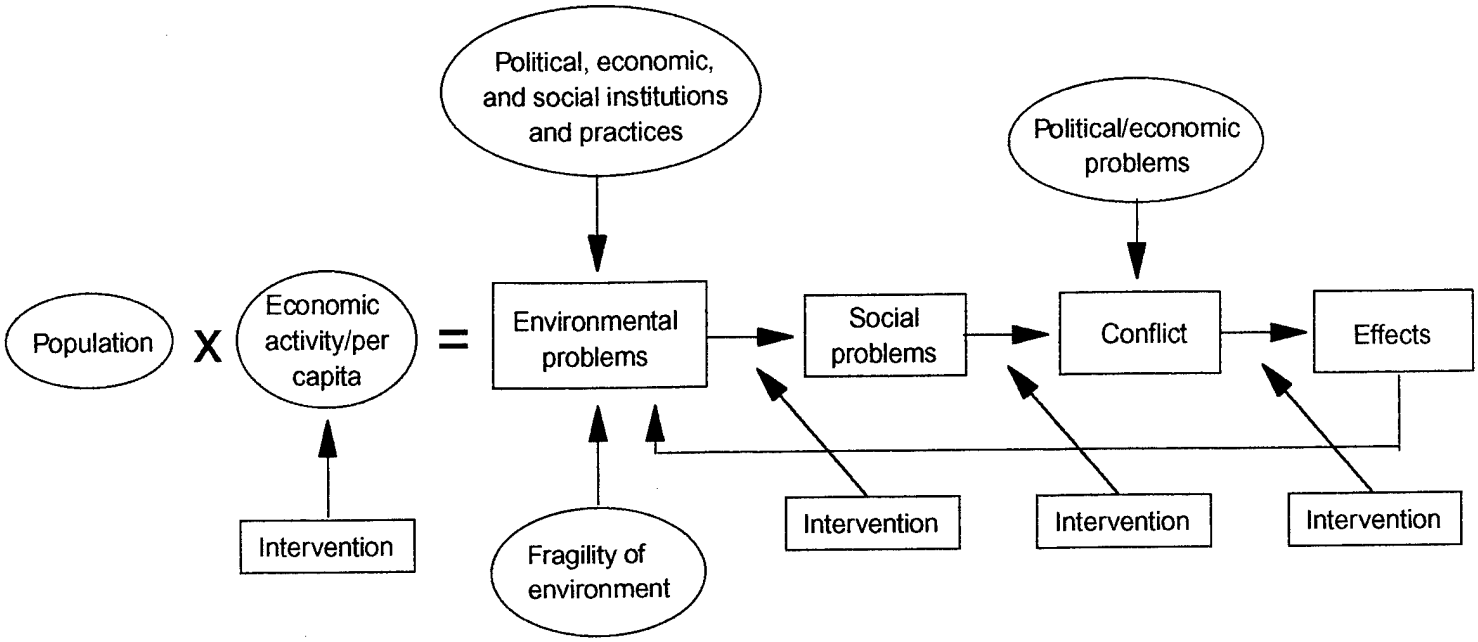
Adapted from Thomas F. Homer Dixon, "On the Threshold: Environmental Changes as Causes of Acute Conflict," International Security no. 2, Fall 1991, p. 86.

Figure 2: Revised Conflict Causality Model



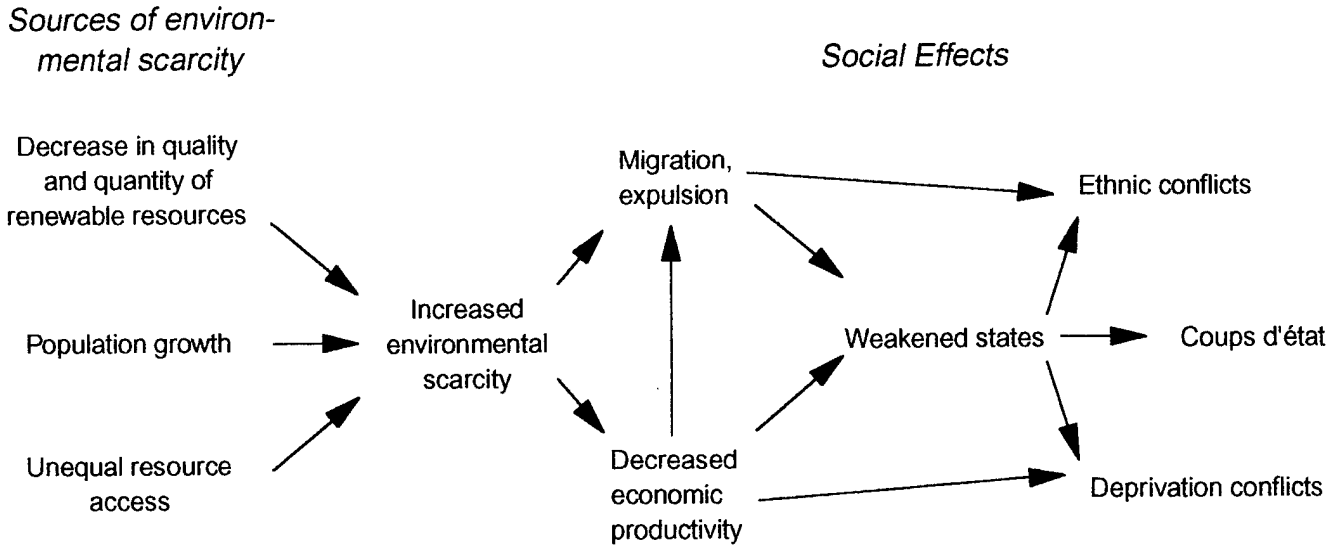
Adapted from James A. Winnefeld and Mary E. Morris, Where Environmental Concerns and Security Strategies Meet, Santa Monica, CA: Rand, 1994, p. 17.

Figure 3: Expanded Conflict Causality Model



Adapted from James A. Winnefeld and Mary E. Morris, Where Environmental Concerns and Security Strategies Meet, Santa Monica, CA: Rand, 1994, p. 19.

Figure 4: Combined Conflict Causality Model



Adapted from Thomas F. Homer Dixon, "Environmental Scarcities and Violent Conflict: Evidence from Cases," International Security no. 1, Summer 1994, p. 31.

[1] The following sources provide comprehensive studies of the environment as a victim and weapon of conflict: Susan D. Lanier-Graham, The Ecology of War: Environmental Impacts of Weaponry and Warfare, New York: Walker and Company, 1993; Christopher Manes, Green Rage: Radical Environmentalism and the Unmaking of Civilization, Boston, MA: Little, Brown and Company, 1990; and Muhamed Sadiq and John C. McCain, The Gulf War Aftermath: An Environmental Tragedy, Boston, MA: Kluwer Academic Publishers, 1993; William Thomas, Scorched Earth: The Military's Assault on the Environment, Philadelphia, PA: New Society Publishers, 1995.

[2] Kent Hughes Butts, an Associate Professor of Political Military Strategy in the Center for Strategic Leadership at the U.S. Army War College, is one of the Army's foremost authors on the environment. He has written several works on the subject for the Strategic Studies Institute, including The Army and the Environment: National Security Implications (3 June 1991), Environmental Security: A DOD Partnership for Peace (25 April 1994), and Environmental Security: What is DOD's Role? (28 May 1993).

[3] John Y. Schrader, Global 92 Analysis of Prospective Conflicts in the Tigris-Euphrates Watershed, Santa Monica, CA: Rand, 1993, pp. 3-13 and 34-38. See also Stephen C. McCaffrey, "Water, Politics, and International Law," in Water in Crisis, Peter H. Gleick, editor, New York: Oxford University Press, 1993, p. 93, Ewan W. Anderson, "Water: The Next Strategic Resource," in The Politics of Scarcity: Water in the Middle East, J. R. Starr and D. C. Stoll, editors, Boulder, CO: Westview Press, 1988, p. 13 and Joyce R. Starr and Daniel C. Stoll, "Water for the Year 2000," in The Politics of Scarcity: Water in the Middle East, J. R. Starr and D. C. Stoll, editors, Boulder, CO: Westview Press, 1988, pp. 147-149.

This fictitious scenario is based on well-researched studies and actual events. The Rand study looks at Syria and Iraq's dependence on the Tigris and Euphrates rivers and offers possible invasion scenarios. McCaffrey's article provides details of water consumption by Turkey, Syria, and Iraq. He also recounts Turkey's decision to stop the flow of the Euphrates from mid-January to mid-February 1990 to fill the reservoir behind the Ataturk dam. The Anderson and Stoll articles examine a similar case in which Iraq threatened to destroy the Ath-Thawrah dam in Syria in 1975. Iraq claimed that Syria's decision to reduce the flow of the Euphrates to fill the reservoir behind the dam threatened the livelihoods of over 3 million farmers.

[4] Frank Barnaby, editor, The Gaia Peace Atlas: Survival Into the Third Millenium, New York: Doubleday, 1988, p. 38.

[5] Peter H. Gleick, "Water in the 21st Century," in Water in Crisis, Peter H. Gleick, editor, New York: Oxford University Press, 1993, p. 109. See also McCaffrey, "Water, Politics, and International Law,"pp. 92-93.

[6] Many historians are using a multi-disciplined approach in their research. Consequently, the histories of the Greeks, Mayans, and even the Easter Islanders are receiving new appraisals. For example, see William R. Catton, Jr. Overshoot: The

Ecological Basis of Revolutionary Change, Chicago, IL: University of Illinois Press, 1980, p. 215.

[7] Quoted in John D. Schlegel, "Environmental Degradation: Implications for National Security," Monograph, Carlisle Barracks, PA: U.S. Army War College Strategic Studies Institute, 30 March 1990, p. 8.

[8] Robert D. Kaplan, "The Coming Anarchy," The Atlantic Monthly no. 2, February 1994, p. 54.

[9] Samuel P. Huntington, "The Clash of Civilizations?," Foreign Affairs no. 3, Summer 1993, p. 22.

[10] Thomas F. Homer-Dixon, "Environmental Scarcities and Violent Conflict," International Security no.1, Summer 1994, pp. 8-9.

[11] Ibid., pp. 8-9.

[12] Herodotus, quoted in Garrett Hardin, Living Within Limits: Ecology, Economics, and Population Taboos, New York: Oxford University Press, 1993, p. 17.

[13] Thomas F. Homer-Dixon, "On the Threshold: Environmental Changes as Causes of Acute Conflict," International Security no.2, Fall 1991, pp.99-100.

[14] Kaplan, p. 60.

[15] The original Homer-Dixon Conflict Causality Model (Figure 1) was the theoretical framework used by the Project on Environmental Change and Acute Conflict. The model's primary weakness is that it does not address a distributional component as a source of scarcity. Rand developed the Revised Conflict Causality Model (Figure 2) and the Expanded Conflict Causality Model (Figure 3) as adaptations of the original Homer-Dixon model. The revised model merely labels the intervention feedback loops used by Homer-Dixon. The intervention loops consider how social effects and conflict can influence institutions, social relations, preferences, and beliefs. The expanded model adds the three features discussed in the text. The Combined Conflict Causality Model (Figure 4) is a graphic portrayal of the Toronto Project's findings. Thus, it addresses the linear causality between environmental scarcity and conflict and discards the other features from the original model. The Modified Conflict Causality Model (Appendix 1) borrows features from all four models and serves as the analytic framework for this monograph.

[16] Thomas F. Homer-Dixon, Jeffrey H. Boutwell, and George W. Rathjens, "Environmental Change and Violent Conflict." Scientific American no. 2, February 1993, pp. 39-41.

[17] Lester Brown, "Nature's Limits," in State of the World: A Worldwatch Institute Report on Progress Toward a Sustainable Society, Lester Brown, editor, New York: W.W. Norton & Company, 1995, pp. 7-8.

[18] Essam El-Hinnawi, Environmental Refugees, Nairobi: United Nations Environmental Program, 1985, p. 4.

[19] Homer-Dixon, "Environmental Scarcity," p. 25.

[20] Homer-Dixon, "On the Threshold," pp. 106-109.

[21] Homer-Dixon, "Environmental Scarcity," pp. 31-32.

[22] Ibid., p. 16. See also Nazli Choucri, Janet Welsh Brown, and Peter M. Haas, "Dimensions of National Security: The Case of Egypt," in In the U.S. Interest: Resources, Growth, and Security in the Developing World, Brown, Janet Welsh, editor, Boulder, CO: Westview Press, 1990, p. 25 and Butts, "Environmental Security: A DOD Partnership," pp. 4-5.

[23] James A. Winnefeld and Mary E. Morris, Where Environmental Concerns and Security Strategies Meet: Green Conflict in Asia and the Middle East, Santa Monica, CA: Rand, 1994, pp. 3 and 13-16.

[24] William H. Durham, Scarcity and Survival in Central America: Ecological Origins of the Soccer War, Stanford, CA: Stanford University Press, 1979, p. 1.

[25] Arthur H. Westing, editor, Global Resources and International Conflict: Environmental Failure in Strategic Policy and Action, New York: Oxford University Press, 1986, p. 207.

[26] Durham, pp. 6-7.

[27] Victor Millan and Michael A. Morris. Conflicts in Latin America: Democratic Alternatives in the 1990s, Conflict Studies 230. London: Research Institute for the Study of Conflict and Terrorism, April 1990, p. 28.

[28] Durham, p. 2.

[29] Ibid., p. 158.

[30] Ibid., pp. 158-161.

[31] Ibid., p. 165.

[32] Ibid., p. 164.

[33] Ibid.

[34] Tommie Sue Montgomery, Revolution in El Salvador, Boulder, CO: Westview Press, 1995, p. 59.

[35] Durham, p. 163.

[36] Lloyd Timberlake and Jon Tinker, "The Environmental Origins of Conflict," The Socialist Review no. 6, 1985, p. 64.

[37] Brian D. Perry, "The Real Cause of Ethiopia's Problems," Nature no. 319, 1986, p. 183.

[38] Norman Myers, Population, Resources and the Environment: The Critical Challenges, London: United Nations Population Fund, 1991, p. 93.

[39] Jessica Tuchman Mathews, "Redefining Security," Foreign Affairs no. 2, Spring 1989, p. 167.

[40] Timberlake, p. 64.

[41] Norman Myers, "The Environmental Dimension to Security Issues," The Environmentalist no. 6, 1986, p. 251.

[42] Samuel M. Makinda, Security in the Horn of Africa, Adelphi Paper 269, London, Brassey's, 1992, p. 20.

[43] Norman Myers, Ultimate Security: The Environmental Basis of Political Stability, New York: W.W. Norton & Company, 1993, pp. 60-61. See also Myers, Population, Resources and the Environment, p. 93 and Myers, "The Environmental Dimension," p. 251.

[44] Homer-Dixon, "Environmental Change," pp. 41-42.

[45] Ibid., p. 41.

[46] Ibid. See also Homer-Dixon, "Environmental Scarcity," p. 12.

[47] Michael Renner, National Security: The Economic and Environmental Dimensions, Worldwatch Paper 89, Washington, D.C.: World Watch Institute, May 1989, p. 30.

[48] Homer-Dixon, "Environmental Change," p. 41. See also Homer-Dixon, "Environmental Scarcity," p. 12.

[49] Ibid.

[50] Ibid., pp. 41-42. See also Homer-Dixon, "Environmental Scarcity," p. 13.

[51] Terrence Lyons and Ahmed I. Samatar, Somalia, Washington, D. C.: The Brookings Institute, 1995, p. 7.

[52] Colin Legum, The Horn of Africa: Prospects for Political Transformation. Conflict Studies 254, London: Research Institute for the Study of Conflict and Terrorism, September 1992, p. 14. See also Hal Kane, "Leaving Home," in State of the World: A Worldwatch Institute Report on Progress Toward a Sustainable Society, Lester Brown, editor, New York: W.W. Norton & Company, 1995, pp. 140-141.

[53] Mohamed Sahnoun, Somalia: The Missed Opportunities, Washington, D.C.: United States Institute of Peace Press, 1994, p. 16.

[54] Kane, pp. 140-141.

[55] Riley, pp. 18-19.

[56] Sahnoun, pp. 5-6.

[57] Lyons, p. 22.

[58] Gareth Porter, "Environmental Security as a National Security Issue," Current History no. 592, May 1995, p. 221.

[59] Lyons, pp. 8-10.

[60] Ibid., p. 8.

[61] Ibid., pp. 7-8, 24.

[62] Porter, "Environmental Security,"p. 221. See also Brown, "Nature's Limits," p. 14 and Derek Denniston, "Sustaining Mountain Peoples and Environments," in State of the World: A Worldwatch Institute Report on Progress Toward a Sustainable Society, Lester Brown, editor, New York: W.W. Norton & Company, 1995 p. 44.

[63] Denniston, p. 44.

[64] Paul Harrison, The Third Revolution: Environment, Population, and a Sustainable World, New York: I.B. Tauris & Co., 1992, p. 130.

[65] Kane, p. 141.

[66] Brown, "Nature's Limits," p. 14.

[67] Patrick J. O'Hallaran, Humanitarian Intervention and the Genocide in Rwanda. Conflict Studies 277, London: Research Institute for the Study of Conflict and Terrorism, January 1995, p. 26. Also note that according to Kane,"Tutsi is not exactly the name of an ethnic group: historically it meant 'people who own cattle.' And Hutu meant 'people who farm.,'" pp. 141-142.

[68] Ibid., p. 4.

[69] For example, the Hutu government mandated that all Rwandans carry racial-identity cards. See O'Hallaran, p. 4.

[70] Porter, "Environmental Security," p. 221.

[71] O'Hallaran, pp. 4 and 21.

[72] Brown, "Nature's Limits,"p. 14.

[73] D. W. Fitzsimmons and A. W. Whiteside, Conflict, War and Public Health, Conflict Studies 276, London: Research Institute for the Study of Conflict and Terrorism, November/December 1994, p. 12.

[74] Homer-Dixon, "Environmental Scarcity,"p. 34.

[75] William W. Mendel, "The Haiti Contingency," Military Review no. 1, January 1994, p. 50.

[76] Timberlake, p. 59. See also John W. Warnock, The Politics of Hunger, New York: Methuen, 1987, p. 190.

[77] El-Hinnawi, pp. 23-24.

[78] Homer-Dixon, "Environmental Scarcity," p. 34.

[79] Brown, "Nature's Limits," p. 14.

[80] El-Hinnawi, pp. 23-24.

[81] Myers, UltimateSecurity, p. 133.

[82] Timberlake, p. 72.

[83] Brown, "Nature's Limits," p. 14.

[84] Ralph Peters, "The Culture of Future Conflict," Parameters no. 4, Winter 1995-96, p. 22.

[85] Riley, p. 20.

[86] Lyons, p. 34.

[87] Kane, p. 147.

[88] Rakiya Omaar, "Somalia: At War with Itself," Current History no. 565, May 1992, p. 230.

[89] Center for Army Lessons Learned. Operation Restore Hope Lessons Learned Report: 3 December 1992-4 May 1993. Fort Leavenworth, KS: U.S. Army Training and Doctrine Command, 1993, p. 7.

[90] John Paul Lederach, "The Intervention in Somalia: What Should Have Happened," Middle East Report no. 2, March-April 1993, p. 39.

[91] Brown, "Nature's Limits," p. 16.

[92] Mathews, p. 168.

[93] Lyons, p. 59.

[94] Riley, p. 22.

[95] Brown, "Nature's Limits," p. 16.

[96] Kane, p. 148.

[97] Myers, Ultimate Security, p. 133.

[98] Ibid., p. 212.

[99] Ibid.

[100] Gleick, p. 105.

[101] Kaplan, p. 59.

[102] George J. Mitchell, World on Fire: Saving an Endangered Earth, New York: Charles Scribner's Sons, 1991, p. 88.

[103] Rachel Carson, Silent Spring, New York: Ballantine Books, 1962, pp. 13-15.

[104] Lester Brown, "A New Era Unfolds," in State of the World: A Worldwatch Institute Report on Progress Toward a Sustainable Society, Lester Brown, editor, New York: W.W. Norton & Company, 1993, p. 5.

[105] A. J. Fairclough, "Global Environmental and Natural Resource Problems--Their Economic, Political, and Security Implications," The Washington Quarterly no 1, Winter 1991, p. 83.

[106] Quoted in Sandra Postel, "Facing Water Scarcity," in State of the World: A Worldwatch Institute Report on Progress Toward a Sustainable Society, Lester Brown, editor, New York: W.W. Norton & Company, 1993, p. 22.

[107] Ibid., pp. 23-24. Nations are considered to be water-scarce when water availability drops below 1,000 cubic meters per person per year (about 725 gallons per person a day).

[108] Ibid., p. 24.

[109] Myers, Population, p. 35.

[110] Gleick, p. 105.

[111] Malin Falkenmark, "Fresh Waters as a Factor in Strategic Policy and Action," in Global Resources and International Conflict: Environmental Failure in Strategic Policy and Action, Arthur H. Westing, editor, New York: Oxford University Press, 1986, p. 87.

[112] Renner, p. 31.

[113] Michael Harbottle, New Roles for the Military: Humanitarian and Environmental Security, Conflict Studies 285, London: Research Institute for the Study of Conflict and Terrorism, November 1995, p. 15.

[114] Janet Welsh Brown, "Why Should We Care?" in In the U.S. Interest: Resources, Growth, and Security in the Developing World, Janet Welsh Brown, editor, Boulder, CO: Westview Press, 1990, p. 5.

[115] Ibid., p. 1.

[116] Ibid.

[117] National Security Strategy of the United States, February 1995, Washington, D. C.: Government Printing Office, 1995, p. 1

[118] Ibid., p. 7.

[119] Ibid., p. 18.

[120] National Military Strategy of the United States, February 1995, Washington, D. C.: Government Printing Office, 1995, pp. 3-4.

[121] Ibid., pp. 8-12.

[122] Department of the Army, Field Manual 100-5, Operations, Washington, D.C.: Headquarters, Department of the Army, June 1993, p. 3-12.

[123] Department of the Army, Field Manual 100-23, Peace Operations, Washington, D.C.: Headquarters, Department of the Army, December 1994, p. 28.

[124] Department of the Army, Field Manual 34-130, Intelligence Preparation of the Battlefield, Washington, D.C.: Headquarters, Department of the Army, 8 July 1994, p. 1-1.

[125] Department of the Army, Field Manual 34-3, Intelligence Analysis, Washington, D.C.: Headquarters, Department of the Army, 15 March 1990, p. 10-7.

[126] Department of the Army, TRADOC Pamphlet 525-5, Force XXI Operations, Fort Monroe, VA: TRADOC, 1 August 1994, p. 2-2.

[127] Force XXI Operations, p. 2-3.

[128] Butts, Environmental Security: A DOD Partnership, p. 2.

[129] Ibid., pp. 2-3.

[130] Myers, Ultimate Security, pp. 217-221. Myers has a personal agenda. He often takes an anti-military perspective, refusing to acknowledge the positive contributions of the military in combating environmental problems. For example, he is quick to cite the positive contributions by international agencies in places such as Somalia, Rwanda, and Haiti, but he avoids the issue of creating conditions in which such agencies can operate. Arguably, international agencies would have failed in Somalia, Rwanda, and Haiti without the military's presence.

[131] Myers, Ultimate Security, p. 24.

[132] Renner, p. 38.

[133] Ibid., p. 7.

[134] Kaplan, p. 70.

[135] See Roberta B. Carr, "The Greening of Global Security: The U. S. Military and International Environmental Security." Monterey, CA: Naval Postgraduate School, December 1993, p. ix. Carr notes that U.S. planners must begin to address the reality of environmental security as a future mission.

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