

# Historical and Current Overview of the Issue

*The United States is providing the leadership to promote global peace and prosperity. We must also lead in safeguarding the global environment on which that prosperity and peace ultimately depend.*

—Former U.S. Secretary of State Warren Christopher

National security has traditionally been seen as a matter relating to the military defense of state borders. Now, however, global environmental phenomena such as climate change, deforestation, and extreme weather events all have an impact on national security. This means that any nation wishing to preserve or strengthen its national interest must not only be ready to deal with environmental issues within its own territory, but must cooperate with other nations on the world stage to ameliorate environmental problems.

## **Traditional Views of National Security**

When most people think of national security, they think of war. War and the preparation for war have been the constant focus of security practitioners since the birth of the modern nation-state. Although different countries give greater or lesser priority to different national values, a nation's ability to defend itself has always been its paramount value. Political realists follow Hans Morgenthau's lead in equating the national interest with national security and hence with the preservation and expansion of state power (see Morgenthau 1948). Since the military has been the traditional means of securing this power, national security has come to mean military might.

When viewed as a military outcome, national security was calculated with a simple metric. One nation's armed forces met another nation's armed forces

on the battlefield, and whichever side had superior strength, cunning, and tenacity won the battle and was awarded the prize of national security. War could be started by decree, as when Lincoln requested troops in response to the Confederacy's firing on Fort Sumter before the U.S. Civil War. War could be started by sudden attack, as in the Japanese attack on Pearl Harbor, or by stealth and creeping encroachment, as in Hitler's Anschluss before World War II. War could even be started by the act of a single individual, as in the assassination of an Austrian official before World War I. However, the deciding factor in victory was the military might of one state or a combination of states. War would be over when the government of one nation surrendered to the government of the other. Security was defined as a wholly state-based affair: the government proposed and the military disposed.

### Zero-Sum Realism

For political realists, this makes perfect sense. The international system is anarchic and always has been, and each nation that values its existence (that is to say, every nation) has the right and duty to act to protect itself against its enemies. Although countries give greater or lesser priority to different national values, the ability of a country to defend itself has always been its paramount value. Since the only force that was seen to threaten the existence of a nation was another nation's armed forces, security as defined in the context of power was logical and just. National security in an anarchic system is a zero-sum game: if one nation gains a certain measure of security, it means that another nation has lost security in that same measure.

Morality is irrelevant to realists of the Morgenthauian persuasion, as are alliances between nations. A state's only moral goal is its survival, and any action which supports that survival is allowable, if not strictly moral, in a realist world. Because one state can never know with certainty what another state will do to ensure its survival, alliances are temporary at best and never to be chosen over national interest. Consequently, decisions are best made on a unitary basis. Morgenthau wrote these rules down in 1948, after decades of world wars and economic turmoil. Modern students of environmental security will have to ask themselves whether these assumptions about national interest and power are still true.

Although the ability of a state to defend and preserve itself has always been its supreme value, states give different national values greater or lesser priority depending upon their own internal security calculus (see Wolfers 1952, Baldwin 1997). Other national values might include political systems, cultural homogeneity, religious purity, economic openness, or ecological health, though this last value occurs only rarely as a specific national interest. Realists argue that without security, none of these other interests can be

protected, though what constitutes security itself changes from time to time and from nation to nation. Arnold Wolfers wrote at mid-century:

Security is a value, then, of which a nation can have more or less and which it can aspire to have in greater or lesser measure. . . . (Wolfers 1952, 484)

Security, then, is not an absolute value, but a derivative one. A nation will identify its core values and take steps to secure them from threat. How secure the nation wishes to make those values will then lead it to ask more or less of its citizens in sacrifice, so if a country greatly fears attack from a foreign army, it might require military conscription. If a nation wishes to insulate itself from economic shock, it may disallow imports. If it wishes to be secure in energy supplies, it may build nuclear reactors. But in recognizing the range of values that a nation wishes to secure, it is important to realize that there are values that will not be secured by power.

Realism's contrasting theory, the theory of liberalism, posits that security is achieved collectively. Because states are embedded in an international system that constrains their actions, improved security for one state does not automatically result in decreased security for others. Liberals argue that while the international system is anarchic because there is no overarching authority to compel the behavior of sovereign states, the gains and losses incurred by a state after a particular action or policy are encouragement or deterrent enough. Because security under liberalism is not zero-sum, collective gains can be made by strengthening the international institutions that guide state behavior. The role of collective gains in the pursuit of environmental security will be reexamined in Chapter 6.

What is axiomatic in any discussion of national security in the traditional sense is that the threat to security is always exogenous; it comes from another nation or group of people (e.g., tribe, ethnic group, terrorist cell). Nowhere in traditional security studies, except for those forward thinkers discussed later in this chapter, appears the idea that a security threat may be *endogenous*, that is to say, coming from within, from our own peacetime behaviors. Further, nowhere in the discussion of national interest is any mention made that a country's legitimate national interest would include a stable ecosystem. Only recently have we recognized that human activities could alter the global ecosystem to the point where our economic capabilities, territorial integrity, and public health could be jeopardized.

### High Politics vs. Low Politics

Now the question arises: how are nations defending themselves and from what sorts of threats? Modern national security is no longer merely a function

of state-based military capabilities, and does not wholly resemble national security in Morgenthau's time. State capabilities are asymmetric in power and their strategies are asymmetric in aim.

Modern military forces in most countries are very powerful and equipped with new and increasingly destructive technology. This confidence in technological capability may lead powerful nations into wars of choice by fooling them into thinking that their weapons are so superior that war will be easy, as in the American invasion of Iraq. However, most wars now are not likely to occur between one state and another—though this is always a possibility—but between a state and a nonstate actor like Al Qaeda, or between two tribes or ethnic groups within a state as in Sudan or Yemen.

It is interesting to note—though such analysis lends itself to bias—to what degree the definitions and assumptions about national security have been colored by the perception that security is guaranteed by mostly male military forces and is not something in which women play a significant role. **High politics**, in its Hobbesian form, refers to those things that are critical to the survival of the state, such as armies, weapons, nuclear missiles—anything related to national and international security. **Low politics**, by contrast, encompasses policies that are thought not to be critical to state survival, such as the environment, demographics, education, culture, and public health—all the things in which women have had greater representation. A thorough discussion of the role of women in national security is beyond the scope of this volume, but for further consideration of the gender dimensions of security and international relations see Elshtain 1985, Cohn 1987, Tickner 1992, and Wibben 2004.

Low politics, ecological health included, are not to be discounted as factors in the high politics calculations of national and international security. When we look at the current security crises around the world, we can see that many of them have their roots in low politics. For example, war has raged in Afghanistan for over 30 years, as the Afghans have faced attack first from the Soviet Union and then from NATO and the United States. The outward rationale for this interference in Afghanistan was Cold War politics, but when examined more fundamentally, population growth, agricultural resources including opium, and religious extremism have been the drivers of war. The most horrific examples of ethnic cleansing in Bosnia, Kosovo, and most recently, Darfur, have also been fueled by religious and cultural differences and growing population. More recently, the stability and economic recovery of Haiti, already a mammoth task, has been shaken by the news that UN peacekeeping troops recently arrived from Nepal brought with them a new and deadly strain of cholera that killed over 5,500 people and sickened hundreds of thousands more. Even now, the political unrest spreading across the Middle East and North Africa stems in part from food shortages, and it

is instructive to realize that something as quotidian as food can bring down a state regime.

### History of Environmental Security Thinking

#### Breaking the Mold

Beginning in the late 1960s, a few thinkers began to view threats to national security through a larger lens and consider environmental issues as drivers of national security threats. In 1968, Paul Ehrlich wrote *The Population Bomb* in which he posited three scenarios for future development in a world of overpopulation and scarce resources; all three ended in starvation and war, with the most “optimistic” scenario predicting the death of only one-fifth of the world's population (Ehrlich 1968, 72–80). The connections between overpopulation, resources, and war were elucidated further two years later, when he and coauthors Anne Ehrlich and John Holdren concluded that,

Finite resources in a world of expanding populations and increasing per-capita demands create a situation ripe for international violence. The perceived need to control resources has been a major factor in U.S. military and paramilitary involvements around the globe since World War II. (Ehrlich et al. 1970, 909)

In 1977, Lester Brown, founder of the Worldwatch Institute, argued that systemic environmental issues such as climate change, deforestation, and loss of arable land could be nonmilitary drivers of insecurity, and that military forces would be ineffective against these new threats. To counter them would require a new vision of security. Brown recommended reallocation of budgetary assets to meet the spectrum of threats to security, military as well as nonmilitary, though he warned that “few individuals are trained or able to weigh and evaluate such a diversity of threats and then to translate such an assessment into the allocation of public resources that provides the greatest national security” (Brown 1977, 38).

In 1983, Richard Ullman argued for the “redefinition” of what constitutes a national security threat to include endogenous threats like environmental conditions in addition to traditional state and military concerns. He defined a national security threat as,

an action or sequence of events that (1) threatens drastically and over a relatively brief span of time to degrade the quality of life for the inhabitants of a state, or (2) threatens significantly to narrow the range of policy choices available to the government of a state or to private,

non-governmental entities (persons, groups, corporations) within the state. (Ullman 1983, 134)

This definition of national security significantly expands the realms of what can be viewed as a threat. No longer is military protection of a state's borders sufficient to guarantee security, and in fact Ullman warned that defining national security primarily in terms of military threats conveyed a false image of reality because it allowed states to ignore other harmful dangers, such as civil conflicts, overpopulation, and public health crises that reduced their overall security. However, the Cold War was a time of zero-sum security metrics measured in ICBM throw weights, Trident submarine MIRVs, and megatons of nuclear destruction. National security meant that one side had more, or at least better-targeted, nuclear missiles than the other side, and concerns such as fresh water, arable cropland, and greenhouse gases were either ignored or shoved into the portfolio of low politics. At the time, Brown's and Ullman's admonitions to focus on nonnuclear, nonstate, environmentally based strategic threats were not well received or widely heeded.

#### **As Much Security through Trees as through Tanks**

However, as the Cold War began winding down, environmental issues began to emerge from their nuclear eclipse, and what came to be known as environmental security theory was reexamined beginning in 1989. Jessica Mathews called for redefining security to include environmental threats, stating that the institutions and assumptions that governed international relations and national security since the end of World War II were "a poor fit" with the new realities of environmental stresses, demographic changes, and the decline of U.S. economic hegemony (Mathews 1989, 162), in particular the obsolete assumption that national interests end with territorial borders. In the same year, David Wirth, writing in *Foreign Policy*, pointed out that the United States would suffer significantly from warming-induced sea level rise and warned that "policymakers should give the most serious consideration to the security implications of the ongoing failure to anticipate and arrest greenhouse warming" (Wirth 1989, 10). Norman Myers was more specific, pointing out that environmentally driven problems such as water security in the Middle East, soil erosion in El Salvador, and outmigration in Mexico have the potential to become conflicts; he also noted that the time could "be coming when as much lasting security can be purchased through trees as through tanks" (Myers 1989, 41).

In 1991, three critical articles came out spotlighting the link (or nonlink) between environmental conditions and security threats. Thomas

Homer-Dixon (1991), in "On the Threshold," argued that environmental degradation can cause conflict, especially in poor countries with less robust adaptive capacity, in one of four ways: reduced agricultural production, economic decline, population displacement, and/or disruption of legitimate social relations. In turn, this would cause scarcity disputes between countries or ethnic groups. Examples will be discussed in later chapters.

Homer-Dixon pointed out that the modern realist perspective in international relations was insufficient to deal with issues of environmental security because it viewed states as rational power maximizers in an otherwise anarchic system (Homer-Dixon 1991, 84). In Morgenthauian terms, states are territorially distinct and mutually exclusive. With each nation in a zero-sum system looking to advance its own interests over those of its neighbors, there is no incentive to solve transboundary ecological problems cooperatively. Rather, there is incentive to free-ride on the good behavior of your neighbor.

At the same time, Peter Gleick and Daniel Deudney published pro and con articles surrounding the topic in the same journal. Gleick argued that a redefinition of national security was not required, but rather an expanded understanding of the nature of threats to security, especially links between natural resources and international behavior. He saw the growing economic and technical inequity between the developed countries in the global North and the developing countries in the global South as a possible security problem. In order to forestall environmentally driven conflict, he recommended a transfer of resources from North to South, both to counter arguments of environmental inequity and to curb the environmentally destructive development practices demanded by Northern institutions such as the World Bank and the IMF that would be fueling much of the coming degradation (Gleick 1991, 21). In this way, the development gap between the North and the South would not spiral into conflict.

Deudney, on the other hand, argued that national security has traditionally concerned itself with protection from organized violence, and if redefined (i.e., conflated with environmental degradation), the term "national security" would lose all analytical usefulness. Since the two concepts are fundamentally different in nature and in scope (security has "them and their behavior" as the enemy, whereas environmentalism has "us and our behavior" as the enemy), the traditional national security apparatus is insufficient to deal with the new environmental problems, and in Deudney's eyes, this meant that they were not security problems (Deudney 1991, 25). The Cold War definition of national security that restricted the field of security studies to military affairs largely prevailed in the security community during the following decade (see Levy 1995).

In the early scholars' attempts to clarify the relationship between environmental issues and national security, the definition of security was rewritten once again:

A national security issue is any trend or event that (1) threatens the very survival of the nation; and/or (2) threatens to drastically reduce the welfare of the nation in a fashion that requires a centrally coordinated national mobilization of resources to mitigate or reverse. (Goldstone 1996, 66)

While Goldstone should have added the word "external" to his description of trend or event, this definition and the ones preceding it are important to consider because they were instrumental in prying open the domain of security studies for input from other disciplines. Since Westphalia, the function of national security has revolved around protecting a state's borders, and up until the age of global environmental phenomena, the only thing that could penetrate a state's borders was another state's military force (or, on occasion, refugees in large numbers). Now, however, forces that can pose a security threat to a state's citizens are not always military in nature.

Environmental security in this instance is not to be confused with *human security*; the two concepts are related, but they are not identical. The redefinition of the idea of national security in the 1980s and 1990s broadened it significantly to include many nonmilitary threats. However, human security, as it is understood in a modern academic sense, deals with forces such as development, famine, and disease that are threats to the well-being of individuals regardless of their status as citizens, thereby making the human the referent of security (see generally Gasper 2005, Uvin 2004). While many of the forces acting to threaten human security are created or exacerbated by environmental degradation, the referent of security for this volume is the state and the international system as a whole.

### Countervailing Arguments

Some scholars have argued that the term "environmental security" is misleading or incomplete, and have leveled three types of countervailing arguments against the linkage of environmental and national security. Much of the disagreement has to do with the definitions of "environment" and "security," respectively.

The first and most commonly made argument is that environmental issues cannot be security problems because they do not involve a traditional security apparatus like the military. Consequently, any attempt to link national security and environmental drivers is merely an attempt to attract some of

the high politics glamour of security to the low politics topic of the environment; far from environmental issues threatening national security, the security establishment itself appears to be threatened by an undue emphasis on the environment (Deudney 1991). Because the military is the customary frame in which to place issues of national security, it appears to be used with exclusion.

A common thought experiment used to separate security threats from other threats . . . is to ask whether the values affected and the degree of degradation threatened are sufficient to provoke a military defense. For any alleged security threat, one can ask, "Would we fight over it?" (Levy 1995, 41)

In asking this question, Levy is relying on traditional security thinking to assess this connection, and it is not surprising that those who make this argument cannot fit endogenous drivers into the nation-state-based security framework. Dalby (2002) agrees, arguing that classifying particular environmental threats as security threats causes the solution to be misframed as a military one and not one of economic development. However, we now know that military capability is not necessarily the barometer for determining a critical national security interest. Even when assessing a traditional security situation, the military may still be the wrong instrument to use. Some international issues are of such critical concern that they can legitimately be considered security threats (e.g., oil, Islamic fundamentalism), and yet a military response has not only not secured the threat in question, but it has arguably made the condition worse.

The second countervailing view against environmental security argues that linking national security and the environment smacks of *eco-colonialism*, or environmental rule-setting by the global North for its own benefit at the expense of the developing South. To this end, Jon Barnett thinks that the economic exploitation of the South by the North has driven much of the environmental degradation that the North is now trying to address. By labeling it a security problem, the North's considerable resources will now be directed toward ensuring that this inequality is permanent and militarized (Barnett 2001). His view contains a necessary cautionary element—that military means to attain security can be environmentally destructive (see Chapter 5 for further discussion of collateral environmental damage) and that a defensive war mentality on the part of states can obscure cooperative solutions to global or transboundary environmental problems.

However, the *eco-colonialism* frame is misplaced for two reasons. First, and consistent with the argument above, security is not always something best guaranteed by the military. If an environmental problem presents a security

risk, military involvement may make the situation worse, not better. Second, Barnett thinks that environmental degradation is something the North has perpetrated on the South. Although colonialism has historically involved the transfer of natural resources from South to North, environmental security should not be viewed through a simple North vs. South framework. Developing countries have allowed plenty of environmental degradation within their own states in pursuit of economic development. Population, an environmental stressor second to none, has been rising in the global South much faster than in the North, and is predicted to account for 86 percent of the total global population by 2050 (Population Reference Bureau 2008). Finally, developing states themselves are concerned about South-South environmental security issues. Not all developing states are developing at the same rate, and what once appeared to be a clear have-have not divide is more nuanced in reality.

The third argument is not so much a countervailing view of the concept as a search for proof by making the idea of environmental security fit within a predefined academic framework. Scholars at the Peace Research Institute Oslo have attempted to uncover a rigorous statistical correlation between indicators of environmental change of various kinds and the severity of conflict in the area affected by the change. Their research has yielded mixed results, which leads them to conclude that the connection between environmental drivers and security outcomes is yet unproven. Their use of conflict models and databases is predicated upon the assumption that the future is becoming more peaceful (Nordås & Gleditsch 2007, 635).

While academic frameworks and peer review are necessary to demonstrate the durability of a thesis, statistically based assumptions about real world events suffer from key weaknesses. Statistical models are not and cannot be as complex as the real world. Consequently, any representation of a relationship between two variables (e.g., lack of rainfall and violence) will not account for all the intervening variables that govern the outcome. A statistical mean that averages data over a country or a set time period will often hide substantial regional or temporal variations, so what looks to be a nonsignificant trend can in fact be very significant for a particular subset of the data. Conversely, the exclusion of information about one country or region can make an otherwise significant result statistically insignificant. Data gathered at a national level may not reflect local conditions (see Raleigh & Urdal 2007), so if the results of a statistical model show a lack of apparent correlation between two variables, this does not mean that they are not in fact correlated in any situation. Just because a large-N study does not find a statistically significant relationship between two variables across the entire sample does not mean that the relationship should not be examined on a case-by-case basis.

The first argument assumes that security is a unitary problem viewed through a military lens and possessing a unitary solution. In order to maintain this exclusionary frame, Deudney drops the environment as an acceptable driver. The second argument assumes that since a sovereign nation in an anarchic international system is permitted to do anything it can to ensure its national security, "environmental security" is the perfect label to use to justify status quo-preserving behavior. Therefore Northern interest in environmental security is a thinly disguised attempt at colonialism, and Barnett drops national security as an acceptable outcome. The third argument is only justified within a particularly narrow methodological straitjacket. All three of these countervailing arguments attempt to predefine the terms "environment" and "security" and then fit them into existing frameworks rather than examine the connection on a messy, inconsistent, and wholly necessary case-by-case basis.

#### Modern Environmental Security

From 1991 to 2006, the study of environmental security in the United States lagged, not on the academic side, but on the policy side. Much of the reason for this gap had to do with the dearth of environmental legislation during the Bill Clinton administration, including the passage of the Byrd-Hagel Resolution in the U.S. Senate in 1997 which preemptively rejected the Kyoto Protocol for ratification. After the *Bush v. Gore* Supreme Court decision awarding the 2000 election to George W. Bush, his administration and the Republican-controlled Congress subsequently refused to address environmental issues in any form. It wasn't until 2006, when the Democrats retook both the Senate and the House of Representatives, that the logjam broke and discussion of the environment could again take place in the political sphere.\*

That same year, two studies were released which examined the role of climate change as a security driver: one from the Center for Naval Analyses (CNA) and one from the Center for Strategic and International Studies and the Brookings Institution. These could have been just another academic exercise, but the CNA study in particular was noteworthy because it was

\* The only exception occurred in 2003, when a research office in the U.S. Department of Defense commissioned a study from an independent research firm looking at the international security implications of a large climate shift. Their conclusion that climate was intimately connected to security and that the United States would suffer hugely under a changed climate was not popularly received by the president's political advisors, and the report was subsequently disavowed by the administration (see Schwartz & Randall 2003).

authored by a number of retired three- and four-star military officers who wrote about the effects of environmental degradation and resource scarcity from their own careers (CNA 2006; see also Campbell ed. 2008).

### Ecosystem Services

A key component in any discussion of security is the different national values that states are seeking to protect. These could be liberty, religious expression, capitalism, and political dominance of one social group, among many values. What makes the environment so valuable? The answer is **ecosystem services**. These are the goods and services that a healthy ecosystem provides for us, including but not limited to those outlined in Table 1.1.

In 1997, Robert Costanza, an ecological economist at the University of Maryland, attempted with his colleagues to calculate the dollar value of the world's ecosystem services. Using conservative estimates of value wherever possible, they reached the range of \$15–58 trillion 1997 dollars, with an average value of \$33 trillion (Costanza et al. 1997). To compare that to a more traditional economic measure, the global GDP at that time was \$18 trillion. This means that nature gives us almost twice the value of what we can provide for ourselves, and it does so for free. Human technology can replace some of these services *temporarily*, such as purification of water (e.g., we can build a water treatment plant to do artificially what a wetland does naturally, but at much greater expense). However, it is all but impossible for humans to duplicate all these services on a global scale over the long term. Nature is simply too complex a system for human knowledge to reproduce.

**Table 1.1** Examples of Ecosystem Services

Climate stabilization	Air and water purification
Moderation of weather extremes, such as hurricanes and storms	Disease regulation
Pollination of plants, including grains, crops, and vegetables	Dispersal of seeds
Protection against ultraviolet radiation	Mitigation of floods and droughts
Detoxification and decomposition of wastes	Pest control
Generation and preservation of fertile soils	Cycling and moving nutrients
Erosion protection	Generation and maintenance of biodiversity

### Methods of Attaining Security Are Changing

As we expand the definition of national security to include consideration of threats from nontraditional drivers, we must also reconsider how security is to be attained in the face of these drivers. The realist view of international power assumes that states are the guarantors of security, that all states have the same strategic goals, and that security comes at the expense of other states. This means that nations compete to become more secure than their neighbors, a problem known as the **security dilemma**. Actions that nations may take to increase their security, such as building up military forces, leaves neighboring states less secure. These states then build up their own forces, reducing the global security balance to its original condition (see Jervis 1978). Is the security dilemma relevant to environmental security? In a limited way, yes. Nations that wish to secure particular resources like fresh water or food may view the acquisition of these resources as a type of security dilemma: if I don't dam this river, my upstream neighbor might. But when considering the stability of the global environment as a whole, the security dilemma does not apply.

Due to the very nature of climate change and other global environmental phenomena, environmental security *cannot* be addressed in an anarchic fashion. For example, if the United States works to retool its economy and bring down its greenhouse gas emissions, it will not accrue that climate benefit solely for itself. It must involuntarily share that benefit with all other nations on earth. Similarly, if the United States continues to emit GHGs and destabilize the climate, not only will it suffer the ecological consequences, but so will everyone else. No amount of power or policy will make the atmosphere directly above the United States "American atmosphere," a space in which the United States can unilaterally do what it wishes. Consequently, its security now involuntarily rests, at least in part, on the actions and decisions of other nations.

If the physical environment cannot be governed by means of political boundaries, then it should not be surprising that traditional military strength is no longer sufficient to guarantee state security, as the recent American experiences with Al Qaeda have demonstrated. Asymmetrical aims and capabilities in modern international relations can nullify the advantage of superior military technology and superior numbers of powerful nations, and bring strong vs. weak conflicts to a stalemate. If combat has traditionally been the main competency of military forces, their capabilities now need to stress **stability operations**, or operations other than war (OOTW). Stability ops include the power to "maintain or reestablish a safe and secure environment, provide essential government services, emergency infrastructure reconstruction, and humanitarian relief" (FM3-07, vi). Specific instances of OOTW

will be addressed in later chapters. The U.S. Army is already emphasizing stability operations in its planning and training, and has declared that stability operations are not secondary to combat operations, but are parallel in importance. The need for any nation's armed forces to provide stability ops can arise from a number of situations, irrespective of whether they are environmentally related or not. However, as environmental issues contribute to insecurity and possibly conflict, the OOTW capabilities of the world's military forces will be called upon to a greater degree.

### **Confounding Problems**

A new consideration of national and international security means that we must now include new methods of thinking in our study. This is, of course, easier said than done, for both academics and policy makers. First, because the intersection of global ecology and international relations is so rich and complex, there is rarely one causal chain to follow when tracing the connection between environmental drivers and security outcomes. This means that two variables can relate in different ways, directly and via a feedback loop. For example, increasing temperatures in the Arctic will cause reflective ice and snow to melt, uncovering darker ground and ocean beneath. The darker surfaces generate more heat, raising temperatures. Such self-reinforcing loops are known as positive, while a loop that cancels itself is negative. Since feedback loops occur both in environmental sciences and in social sciences, we may expect that they occur at the intersection of these two fields. Unfortunately, they can make solutions harder to achieve because our understanding of global ecological science and our ability to predict the consequences of human activity are still incomplete.

Second, complex environmental security issues occur across varying scales of time and space. Transboundary resources like forests or watersheds and global environmental commons like the oceans or the atmosphere exist independently of national political boundaries, which makes solutions dependent upon international cooperation. Issues like climate change or ozone depletion, in which the effect may be separated in time from the cause by years or decades, require nations to shoulder the cost of the solution now without enjoying the benefit at the same time. This means that effective solutions require a policy-making time horizon well ahead of the two- and four-year election cycles politicians favor, much less the year-to-year reassessment of national security needs. This is a confounding effect because politicians and security planners do not generally operate under long time horizons, and prefer to push the search for solutions into the future.

### **Upcoming Environmental Security Threats**

In the subsequent chapters of this volume, we will examine the various types of resources and environmental conditions that can become drivers of insecurity, and in some cases, where the quest for security can in turn affect the environment.

#### **Natural Resources**

Most discussions of natural resource security are driven by the competing notions of scarcity and plenty: does a lack of natural resources cause insecurity and conflict, or does their abundance? Depending upon the type of resource, its uses, and the places where it is found, both of these conditions are true.

Resource scarcity is the most obvious environmental security concern, because basic natural resources like food and water are critical for survival. British demographer Thomas Malthus argued in 1798 that humanity was perfectly capable of overreproducing and if human populations were left unchecked, we would outgrow and outstrip our food supply, resulting in death from famine and disease. Malthus, a clergyman in the Church of England, thought this constant threat of famine was God's way of keeping humanity from the sin of laziness. Sin aside, Malthusians regard resource shortages as the limiting factor for civilization, and warn that humanity must lower its population growth or suffer possibly catastrophic famine.

Global population has surpassed 7 billion, however, and we have not yet seen a worldwide famine (localized famines usually have a political or distributional component, discussed further in Chapter 3 of this volume). This is due largely to two factors. First, nations generally do not operate in conditions of autarky (no trade). If one nation is facing a food or energy shortfall, it can generally buy what it needs on the world market. Nations that have open trading policies generally do not face resource shortages. Second, technological advances can obviate shortages of critical goods by providing substitutes where possible. For example, copper was predicted to be in short supply as construction of telephone lines increased. Once fiber optics was invented, substituting glass cable for copper, the demand for copper dropped and the upcoming "shortage" disappeared. As humanity invents new technology, the demand for resources can increase or decrease depending upon the technology involved.

#### **Water Resources**

For some basic goods like water, however, there is no substitute. Water resources are critical not only for human life and health, but also for ecological diversity, economic development, energy, and national security.



Although 70 percent of the earth's surface is covered with water, only 2.5 percent of that water is fresh, and only 0.7 percent is available to humans. Shortage of fresh water, not its abundance, is the security issue. Although there is plenty of water on earth if measured on a global per capita basis, it is not distributed equally around the world and is certainly not plentiful in all populated areas.

Increasing population globally means greater need for fresh water, and competition between users of this limited resource means that existing supplies can be oversubscribed. Surface water such as rivers and lakes are withdrawn for municipal water supplies, irrigation of farmland, and power plant cooling. Groundwater is pumped up from aquifers for agriculture at an increasingly unsustainable rate. Climate change will affect water availability by changing the form and timing of precipitation: rain may fall earlier or later than expected, it may fall in the form of rain rather than snow, or it may fall in greater or lesser quantity. These changes will affect food production, transportation, energy, economic production, and general public health, as discussed further in Chapter 2.

How does fresh water affect national security? Watershed boundaries do not line up neatly with political and state boundaries, so nations that are able will construct water infrastructure to alter the hydrological cycle and increase their domestic water supply. Water use is linked to energy production (e.g., nuclear power, hydroelectricity, hydraulic fracturing), and hence to energy security, so nations that are developing will find it necessary to obtain and secure water supplies to build industry. However, countries facing water stress (less than 1,667 m<sup>3</sup>/year) may find themselves at a development impasse.

Since water is becoming an increasingly scarce resource, environmental security theory states that nations may fight over it (see Homer-Dixon 1991, 1995). However, while the potential for conflict over water exists and will be exacerbated by growing populations and climate change, this does not mean that water conflicts are guaranteed. Recent environmental security research, discussed further in Chapter 2, finds that nations with shared water resources will negotiate and cooperate over the allocation of these resources rather than enter into conflict.

### *Diamonds/Timber/Minerals*

Unlike the case of fresh water, where scarcity is the environmental security driver, abundance of commodity resources like diamonds, timber, gold, and other minerals can exacerbate conflict by providing a source of funds. Several examples of this type of environmental security issue have occurred since the end of the Cold War. During the 1990s and 2000s, Charles Taylor used the revenue from sales of diamonds to continue his violent 15-year regime across Liberia and Sierra Leone. Tropical hardwoods have provided the means for

continuation of civil war in Cambodia, Indonesia, and Myanmar (Burma), and the Democratic Republic of the Congo has paid for the death of over 5.5 million people since the mid-1990s with diamonds, copper, zinc, and coltan.

Nations that have significant wealth in commodity resources often suffer from lower levels of development and higher levels of corruption and violent conflict than would be expected for so-called rich nations. This is known as the **resource curse**. Why do some resource-rich states fall prey to corruption and conflict and others don't? By itself, the existence of natural resources does not mean a nation will become corrupt. Rather, conflict is dependent upon other political, economic, and military factors such as the lack of democratic tradition, tribal loyalties, and the lack of diversity in the economy. If a nation is already developed and subject to the rule of law when valuable resources are discovered, then it will likely not suffer the resource curse because it already has transparent institutions in place to govern new wealth and a sufficiently developed economy that new resource money is not a significant portion of its GDP. Examples of nations that have avoided the resource curse include Canada, the United Kingdom, Norway, and Australia. However, if a nation is poor and less developed, or has little tradition of democracy or public accountability, then a sudden influx of new wealth is more likely to engender corruption, fuel traditional social and political divides, and prolong violence.

Conflicts triggered by resource abundance are generally not international in nature, since natural resource commodities such as diamonds and minerals are freely traded on the global market. Rather, resource abundance furthers internal conflicts, and even though they are not technically international wars, they are connected to international security in several ways. First, ongoing conflicts provide new markets for small arms trade, and several large developed countries enjoy robust arms exports to nations fighting civil wars. Second, civil conflicts can require international peacekeeping or peace enforcement troops, and will certainly require food and medical aid from the international community. Third, civil conflicts that last long enough can proliferate for-hire private security forces, also called mercenaries. In addition, because natural resources are extractive industries, collateral damage to the environment is often severe in resource abundance conflicts (addressed further in Chapter 5).

### *Petroleum*

Petroleum resources are a unique natural commodity because both shortage and abundance of the resource are security issues. Oil is critical to the functioning of the modern global economy, used around the world for transportation fuel and for manufacturing of various goods including plastics. It is the number one traded commodity around the world, whether measured by

value, by volume, or by the carrying capacity needed to move it (EIA n.d.). The environmental security aspect of petroleum is not generally a function of shortage or abundance. Since both oil and natural gas are traded transparently on the global market, price fluctuations are a clear signal of supply and demand. Rather, it is the nonmarket aspects of oil production and consumption that give rise to security concerns.

Oil-exporting nations face a unique set of security issues. Because global demand for oil increases every year, oil-exporting states have felt economically justified in basing significant portions of their entire national income on revenue from oil and very little else. Eighty percent of the Saudi Arabian treasury is funded by income from oil exports, as are 95 percent of the Nigerian treasury and 55 percent of the Venezuelan treasury (CIA World Factbook 2011). If the global price of oil drops, this leaves them with very little economic cushion. Terry Lynn Karl argues that oil-exporting states suffer from a special version of the resource curse. Called "petro-states," their oil wealth means that they have not had to develop politically transparent governance structures, so money and political power within the state is skewed toward a small minority. Moreover, their economic foundation has not diversified much beyond oil, which means that development is precarious (Karl 1997). Many petro-states like Saudi Arabia and Venezuela subsidize the price of gasoline and other basic goods to keep their populations pacified. Should these subsidies be curtailed due to the falling price of oil, the population can get restive and start demanding economic and political reforms, as we are currently seeing in countries across the Middle East and North Africa. Because oil wealth generally flows to an elite segment of the population, disenfranchised populations can also resort to violence and terrorism against the government and against any foreign oil companies working with the government. Militants can sabotage petroleum infrastructure, take hostages, usually from among foreign oil workers, and terrorize local populations (e.g., Colombia, Nigeria).

Oil-importing nations face their own security issues. Developed nations that rely heavily on imported oil, such as the United States, will state energy security as one of their national strategic interests. But what is energy security, and is it realistically achievable? Energy security, in the common political use of the term, means having access at all times to sufficient quantities and types of affordable energy to pursue a nation's development goals. However, most developed nations consume more oil than they produce, and in order to secure supply, may assist petro-states with economic or military aid. The quest for energy security can lead democracies to deal on a favorable basis with regimes that have questionable to poor human rights records, like Sudan and Saudi Arabia. Even the United States declared in 1980 that it would use all available tools of national power, including military force, to

keep oil flowing from the Persian Gulf. As global oil prices increase, the people of oil-importing nations often agitate politically for energy independence, but is self-sufficiency in energy realistic? Not without a significant reduction in oil demand.

### **Food Security**

Provision or lack of food is not traditionally considered to be key to national security, and yet a nation that cannot produce or import its food is not secure at the most fundamental level. Food security, defined by the UN as people having access to sufficient stock and supplies of food to provide a nutritionally adequate diet, derives from the availability of food, access to food for the entire population, optimal utilization of food, and the stability of the national food system over time. The majority of people facing food insecurity live in the developing world. Humans have dealt with food insecurity by increasing food production where possible, and our estimates of worldwide agricultural output, and hence global food security, are predicated upon our assumptions of a stable climate. However, environmental, political, and distributional factors will all affect food production and availability.

Climate change-induced fluctuations in temperature and precipitation will have a net negative effect on crop production by shifting the growing seasons and the expected rainfall. Extreme weather events such as flooding or droughts of the magnitude we are now seeing across North America can also affect crops at critical points in their growth. In addition, arable land has been redirected away from food crop production toward biofuel crop production, taking food off the global market and increasing food insecurity. Although biofuels are considered to be both better for the climate and an important alternative to oil from unstable regions of the world, the Intergovernmental Panel on Climate Change (IPCC) predicts that the world's nations will need to increase food production by 55 percent by 2030 just to keep up with growing population (IPCC AR4 WGII, 280–281). It is unclear as to where that increase in arable land is going to come from. Finally, as the world's population gets wealthier, they demand more animal protein, and this compounds food insecurity: 70 percent of the world's grain supply currently goes to feed livestock.

Global food prices are rising every year, and this relentless upward pressure means uncertainty and instability in the world's food markets. Climate-induced supply shocks such as the recent ban on wheat exports from Russia in the wake of a punishing drought exacerbate this instability, and can lead food-insecure nations to hoard stocks, further driving up prices. Political factors such as trade sanctions and social and cultural factors such as the status

of women or the access of low-caste people to food can contribute to food insecurity.

Changes in the ability to produce food can lead to a shift in relative economic and political power between agricultural exporting states and importing countries. State governments can draw down national food stockpiles to offset shortages, but this is a stopgap measure at best. Food shortages and rising prices have already caused riots in over 60 countries and underlie much of the current unrest across North Africa and the Middle East. Food itself can be used as a weapon of war by governments which selectively withhold food to certain portions of the population to achieve political aims, even escalating to what one legal scholar calls "faminogenic" behavior (Marcus 2003). Food insecurity writ small is a tragedy, but food insecurity writ global can destabilize the entire international system and affect the national security interests of even food-plentiful nations (Brown 2009).

### Climate Change

Article I of the 1992 UN Framework Convention on Climate Change defines climate change as "a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." In its most recent assessment report, the IPCC concluded with a greater than 90 percent certainty that the earth's climate is warming and that humans are contributing to this warming. Climate change will have significant short- and long-term effects on the natural environment that we take for granted and the national security strategies and tactics that nations pursue.

### The Arctic

The Arctic is the bellwether for the effects of climate change, both geographically and politically. The 2007 IPCC Assessment has forecast considerable loss of sea ice in the Arctic Ocean during the 21st century, and newer estimates have moved this date up as close as 2030. The last time the Arctic was substantially ice-free was 125,000 years ago, well before modern human civilizations, so climate change is physically making the Arctic into a world that humans have not inhabited before. What does this mean for modern international security?

First, less ice means more open water, which in turn means more cross-Arctic transit. Merchant ships, naval and coast guard vessels, submarines, cruise ships and other recreational boats, and smugglers will all find a regularly ice-free Arctic easier to navigate. Commercial ships transporting goods across continents can save time and money along one of two passages: the

Northern Sea Route, above the coast of Russia, and the Northwest Passage, above the coast of Canada and the United States. Greater commercial transit will result in greater national presence by the circumpolar nations in order to maintain their security interests in the region.

Significant mineral resources lie under the Arctic sea floor, including oil and natural gas. The U.S. Geological Survey estimated that approximately 22 percent of the world's known recoverable petroleum reserves lie north of the Arctic Circle (USGS 2008). Climate change will make these resources easier to extract. The area also holds the potential for cold-water aquaculture, a significant food security issue. Even nonpolar nations such as Japan and Korea have sent exploratory vessels up to Arctic waters to estimate resources.

There is no overarching legal regime governing the Arctic. The UN Convention on the Law of the Sea currently represents the operant body of law, although the United States, a significant world power with an Arctic coastline, has not ratified it. In addition, the Government of Canada argues that because the Northwest Passage lies in the midst of the Canadian archipelago, it is considered internal waters and any ship wishing to transit the passage needs Canadian permission. However, an international strait is defined as any strait of water connecting two portions of the high seas; this definition allows for innocent passage of any warship or merchant vessel, and could put the Canadians on the wrong side of UNCLOS. The Arctic is the most profound example of the effects of a changing environment on national and international security, and it is yet unknown if a new legal, economic, and security regime is needed to govern a globally warmed Far North.

### Migration

Populations faced with resource shortages, changing environmental conditions, extreme weather events, and possible public health impacts may make the decision to migrate, if they are able. Migration is a complex phenomenon and is governed by economic and political factors as well as environmental conditions, but if the same environmental conditions populations rely on for agriculture and livelihood are sufficiently changed, this might provide enough of an impetus, a push factor, to increase marginal levels of migration. Climate change is predicted to increase the intensity and possibly the frequency of extreme temperature events, precipitation events, floods and droughts, and hurricanes and storms. The recent experience in Japan shows us that even the wealthiest and most robust nations cannot adapt readily to a large disaster; how much harder will it be for populations without wealth and strong government support to adapt.

The migration of large numbers of people fleeing extreme events or environmental change can affect national security in several ways. The sheer

numbers of refugees, or internally displaced persons (IDPs) if they have not crossed an international border, might overwhelm any resources the host government has set aside to assist them. Crossing an international border itself can become administratively problematic if refugees do not have proper visas or identification papers. Governments may be unwilling to accept refugees if they can't keep track of them. If the refugees are of a different ethnicity, race, or religion, neighboring governments may not accept them at all, fearing political or social unrest within their own population.

### *Disease and Public Health*

Finally, climate change will affect disease vector ecology, increase the global spread of infectious diseases, and affect public health worldwide. Gradual changes in temperature and precipitation can alter the behavior of the vector, the host, or the target species, including human behavior. Mosquito-vector diseases like malaria and dengue, rodent-vector diseases like hantavirus, or human-vector diseases like influenza are likely to increase under climate change. Sudden events such as storms, hurricanes, and floods can cause a localized spike in disease exposure, whereas incremental environmental changes can affect the baseline epidemiology of a country or region.

Infectious diseases then affect security by opening up new areas of instability due to geographical and social attrition. If the outbreak is acute, such as after a natural disaster, it can precipitate outmigration of a large number of people from the stricken area, some of whom are likely to be infected. This then presents a national security problem, or if the individuals cross a border, an international problem. If changing environmental conditions allow the disease to migrate into new areas, then it can affect national development by depressing economic productivity, as AIDS has done across much of sub-Saharan Africa. Governments that are unable to provide basic levels of public health care may face domestic instability.

Disease can also deplete the operational capability of a nation's armed forces. Deployment into areas that face newly endemic diseases means that soldiers must increase inoculations and take precautionary measures in order to maintain readiness. If they face a new and unknown disease, no inoculation may exist. In addition, societies that face high levels of chronic disease will see the effects in the military recruitment pool, as increasing numbers of young people will be unfit for military service due to poor health.

### *Collateral Damage*

It is not only resources and degradation of the environment that drive insecurity, but war itself and the preparation for war can in turn drive environmental degradation. In decisions of national strategic interest, the ability

to wage war has always been considered more important to state survival than the maintenance of a healthy ecosystem. Consequently, any restrictions on collateral environmental damage during war have generally been ignored in favor of military advantage.

More troublesome from an environmental standpoint is the occasional use of the environment itself as a weapon of war, or the deliberate targeting of environmental resources in an effort to defeat the enemy by denying them cover or sustenance. Actions such as these have been an accepted part of warfare for millennia, and it is only within the last century that the destruction inherent in these types of actions has been judged to be destructive beyond the military advantage gained. Several international legal instruments now exist to prohibit or limit environmental damage during war, including the Geneva Protocols and the Environmental Modification Convention, but these have yet to be tested in any international court.

As our awareness of the global ramifications of environmental problems increases, we can begin to recognize the implications for national security. Militarily strong nations may be prepared for combat operations, but are unprepared for environmental security threats, particularly those presented by global climate change. The world's population surpassed 7 billion people in October 2011, and emissions of heat-trapping gases into the atmosphere are increasing every year. Consequently, the examination of environmental phenomena as a threat to security has never been more timely.

### *References*

- Barnett, Jon. 2001. *The Meaning of Environmental Security*. London: Zed Books.
- Brown, Lester. 1977. *Redefining National Security*. Worldwatch Papers. Washington: Worldwatch Institute.
- Campbell, Kurt M., ed. 2008. *Climatic Cataclysm: The Foreign Policy and National Security Implications of Climate Change*. Washington: Brookings Institution Press, 235 pp.
- Cohn, Carol. 1987. "Sex and Death in the Rational World of Defense Intellectuals." *Signs*. Vol. 12, No. 4, Summer 1987, pp. 687-718.
- Costanza, Robert, Ralph d'Arge, Rudolf de Groot, Stephen Farber, Monica Grasso, Bruce Hannon, Karin Limburg, Shahid Naem, Robert V. O'Neill, Jose Paruelo, Robert G. Raskin, Paul Sutton, and Marjan van den Belt. 1997. "The Value of the World's Ecosystem Services and Natural Capital." *Nature*. Vol. 387, May 15, 1997, pp. 253-260.
- Dalby, Simon. 2002. *Environmental Security*. Minneapolis: University of Minnesota Press.
- Deudney, Daniel. 1991. "Environment and Security: Muddled Thinking." *Bulletin of the Atomic Scientists*. Vol. 47, No. 3, April 1991, pp. 22-28.