Summary observations

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The introductory and subsequent articles in this book, including the foundational material contained in Section 6, present significantly more information than was discussed at the workshop, "Environmental Threats and National Security: An International Challenge to Science and Technology." However, the workshop discussions served to integrate and emphasize some of the most important points raised in these papers. The following observations draw from both the workshop and the papers.

Six principal points are raised:

- The Importance of Environmental Issues. At the end of the 20th century, most projections indicate that the world will double in population by the year 2050. Much of the increase will be in developing countries, which are simultaneously striving to attain a higher standard of living for their people. The stress on the limited common resources of the planet—air, water systems, fossil fuels, and land for agricultural use—will be enormous and unevenly distributed. Localized impacts on biodiversity and habitat will be significant. The linkages among these factors and their resultant impact on regional well-being and the global environment need to be much better understood. Consequences of environmental mismanagement are very evident, for example, in areas of the former Soviet Union, where life expectancy has sharply declined over the last decade. We need to begin to take steps to limit the increase in global and regional environmental stresses and to hedge against anticipated adverse consequences.

- The Security Dimension to Environmental Threats. Secretary of State Warren Christopher stated in April 1996: "As we move to the 21st century, the nexus between security and the environment will become even more apparent." Not all environmental issues are security issues, but scarcity and environmental deterioration can fuel old hatreds based on religious, ethnic, or class differences and intensify conflict. Emergent diseases, which can arise and spread from unsanitary, overpopulated regions, are also a security concern. Various regions and environmental stresses leading to or setting the stage for conflict have been the focus of several academic studies of "Environmental Security" over the past decade.

  The subject of environmental security has other facets as well. For example, within the Department of Defense, environmental security is an aspect of preventative defense, intended to create conditions for peace in a region. It entails engaging foreign militaries in environmental collaborations associated with defense activities, acquiring new weapon systems whose day–to–day operations have reduced environmental impact, and working with regional parties to identify sound solutions to regionally troublesome environmental problems. In cases where there is a certain and proximate relationship between the environmental concern and the potential for

conflict, the U.S. national security apparatus is much more likely to become engaged. Environmental conditions must also be understood if and when American personnel are committed to overseas activities.

Environmental security—whether it be broadly or narrowly defined—can be a helpful explanatory framework and analytical tool for decision makers, scholars, and the public. It can assist in the conceptualization of problems, the setting of priorities, and the organization of responses to environmental and demographic changes. Over time, it might evolve to become an established discipline in international security, like arms control. There are many parallels between environmental security and arms control. Yet, in the two cases there remain differences in the proximity and immediacy of issues and the clarity of theory and policy strategies: one is a developed field, while the other is still in its infancy.

- The Complexity of Environmental Security Issues. Environment and security issues are multifaceted and complex, in both a cultural and scientific sense. In a fundamental way, environment must be viewed as a strategic factor to be weighed in with many other variables affecting a regional situation. It cannot be considered in isolation as if it were overhead, and it must be worked with full participation of regional entities. Furthermore, global environmental issues must be considered in an international context that has changed significantly in the recent past. In addition to independent states, there are now transnational elites and networks, thousands of intergovernmental organizations, and tens of thousands of nongovernmental organizations (NGOs) that have interest and equity in the international system. These factors raise a broad spectrum of issues related to international agreements, such as accountability, capability overload and congestion, and compliance.

  Any analysis of the Earth system requires a multidisciplinary approach. Modeling must include human, biological, and physical factors. Overall, it is going to be difficult recognizing, defining, and attributing changes in regional and global natural systems—physical, chemical, and biological—to human actions. Linkages are very significant and very complex. The modeler is challenged to identify what factors are most important and to reduce uncertainties in those areas first. This task is made more difficult by the nonlinearity of the overall systems. It is possible a small perturbation due to human actions or random factors can result in a very large effect (e.g., an abrupt change in ocean current that significantly changes global temperatures). In the historic past, a 6° C average temperature drop occurred in northern Europe over a decade.

  In the final analysis, the human factors may be the most difficult to model (and to deal with). An example is provided in the transportation sector. There are many problems associated with transportation, one of which is CO_2 emissions. It is an easy problem to ignore, and we cannot deal with it effectively until we understand underlying sociological factors, such as the coupling between income and mobility. Moreover, within the United States, there presently is no feedback mechanism (so-

cial, technical, or economic, such as a gas tax) to stabilize CO_2 emissions. Furthermore, there is no consensus whether or how to approach the issue.

- The U.S. Role in Environmental Security. The United States has the capability to measure, understand, and predict environmental consequences through the application of science and technology. We must influence actions taken in the United States and other industrialized nations that affect the global environment. We must also influence the actions of states with rapidly growing economies, such as China, India, and Indonesia, which will be among the largest economies in the world in the 21st century. China, for example, is a case of rapid economic growth, limited natural resources (both oil and land for agriculture), and a degraded environment that is of international concern. Acid rain from coal burning is a problem for China and for its neighbors. However, there is some good news in this case. China is starting to act to improve its environment at an earlier stage in its economic development than other countries have. With proper management, China may be able to avoid food shortages and major health problems from air pollution in the coming decades.

  In general, the United States has three broad roles to play in the environmental security area. First, we solve problems and share the developed technological capabilities with other countries. An example, currently being worked within the Department of Energy, is a nuclear materials stewardship program. In this effort, technically sound, integrated approaches to managing radioactive materials are being sought, which may engender international cooperation on concepts such as regional storage facilities. Second, we work with other countries to build capacity to prevent environmental stresses. The goal is long-lasting solutions achieved through partnership with host countries. There are academic examples of these activities—humorously portrayed at the workshop as being analogous, at times, to "herding cats." In addition, there are U.S. government activities, such as the Arctic Military Environmental Cooperation effort, where we are engaged with Norway and Russia on spent-fuel disposition and radioactive waste handling issues. Finally, the United States provides direction to international efforts through leadership and example.

- Science and Technology in Response to Environmental Threats. The application and advance of science and technology is crucial to the formulation and execution of responses to environmental threats. Both research universities and national laboratories can contribute to the effort, working in conjunction with private industry and laboratories. Their responsibilities are to develop objective knowledge and technologies. Efforts include analysis, research and testing, and model development for applications ranging from site characterization to global circulation.

  Universities have special responsibilities for the education of the next generation of decision makers, analysts, and scientists; while the Department of Energy laboratories have special responsibilities in the areas of radioactive waste remediation, nuclear safety, and nuclear material handling. In addition, other research institutions (including universities) advance agricultural technologies. These advances will be

relied upon to feed a more populous planet in the future. However, grainland under cultivation, per capita water use for irrigation, the size of the fish catch, grazing land, per capita grain yield, and fertilizer use have all leveled off or fallen from peak values during the 1990s. And, agricultural research organizations are not receiving adequate financial support. More support is also needed for many aspects of disease control. Since there is no way to predict when or where the next important new pathogen will emerge, investments are necessary for the various elements of a "discovery-to-control" continuum of activities. Proposals exist to expand activities: a global disease surveillance system, a global diagnostics system, a global emergency response system.

In the area of sensors and global monitoring, the use of intelligence assets and, in the future, high-resolution civilian satellites will provide an ability to understand and respond to humanitarian crises and to monitor flashpoints. Environmental intelligence is now a significant responsibility of the U.S. intelligence community. A Measurements of Earth Data for Environmental Analysis (MEDEA) team, consisting of about 70 scientists, advises the intelligence community on the use of its resources for the study of the environment. MEDEA is also responsible for making data available pertaining to deforestation, change in the temperature of oceans, wetlands management, and radioactive contamination. The intelligence community also works with various agencies on disaster response and monitoring. For the future, NASA has plans for Earth-monitoring satellite systems that will have high spatial and spectral resolution and rapid revisit times.

Remote sensing offers the prospect of supporting a wide range of detailed studies, ranging from issues related to urban areas to aspects of sustainable agriculture. Activities were discussed at the workshop that involved the fusion of various data bases to study the regional consequences of environmental factors which are, in cases, global in origin. The overall objective is to develop multifactoral maps of environmental stress, which can be compared to the regional distribution of various human factors. It might be possible to develop predictive measures for environmentally related security problems. Data is the driver. There is a need for better organization of existing data and the data expected from future sensor systems. The data must be workable, transparent, and accessible. This will facilitate regional cooperation, strengthen policy and regulatory analysis, and foster sustainable use of resources.

- The Future of Environmental Security. The April 1996 statement by Warren Christopher is evidence of high-level Clinton administration interest in environmental security. Significant pronouncements have also been made by John Deutch (as director of Central Intelligence) and Secretary of Defense William Perry. In addition, memoranda of understanding exist among various departments and agencies fostering cooperation on environmental security issues. This high level interest provides a basis for work projects at various levels within DoD, DOE, the State Department, and the Environmental Protection Agency.

Yet, there are two related sources of concern. First, as expressed by one workshop participant, "If everyone owns the problem, no one owns the problem." If there are shared interests in environmental security, it is important that responsibilities are carefully delineated and that vital aspects of the research, development, and execution responsibilities do not fall through the cracks; alternatively, responsibility could be delegated to one central entity, but there are problems with that approach also. Second, a combination of federal budget pressures, a lack of immediacy, and an absence of sharp focus to environmental security activities can lead to systemic under investment. We will soon see what momentum environmental security has in the second Clinton administration.

In a much broader sense, it may take several administrations after the end of the Cold War to readjust priorities and realign the direction of the national security apparatus in the U.S. government. Environmental security may take time to mature into a well-funded thrust area. Alternatively, the evolving new relationship between humans and the natural environment might broaden to become a principle of basic quality of life worldwide—a theme much broader than environmental security. What are our overall responsibilities to all the citizens of Earth and to future generations?