INTRODUCTION:
The Environment-Security Nexus in Northeast Asia

IN-TAEK HYUN
SUNG-HAN KIM

ASIA'S ENVIRONMENTAL WARNINGS

Environmental conditions are rapidly degrading in Northeast Asia; the transboundary effects of pollution and competition for natural resources are being felt throughout the region. Environmental problems are starting to reach crisis proportions, and, as a result, the governments of the region are beginning to be forced to respond domestically and—when that does not suffice—at the bilateral and regional levels as well, sometimes with extraordinary measures. A few examples will suffice to illustrate the severity of the problems confronting the region.

Partly as a result of the excessive use of groundwater in regions bordering the Gobi and Taklimakan deserts, increased desertification has become a serious problem. A related problem that is threatening northern China are severe dust storms that now hit Northeast Asia almost every spring, greatly reducing visibility, causing discomfort (especially among those already suffering from respiratory ailments), and, in the worst cases, forcing businesses, schools, and government offices to shut down. The "yellow dust," often dubbed the "gate-crasher of spring," affects northern China most severely but also troubles neighboring Korea and Japan. Seoul, Daegu, Daejeon, and North Gyeongsang and Gangwon provinces in South Korea were put under Level 3 warnings,

the worst possible level under a newly created yellow dust alert system, in April 2002 after a particularly severe storm hit the region—dust levels hit a record 2,070 micrograms per cubic meter. (In Seoul, 70 micrograms of dust per cubic meter is considered a normal level during most of the year. When dust levels reach 1,000 micrograms per cubic meter, serious health warnings are issued.[1]) The dust storms in spring 2006 were also very bad; in one case, Seoul was covered in a blanket of yellow snow.[2] The dust from the deserts, moreover, can bind with toxic industrial pollutants, including arsenic, cadmium, and lead, increasing the threat to human health.[3] Yellow dust has become such a serious problem for the region that the environmental ministers of Korea, Japan, and China decided on April 21, 2002, to form a joint yellow-dust monitoring network. In May 2006, they went one step further and, at China's initiative, formed a Northeast Asia Anti-Sandstorm Alliance together with Mongolia.[4]

Another severe problem confronting the region's environment is energy-related. The problem of finding sites to dispose of low-, intermediate-, and high-level nuclear waste has become a cause of considerable domestic and even some international tension in the region as well. At the domestic level, there has been local opposition, at times violent, to government plans to designate permanent nuclear waste repositories. Such reaction has led to some extraordinary and controversial plans. In early 1997, for example, a plan to ship Taiwanese nuclear waste for storage in North Korea threatened to put Seoul-Taipei ties into a deep freeze.[5] Taiwan abandoned the plan when South Korea put up strong resistance. But in 2000, Taiwan again pursued a plan to ship 60,000 barrels of nuclear waste to North Korea. This plan also fell through, but not before engendering considerable concern. "The proposed burial of the harmful waste in the North would be an immoral, inhumane and irresponsible act that must not take place," said an activist of the Korean Federation for the Environmental Movement (KFEM). "Otherwise, it will not only cause an environmental disaster on the Korean Peninsula, but threaten peace in Asia."[6]

Environmental destruction in North Korea has been a factor in the flooding and poor harvests that led to the death of millions from starvation in the latter half of the 1990s. In June 2002, five North Koreans fleeing hunger and oppression rushed the Japanese Consulate in Shenyang, seeking asylum in South Korea. Since then, there have been hundreds of North Korean refugees seeking asylum at embassies and consulates in China. The number of "environmental refugees" escaping from North Korea, where "food security" has been a problem, has complicated already tense regional relations.[7] The North Korean asylum

seekers have made it difficult for China to manage its relationship with the two Koreas. Concerned that the problem of North Korean defectors might embolden the minority people in Tibet and Xinjiang provinces, the Chinese government has forcefully returned numerous asylum seekers to North Korea to an unknown fate, prompting the U.S. Congress in 2002 to pass a resolution encouraging China to protect North Korean refugees[8] and the North Korean Human Rights Act of 2004, which among other things pressured the U.S. State Department to facilitate applications by North Koreans seeking asylum.[9]

The region also has been shocked by North Korea's announcement of its nuclear weapons program and recent nuclear test. The stunning news has halted a joint United States, Japanese, and South Korean initiative to develop two light water nuclear reactors in North Korea to help the North with its energy problems in return for a 1993 pledge by the North to abide by the Nuclear Nonproliferation Treaty (NPT). There is a clear link between North Korea's nuclear energy program and its nuclear weapons development.

In 2005, an explosion at the Jilin Chemical Industrial Company on the Songhua River in northeastern China led to one of the worst chemical disasters in China's history. An estimated 100 tons of benzene and other chemicals spilled into the Songhua River, 240 miles (380 kilometers) upstream of Harbin, a city of 3.5 million and capital of Heilongjiang province. The explosion itself killed five and wounded seventy, but the resulting toxic spill left 3.5 million without drinking water. The spill slowly worked its way downstream and affected Russia (the Songhua flows into the Amur River).[10] Citizens in the Russian city of Khabarovsk were also warned not to drink the water.[11] China was forced to apologize to Russia for the spill and to provide it with assistance in monitoring and cleanup efforts.[12]

All of these are examples of the "environmental warnings" coming from Northeast Asia. They also highlight the nexus among environmental problems, energy issues, and security in the region. Northeast Asia comprises a wide variety of political systems and cultures, as well as diverse levels of industrialization: Japan, China, Taiwan, North Korea, South Korea, Mongolia, and the Russian Far East. It is also one of the least institutionalized regions in the world, with few established regional forums for cooperation and dialogue—a troubling concern because Northeast Asia contains two of the world's military flashpoints (the Korean Peninsula and Taiwan Strait). It is also a region in which environmental security concerns are becoming increasingly widespread. High rates of economic growth, large populations, and growing energy demands are turning the region into an environmental "hot spot." How

the region responds to its increasingly serious pollution problems and increasing constraints on natural resources can have major implications for quality of life, long-term sustainability, and interstate relations within the region and beyond.

In the opening chapter of this volume, Geun Lee defines Northeast Asia as "a rough geographical space on the globe where interdependence of environmental consequences among states is high." The aim of this volume is to explore the relationship among environmental, energy, and security issues in Northeast Asia. It does this by examining environmental security from a conceptual perspective, applying an environmental security framework to the analysis of a range of issues affecting the region, and discussing ways of enhancing regional cooperation for early warning, joint research, and pollution prevention and cleanup. The environmental issues examined include energy and the environment, transboundary air pollution, the marine environment, freshwater sources, and "environmental refugees." Environmental degradation throughout the region, but especially in China and North Korea, is examined. Attention is also given to the roles of different actors in regional environmental politics, including the expanding role of expert and environmental groups from the governmental and nongovernmental sectors. Finally, the prospects for and obstacles to deeper environmental cooperation are discussed.

Security and the Environment

"Environmental security" has been one of the most hotly debated topics in international relations discourses in the post–Cold War era. Discussions about nontraditional security issues in terms of national security are not new. In fact, efforts to expand the scope of national security to include nonmilitary issues have been under way for the past three decades. In the 1970s, the concept of security was expanded to include international economics. Global developments in the 1980s suggested the need for a similar broadening of the definition of security to include resource, environmental, and demographic issues.[13]

The end of superpower confrontation triggered a complete rethinking of traditional concepts of national, regional, and global security. Traditional concepts focused on superpower rivalries, the protection of national sovereignty, and external military threats. New thinking emphasizes three additional dimensions: a broader range of external threats and potential sources of international conflict, including environmental degradation and resource and energy scarcities; a focus on threats to "human security"—that is, to the life and livelihood of indi-

viduals and communities, within as well as among nations, including economic scarcities (for instance, food), ecosystem degradation, discrimination (ethnic, religious, gender, etc.), human rights abuses, and others;[14] and a focus on cooperation, at both regional and global levels, and by both states and nonstate actors, as an essential way to enhance national security.[15]

In particular, environmental problems that transcend national boundaries are challenging governments to broaden their understanding of the scope of national sovereignty and forcing them to grapple in international forums with a host of new, contentious issues. Richard Ullman has redefined a threat to national security as "an action or sequence of events that threatens drastically and over a relatively brief span of time to degrade the quality of life for inhabitants of a state, or threatens significantly to narrow the range of policy choices available to the government of a state or to private, nongovernmental entities within a state."[16] This redefinition, which is adopted here, suggests that the stability and safety of nations is shaped by a potentially wide array of multidimensional factors, including territorial disputes, political and economic problems, and environmental degradation.

"Environmental threats" can be defined as conditions of environmental degradation and scarcity-inducing natural resource depletion that directly or indirectly endanger security by contributing to civil unrest, collective violence, interstate conflict, or destabilization anywhere in the world where important strategic interests are at stake.[17] Environmental threats do not always directly cause violent conflict or political instability. In some cases, they may have direct causal links with conflict, while in others, the links may be only partial or indirect.

There has been considerable debate in the literature as to whether clear causal links exist between environmental degradation and conflict.[18] On the one hand, some scholars argue that environmental change can be an underlying cause of intra- and interstate conflict. Perhaps best known among this camp is Thomas Homer-Dixon, who has offered a sophisticated analytical framework for exploring the links between environmental deterioration and violent conflict and urges better research grounded in in-depth case studies.[19] Opponents of making the linkage argue that environmental degradation does not directly cause interstate conflict and therefore should not be treated as a national security threat. Doing so, they argue, broadens the definition of security too much.[20]

Yet this is precisely our point and our intention. The problem with the latter argument is that it relies on too strict and narrow a conception

of security that tends to conflate the meaning of "security" with traditional, state-centric conceptions of *national* security. Clearly, environmental threats are not traditional military threats; nor are the methods of dealing with them the same as the methods of dealing with military threats. However, a strong case can be made for including "environmental security" in our conception of security.

In fact, it is not possible always even to make a clear distinction between national security and environmental security. Even though environmental security "challenges 'common sense,' at least insofar as it distances itself from the traditional state-centric security agenda, the difficulty is precisely that this distance is not always clear."[21] In some cases, environmental security is an extension of existing security concerns largely because it causes environmentally driven military threats, such as competition for vital resources. In other cases, however, environmental degradation threatens only the property and well-being of the people living within a state.

Clearly, not every environmental issue is a security issue. Nor is every environmental issue a global issue.[22] Links between environmental scarcity and conflict cannot always be established. Thus, we wish to warn against automatic identification of environmental issues with security problems.[23] We argue instead that only when environmental degradation or resource scarcity drastically threatens national conduct over a recognizable time span do they become security issues.[24] Also included in this conceptualization of environmental security are cases where causal linkages between environmental degradation and conflict are only partially established, or, in other words, where environmental degradation is an intervening variable affecting interstate conflict.

It also should be recognized that there is a "contextual" component to the environment-security nexus—that is, the significance of an environmental problem depends on the security relationship between or among countries: The impact of an environmental threat will depend on its location and the sensitivity of the systems that are affected. The security situation of a region provides the context for understanding the impacts of environmental issues. The analysis of environmental issues must be compatible with the analysis of related security issues.[25] For example, a water problem between Israel and Jordan or the two Koreas takes on decidedly different implications than a similar dispute between Canada and the United States.

In considering the relationship between environment and security, it is important to recognize that both security and environmental issues are contextual.

The Environmental-Human-Conventional Security Nexus

Environmental security can be thought of in terms of the source of environmental problems, the scope and impact of those problems, and the level of threat perceived by states or nations in relation to the problems. Environmental degradation can either be a result of natural factors or can be anthropogenic—that is, the result of human or state actions. The scale and scope of the impact can be either domestic or transboundary. Environmental threats can be either ignored or recognized by other states. Threat perceptions, in other words, can range from low to high. Depending on how these factors cluster, environmental security can be viewed as being more or less closely tied to "human security" concerns or "traditional security" concerns. Table 1 shows these different clusters of environmental security problems.

The environmental security problems that fall into Cluster A are least likely to develop into interstate conflicts; their scope is confined to a single state. Thus, neighboring countries tend not to perceive them as serious threats to their own national security. The environmental problems in Cluster A are "security" problems in that they affect human well-being. In this case, then, there is little distinction between environmental security and human security. Human security focuses attention on individual human suffering as a result of humanitarian disasters in the political, military, economic, societal, communal, and environmental spheres.[26] Environmental security and human security, thus, can be overlapping and even mutually reinforcing concepts. Environmental emergencies, like all other humanitarian emergencies, are imminent social crises and have the potential to result in intrastate conflict, even

Table 1. Types of Environmental Security

Cluster	Source	Scope	Threats Perceived by Other Countries	Type of Security
A	Natural, man-, and state-made	Domestic	Low	Environmental/ human security
B	Natural, man-, and state-made	Transboundary	High	Environmental security
C	State-made	Transboundary	Very high	Environmental/ traditional security

if they do not lead to interstate conflict. Environmental problems that fall into this category, however, can be thought of as environmental security issues only if the state is making, or should be making, efforts to overcome them. Human beings are the unit of concern here, but the strategies, policies, and activities for dealing with the issues are (or should be) the responsibility of the state.

Cluster B includes the most typical type of environmental security problems. Their impacts go beyond national borders. When these transboundary environmental problems also result in high threat perceptions in other countries, there is potential for conflict among the concerned states. The intensity of the conflicts that could ensue is not as high as with issues that fall into Cluster C. Most transboundary environmental issues that have an environmental security dimension belong to Cluster B; they are not likely to lead directly to military confrontation between or among states. Critical to whether tension progresses to military conflict are the level of environmental sensitivity in the region and the level of vulnerability that countries feel in the face of environmental degradation. Also important is the cause of the problem. Because most transboundary environmental disasters are unintended, outright conflict is not likely to ensue. The biggest issue for Cluster B problems tends to be one of state capacity and ability, or lack thereof, to handle the environmental crisis. Nuclear waste disposal involving the Russian Pacific nuclear submarine fleet, yellow dust in China, the Songhua River benzene spill, and Taiwan's abortive attempts to ship nuclear waste to North Korea are good examples of Cluster B problems.

Cluster C refers to the most extreme cases of environmental security. In these instances, environmental problems are purposefully used to threaten other countries. Such issues can be equated to a typical "security dilemma" among states. In such instances, there is no clear distinction between environmental security and national security. Interstate conflict stems from purposeful state-made environmental threats and is likely to develop into military confrontation among states. Water security problems between North and South Korea are examples of issues that could fall into Cluster C. In the mid-1980s, South Korea constructed a dam in order to respond to the possible collapse of the poorly constructed Mount Geumgang Dam in North Korea. The Chun Doo Hwan government of South Korea feared that as much as half of the capital city of Seoul would be inundated if North Korea decided to blow up the Mount Geumgang Dam in an effort to damage South Korea. There was a huge national campaign to collect money to construct a counter-dam, which was named the Peace Dam. In 1992, the South Korean government reinforced the dam.

Environmental security stresses that ecological degradation, resource scarcity, and population pressures are sources of conflict (i.e., that environmental problems "cause" conflict) or, conversely, that regional cooperation on environmental issues can play a major role in building confidence and enhancing regional peace (i.e., that environmental cooperation "causes" peace). Putting the concept of environmental security under the umbrella of regional comprehensive security provides a common framework that can support bilateral as well as multilateral initiatives to address issues that lie at the nexus between environment and conventional security affairs. A regional comprehensive security approach could provide the foundation upon which a common understanding, language, and interests could be constructed to address regional environmental and security issues and consider the linkages that may exist among them. Because enhancing environmental security not only addresses sources of conflict but can also be a source of peacemaking, a consensus about the importance of exploring the environment-security nexus must emerge among key elites and policymakers in the region. Two essential themes of any regional comprehensive security framework must be attention to the security implications of regional-scale environmental degradation and promotion of regional energy and environmental cooperation to address environmental degradation and resource depletion, as well as to enhance the potential for multilateral institution building in Northeast Asia.

Toward More Effective Environmental Cooperation

Identifying Environment-Energy-Security Nexus Points

Northeast Asia currently includes numerous large and small zones of political insecurity. The four most prominent are the division of the Korean Peninsula, the relationship between Taiwan and China, disputes over islands (including the Spratly Islands, Kurile Islands, Tokdo/Takeshima Island, and Diaoyu/Senkaku Islands), and the border between China and Russia. Northeast Asia is also a zone of "great power" conflict and tension. Weapons of mass destruction remain a salient issue for the great powers and for the regional powers in Northeast Asia, which is the one region of the world most likely to draw the United States into a conflict with another nuclear power (North Korea or China).

The many small-scale or domestic zones of tension in the region include famine in the dysfunctional state of North Korea, ethnic or

minority tensions (e.g., Tibet, the Uygurs of western China, ethnic groups in Russia), economic tensions in China (e.g., uneven development between coastal and inland areas), and economic tensions in Russia (e.g., lack of economic support from Moscow for the Russian Far East).

Overlapping some of the above zones of political instability are areas of environmental tension. Overarching environmental problem areas in Northeast Asia include those associated with energy use (especially related to coal, oil, and nuclear fuels); the atmosphere (climate change, acid rain, and urban air pollution); inland water resources (scarcity, degradation, flooding, and the Three Gorges Dam in China); fisheries and marine resources (offshore fisheries, seabed resources, and coastal zone management); land degradation (loss of arable land to urbanization, deforestation, and desertification); and population growth and changing demographics (burgeoning population in China, internal migrations to cities, and environmental refugees).

Solving environmental security problems in Northeast Asia will be a daunting task. In order to better address environmental security problems, it is necessary to identify environment-security nexus points, then prioritize the relative importance of the region's environmental problems in terms of their potential effects on security relations, and finally institutionalize regional environmental cooperative efforts in a more effective way.

In the sphere of transboundary marine pollution, for example, the East Sea/Sea of Japan could be a good area to pursue greater regional cooperation. It is a relatively unspoiled regional sea and therefore is a prime candidate for preservation. Moreover, it may be easier to facilitate cooperation among the littoral states in the East Sea/Sea of Japan rather than in the more contentious areas of the Yellow Sea, East China Sea, or South China Sea.

The littoral states of the East Sea/Sea of Japan are Japan, the Russian Federation, North Korea, and South Korea. China also affects the environmental status of the sea by virtue of the Tumen River watershed, and via the pollutants carried by ocean currents from the Yellow Sea. The East Sea/Sea of Japan, although formerly the site of Cold War tension, is expected to experience significant development in the near future. The Russian Far East; coastal areas of Japan; the southeastern coast of South Korea, especially around Pusan and Ulsan; the east coast of North Korea; and the Tumen River basin are all being rapidly developed or are poised for development. The best hope for economic development in the region lies with the offshore oil reserves on the Sakhalin shelf. The oil reserves, however, are located in Arctic conditions in an area subject to seismic activities. Drilling for oil and gas on the Sakhalin

shelf is technologically challenging, and preventing pollution related to the excavation and shipment of oil and gas will be a major challenge. If sustainable development measures can be incorporated into development plans in the region in the early phases (such as is being attempted in the Tumen River watershed), the worst by-products of development may be avoided and the integrity of the sea preserved. As oil pollution is likely to be one of the biggest problems facing the region in the future, this is a good issue-area around which to strengthen regional dialogue.

Above all, the relationship between nuclear energy and security requires greater regional attention. Given the environmental and health hazards associated with nuclear waste, the interest the region has exhibited in nuclear power, and the potential for nuclear proliferation, a good case can be made for prioritizing the development of a regional regime for nuclear safety and nuclear waste management.

Water and food security issues demand rather immediate-term responses—an abrupt decline in the water supply for China's farmers poses a rising threat to world food security, and North Korea's endangered food security situation could lead to bilateral as well as regional conflicts. Transboundary environmental degradation such as air and marine pollution poses a real danger to regional harmony because it can undermine incentives for broader regional security cooperation. Air and marine pollution issues will require steady efforts at developing regional cooperation mechanisms.

In short, it is imperative that a much greater level of cooperation be institutionalized in the region to prevent various political and environmental tensions, individually or synergistically, from reaching intolerable levels.[27] Forging a denser network of cooperative governance structures is essential for realizing a sustainable and secure future in the region. An explosive buildup of security and/or environmental tensions could seriously undermine the region's nascent efforts at institutionalizing cooperation.

"Preventive" Regional Cooperation

As former UN secretary-general Boutros Boutros-Ghali aptly defined the term, preventive diplomacy is an "action to prevent disputes from arising between parties, to prevent existing disputes from escalating into conflicts, and to limit the spread of the latter when they occur."[28] With respect to implementation or practical modalities, there may be several operational measures: confidence-building, fact-finding, early warning, preventive deployment, and the establishment of demilitarized zones. Institution-building and preventive humanitarian action can be added to the category of preventive diplomatic measures.

Preventive diplomacy began to acquire new meaning as a result of interest in "cooperative security," a concept that gained salience following the end of the Cold War and the collective security concept that dominated during this period.[29] There is growing awareness of nontraditional security threats, such as economic conflict, population movements, narcotics and human trafficking, transnational environmental problems, and ethno-religious nationalism. If these threats cannot be met effectively with traditional forms of readiness and deterrence, then more constructive and sophisticated forms of influence and intervention are required. This is the raison d'être of cooperative security in the post–Cold War era.

Environmental security encompasses a wide array of complex issues. Policymakers need expert assistance in determining how to respond to environmental security matters. As a first step toward greater regional cooperation, the growing community of experts working on the environment should be empowered.[30] Scientific groups, nongovernmental organizations (NGOs), and regional and international environmental agencies require greater financial assistance, more transparency in policymaking, and more inclusion of input by expert groups, environmental NGOs, and citizens.

Control over knowledge and information is an important dimension of power. Precisely because the diffusion of new ideas and information can lead to new patterns of behavior, expert communities can be an important force for promoting international policy coordination in the region. In addition, holding regional environmental conferences, developing joint environmental protection projects, and establishing environmental databases open to the public are relatively easy measures that should be promoted by regional governments (especially Japan and South Korea, which are in the best position to support such steps) and supported by international organizations.

Inducing U.S. Commitment

Finally, it is important to consider the special role that the United States can play in promoting regional environmental cooperation. Although the United States has paid considerable attention to its traditional security interests in the region, it has paid only limited attention to the relation between environmental degradation in the region and its traditional military interests. U.S. policymakers have not given much consideration to the fact that just as strategic military changes in Northeast Asia affect U.S. security interests, so too will environmental changes impinge on them.

The United States is closely linked to the region as a result of its bilateral security relations with both Japan and South Korea. It has deployed its Marines in the region in response to fishing disputes. It has become engaged in the region out of concern about nuclear safety involving the Russian Pacific Fleet. North Korea's nuclear capabilities have also put the region back on the front page of U.S. newspapers and have become a matter of deep concern to the White House. Any environmentally induced conflict that has the potential to escalate into a more serious military confrontation must concern the United States.

Clearly, U.S. security interests are already entangled in the environmental and energy problems facing the region. The United States should become more engaged in regional efforts to manage the environmental problems of Northeast Asia. Doing so could help legitimize the efforts that have been initiated to develop regional environmental networks and institutions. It could also be an important component of a strategy for improving both traditional and human security in the region.

An Overview of the Book

A Regional Environmental Security Complex

In chapter 1, Geun Lee furthers the theoretical discussion begun above by examining the concept of environmental security and proposing a model for thinking about Northeast Asia in terms of a regional environmental security complex. His model is useful for making comparisons across issues and regions and for thinking about the extent to which regional environmental regime building has occurred or can be expected to occur in the future.

Chapters 2–7 examine the nexus between specific environmental and energy issues and definitions of security. The problems discussed include fossil and nuclear energies, transboundary air pollution, transboundary marine pollution and resource exploitation, and water and food security issues.

Energy Issues

A good starting point for understanding the environment-security nexus in Northeast Asia is energy. Northeast Asia has a large appetite for energy. Energy use is driven by economic growth, although the correlation between economic growth and energy demand is not necessarily linear. Northeast Asia contains some of the world's largest economies (Japan, China, South Korea, and Taiwan). Long-term economic expansion is expected to continue in the region (with the possible

exceptions of North Korea and Mongolia) driven by China's rapid growth, meaning that energy demand is likely to grow as well.

As discussed in chapter 2 by Sangsun Shim and Miranda Schreurs, rapid economic expansion has fueled demand for energy, creating several environmental and conventional security concerns. Northeast Asia accounted for nearly 20 percent of the world's total energy consumption at the turn of the twenty-first century. In the coming decades, China will have the greatest impact on energy demand in the region: Chinese energy imports will rise substantially, by some estimates approaching U.S. import levels. The three energy sources that pose the greatest security and environmental risks are coal, oil, and nuclear fuels. There are also some tensions related to ownership of deep-sea natural gas reserves.

The region is rich in coal reserves, of which China has the largest share and is the largest user of coal for electric power generation in the world. China's coal-fired power plants, however, are a major source of greenhouse gas emissions, acid rain precursors, and other pollutants that affect local, regional, and global air quality. As coal use is expected to expand, related environmental problems will grow worse unless pollution control measures are taken.

In addition to coal, most of Northeast Asia is highly dependent on imported oil and natural gas. The two most developed economies in the region, Japan and South Korea, are almost totally dependent on imports for their oil, primarily from the Middle East. China is now a net importer of oil as well. Northeast Asian reliance on imported oil (with the exception of the Russian Far East), moreover, is expected to increase in the coming decades. Politically, this means the region's oil lifeline is tied to events in the Middle East, Central Asia, and Southeast Asia, and to events along the sea corridors that are used to transport the oil from these locations to Northeast Asia. There are also many regional issues stemming from disputed ownership claims to deep-sea oil and natural gas fields, transboundary pollution from the burning of fossil fuels, and responsibility for prevention and cleanup of oil spills.

Nuclear energy is still a small fraction of the total energy picture in Northeast Asia, but its use is expected to grow. In Japan and South Korea, nuclear energy already accounts for a large share of electricity production and both countries aim to increase its use. China, which has only limited nuclear energy capacity, has also indicated its intentions to rapidly expand its number of nuclear energy facilities. In the region, only Taiwan has hinted at plans to phase out nuclear energy.

There are two basic types of nuclear power, open cycle and closed cycle, each with associated environmental and security problems. Open cycle refers to nuclear material being used only once in the electricity

generation process. Once nuclear waste is produced, it must be disposed of in specially designed storage facilities that can safely store the waste for decades (in the case of low-level radioactive waste) to 10,000 years or more (in the case of high-level radioactive waste). Closed cycle refers to systems in which the residual unburned uranium and the fissile by-product plutonium are reprocessed and reused. The central hazards associated with nuclear fuel use in both processes are leakage of radioactive materials, "criticality accidents," and safe storage and transport of radioactive waste. In the case of closed-cycle systems producing plutonium, there are also concerns about nuclear proliferation, as plutonium of a certain quality can be converted for use in nuclear weapons. With the opening in 2006 of its Rokkasho-mura reprocessing plant, Japan has taken a major step toward its goals of developing a closed nuclear fuel cycle. Countries with open cycle nuclear programs include China, Japan, South Korea, North Korea, Taiwan, and Russia.

Northeast Asia has experienced numerous crises related to nuclear power, including a series of nuclear accidents in Japan, the dumping of nuclear waste in the East Sea/Sea of Japan by Russia and Japan, Taiwan's (unsuccessful) efforts to export nuclear waste to North Korea, and North Korea's development of nuclear weapons. There have also been major protests over the transport of nuclear waste to the United Kingdom and France for reprocessing.

In North Korea, nuclear energy development and security concerns have come to a head. North Korea has been able to extract sufficient plutonium from its spent nuclear fuel at its Yongbyong nuclear facility to develop several nuclear weapons, and its low-level underground test in October 2006 seemed to signal the regime's intent. North Korea's desperate behavior is in part a reaction to its domestic economic and energy crises: Pyongyang's decision to leave the Nuclear Nonproliferation Agreement and to expel United Nations inspectors has caused an international crisis. Several years into the crisis, the United States, China, Japan, South Korea, and Russia remain focused on their efforts to curb North Korea's programs to produce and export weapons of mass destruction and convince the North to abandon its nuclear weapons program.

In chapter 3, Young-Ja Bae argues that radioactive waste management has become an important social, environmental, and security concern for Northeast Asia. Nuclear waste was traditionally treated as a technical problem, but experts and, gradually, policymakers too are recognizing that nuclear waste disposal is a highly complex issue that entails ethical and environmental considerations, requires public and social acceptance, and brings with it political and strategic concerns. Throughout the region there have been major protests against the building of

nuclear waste storage sites for both low-level and high-level radioactive waste. As a result, most nuclear waste remains in temporary storage facilities. Nuclear waste storage became such a large issue for Taiwan that the government attempted to export the waste to North Korea. The international uproar that ensued killed this plan but contributed to the decision taken in 2002 to stop additional new construction of nuclear power in Taiwan. The nuclear industry in the region has begun to recognize that the long-term future of nuclear energy will be dependent at least in part on finding solutions for the nuclear waste storage problems confronting the region. This has pushed countries of the region to begin to cooperate on research related to the safe storage of nuclear waste through the Forum for Nuclear Cooperation in Asia.

Transboundary Air Pollution

In chapter 4, Anna Brettell examines the implications of transboundary air pollution for environmental security and cooperation in the region. Climate change, stratospheric ozone depletion, yellow dust, acid deposition (acid rain), and urban air pollution are all problems plaguing the region. China is by far the largest emitter of air pollutants in the region. China's greenhouse gas emissions are rising so rapidly that they are of global concern. China is expected to surpass the United States as the world's largest emitter of greenhouse gases in the next decades.

At the regional level, there is growing concern in China, Japan, and South Korea over transboundary air pollution, and especially acid rain and dust storms. Massive "yellow dust" storms—*huangsha* to the Chinese, *kosa* to the Japanese, *whangsa* to the Koreans—can become so powerful that they bring large areas of northern China and, at times, even Korea to a standstill in the spring. The dust storms cause major environmental, human health, and economic damage. Moreover, the dust storms can carry with them aerosols and toxic pollutants, magnifying their environmental and human health impacts.

Within the next decades, as regional sulfur dioxide emissions increase, sulfur deposition levels are anticipated to reach levels higher than those observed in Europe and North America during the 1970s and 1980s. They may even exceed levels observed previously in the most polluted areas in Central and Eastern Europe, where acid rain caused severe ecological damage. Already, Chinese scientists are pointing to the ecological and economic damages that China's acid rain is causing domestically. The levels of sulfur deposition also could cause significant changes in the soil chemistry over wide areas in Asia, affecting growing conditions for many natural ecosystems and agricultural crops. Unless stronger countermeasures are taken, considerable environmental degra-

dation could result, with long-term implications for human security. Northeast Asia has become one of the transboundary air pollution "hot spots" in the world. Brettell shows that atmospheric pollution has become serious enough that governments in the region are being forced into greater regional cooperation even if legally binding air pollution regimes remain a distant potential.

Transboundary Marine Pollution and Resource Exploitation

As Northeast Asia is one of the most densely populated regions in the world with a large percentage of its population living in coastal regions, stresses on its marine environment are great. As Miranda Schreurs discusses in chapter 5, a wide range of problems afflict the regional seas of Northeast Asia. Pollution of the regional seas (the East Sea/Sea of Japan, Yellow Sea, East China Sea, and South China Sea) stemming from coastal development, land-based pollution, and ocean dumping is becoming increasingly severe. Frequent "red tides" have forced China to place bans on fishing for increasingly long periods of time. The growing frequency of oil spills has put tanker accident and effluent prevention on national governmental agendas. A major oil spill off the coast of Japan in 1997 helped stimulate the development of a network of local governments concerned with marine protection.

Although there is still only limited cooperation related to marine pollution issues in Northeast Asia, there are signs that pollution of regional seas is becoming serious enough that governments in the region are feeling pressured to cooperate on at least some levels. Especially important in this regard is the Action Plan for the Protection, Management, and Development of the Marine and Coastal Environment of the Northwest Pacific Region (NOWPAP). In annual Tripartite Environment Ministers Meetings involving Japan, China, and South Korea, the need to enhance regional cooperation through NOWPAP for the preservation of the marine environment has become a regular topic of discussion. In 2005, Japan, China, South Korea, and Russia adopted a regional oil spill contingency plan, a major step forward in regional cooperation on marine issues.

The most controversial marine issues confronting the region are associated with tiny islands that were overlooked until the United Nations Convention on the Law of the Sea (UNCLOS) legitimatized the 200-nautical-mile Exclusive Economic Zone (EEZ) in 1982. This law opened a Pandora's Box of territorial disputes over the tiny islands, such as the Spratly Islands in the South China Sea, Tokdo/Takeshima Island in the East Sea/Sea of Japan, and the Diaoyu/Senkaku Islands in

the East China Sea. Suddenly, the islands became valuable not for their miniscule land space, but for the 200-nautical-mile zone surrounding them and the fishery and underwater energy resources that they might contain.

Some of the most deadly conflicts in the region in the past several decades have been over access to fishing grounds in disputed territorial waters. The fear is that the increasingly tense disputes over the ownership of deep-sea energy fields could turn violent as well. The severity of the fishing disputes, as well as international legal developments, have pushed countries in the region to form new bilateral fishing agreements and to begin to find ways to protect the heavily overfished stocks in regional seas. Nevertheless, as long as territorial disputes remain, fishing disputes are likely to continue to plague the region unless there is better joint monitoring of fishing activities. It remains to be seen how the region will address competing ownership claims to underwater oil and natural gas fields.

Water and Food Security

Mika Merviö argues in chapter 6 that water security should be given at least as much attention by states as military security. Establishing "water security" requires securing the water resources necessary for sustainable use by all communities and ecosystems. Access to sufficient clean water is closely linked to the pursuit of social justice. Shortage of water can be a source of internal conflict, especially when water resources are distributed unfairly. Pollution caused by upstream activities also can lead to confrontation when downstream users feel they are being unjustly treated. These issues can be a source of crossborder tension in cases of shared rivers or waterways, as happened after the 2005 Songhua River benzene spill flowed from China into the Amur River in Russia.

There are numerous challenges related to fresh water affecting the region. Water shortages have become a concern for parts of northern China, where population pressures and agricultural activities are placing strains on limited water supplies. Rapid industrialization in the context of inadequate pollution prevention measures means that water in a large percentage of China's rivers is unfit for human consumption. Beyond this, the building of dams for hydropower development is having a major impact on communities that are being forcefully resettled and on sensitive ecological systems. This has resulted in unprecedented mobilization of affected citizens within China as well as across national boundaries.

Shin-wha Lee discusses in chapter 7 how food security has become a matter of regional concern in relation to the famines that struck North Korea in the 1990s and threaten to strike again at the time of this writing. In the 1990s and early 2000s, "environmental refugees" risked crossing the Sino–North Korean border in search of food and shelter in northeastern China. The nuclear crisis on the Korean Peninsula, however, complicates efforts to provide humanitarian assistance to North Koreans suffering from malnutrition.

Promoting Regional Environmental Cooperation to Enhance Regional Security

The next chapters make a case for enhancing environmental cooperation in order to improve the security environment. In chapter 8, Kyudok Hong takes up what is arguably the most difficult, but most important, test case for environmental cooperation—that of the Korean Peninsula.

Hong provides an overview of the seriousness of environmental and energy problems in North Korea and their real and potential human (and in some cases, more traditional) security consequences for South Korea, China, and the region. Acknowledging the obstacles to working with North Korea on environmental problems, Hong suggests that the issue of environmental protection could be used to promote dialogue on the Korean Peninsula while steps are taken to ameliorate the terrible conditions facing North Koreans. Both South Korea and the international community could do more to persuade Pyongyang of the importance of environmental protection. Providing financial and technical assistance toward that end could improve the security environment on the peninsula.

Esook Yoon, Seunghwan Lee, and Fengshi Wu argue in chapter 9 that nongovernmental organizations (NGOs) should also be given a larger role in promoting environmental cooperation in the region. Although environmental NGOs in the region are weak and have to date shown little interest in regional environmental problems, their circumstances are improving as governmental attitudes toward environmental civil society change at the domestic level. The potential is there for civil society to play a larger role in promoting regional cooperation. Thus, although there are still only nascent efforts at regional network building, information exchange, and cooperative problem solving by NGOs in the region, in the coming years environmental groups could build their capacity and expertise if they are aided by the international community.

The Potential for the Formation of a Regional Environmental Security Complex

The concluding chapters of the book argue that establishing effective regional regimes for managing and solving shared environmental and energy problems will not be an easy task, but that they are important to the long-term stability of the region. In chapter 10, Elizabeth Economy points out several obstacles to regional environmental protection efforts: the lack of multilateral organizations to formulate and implement an overarching environmental strategy; the poor resources of environmental protection agencies; the unstable economic and social situation in the majority of the countries in this region and the relative lack of attention to environmental problems; the weakness of NGOs in this region; and the issue of sovereignty as a stumbling block for regional cooperation.

As environmental degradation grows increasingly severe and environmental awareness grows in the region, there are some efforts to initiate joint scientific research and monitoring and to form bilateral cooperative agreements. While Economy remains pessimistic about the prospects for the formation of a regional environmental regime in the region, she does see the potential for greater bilateral cooperation, particularly in scientific research and monitoring.

Miranda Schreurs argues in the concluding chapter that preventing environmental threats from becoming possible causes of interstate tensions and conflicts should be an important priority for the Northeast Asian region. This will require the development of preventive response mechanisms that can mitigate conflict before it erupts. She suggests that the United States and the international community should be supportive of the nascent cooperative initiatives emerging in Northeast Asia among scientists, NGOs, and governments—not only for the positive environmental consequences they may yield, but also for the added stability they can provide to the region.