

Special Reports

This section highlights the work of various organizations on issues of environmental change and security. This issue includes reports from Ecologic - Centre for International and European Environmental Research, the Master of Science in Foreign Service Program at Georgetown University, and the Natural Heritage Institute.

NATO/CCMS¹ Pilot Study: Environment and Security in an International Context

State of the Art and Perspectives
Interim Report
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*Alexander Carius, Melanie Kemper, Sebastian Oberthür, Detlef Sprinz
ECOLOGIC—Centre for International and European Environmental Research*

1. INTRODUCTION AND OVERVIEW

... The Round Table on Environmental Security, which took place during the NATO/CCMS Plenary Meeting in Washington D.C. on November 14, 1995, highlighted the importance of the relationship between environment and security and marked the start of the Pilot Study on "Environment and Security in an International Context." The establishment of the Pilot Study pays tribute to the fact that, while research has advanced steadily during the last ten years, large gaps still exist in the knowledge about the correlation and interaction of environment and security issues. Much remains to be done to raise public awareness and to inform policymakers. The Pilot Study group met for the first time from April 17 to 18, 1996 in Waldbröl, Germany and adopted the Methodology and Structure for the Pilot Study. All documents are available on the NATO CCMS Environmental Clearinghouse System (ECHS) World Wide Web site.²

... The present report first takes stock of the current state of knowledge about the relationship between the environment and security. Section 2 of the report briefly reviews the conceptual issues surrounding the discussion on the environment and security. Section 3 deals with the development of data collection and indicators that are needed for threat assessment and priority-setting. Section 4 summarizes existing knowledge about the major problems and problem regions with regard to environmental risks to security. Section 5 describes the political and institutional options at the international level that are currently pursued or under discussion and might deserve further investigation. Finally, in section 6, some recommendations regarding the substance and structure of the future activities of the Pilot Study are outlined.

2. ENVIRONMENT AND SECURITY: CONCEPTUAL ISSUES

... There are many meanings of security in everyday language, but in international politics and in security policy in particular, the term "security" generally refers to the absence of violent conflict, the continued exist-

Alexander Carius is the Director of Ecologic; Sebastian Oberthür is a Senior Fellow at Ecologic; Melanie Kemper is a Research Assistant at Ecologic; and Detlef Sprinz is a Research Fellow at the Institute for Climate Impact Research, Potsdam. The above is an excerpt from the interim report which was prepared by Ecologic - Centre for International and European Environmental Research, Berlin and Potsdam - Institute for Climate Impact Research, for the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety, Federal Republic of Germany.

ence, integrity and sovereignty of states (“national security”) and the peaceful coexistence of states in the international system (“international” or “global security”). The perception of what are the causes of threats to security and what are thus security issues has broadened over the years. In the wake of the oil price shocks in the 1970s and the heightened awareness for growing international economic interdependence, economic considerations were taken into account in defining security. Likewise, after the rise of global environmental issues onto the agenda of international politics, the relationship between environment and security has become a major subject of scientific as well as political discussion. In this context, the term “environment” is related to environmental problems like air or water pollution, natural disasters such as major storms, as well as to natural resources.³ The next section discusses the role of environmental degradation and resource scarcities as causes of violent conflict.⁴

2.1 RELATIONSHIP BETWEEN ENVIRONMENT AND SECURITY

The relationship between environment and security can be subsumed under two fundamental environment-security linkages. These refer to problems of environmental degradation (including natural catastrophes) and resource depletion or scarcity as a consequence of military activity in times of peace and war⁵ on the one hand and a direct or indirect source of conflict on the other.

It is the role of environmental degradation and resource scarcities as causes of violent conflicts that needs further study and that is of special concern to NATO.

2.2 THE ENVIRONMENT AS A CAUSE OF VIOLENT CONFLICT

...The potential causal pathways leading from environmental degradation and scarcities of natural resources to violent conflict are presented and systematized in Figure 1.

Figure 1 shows three levels to be distinguished regarding the relationship between environment and security. At the most basic level, there are certain framework conditions or societal capacities, most importantly: (1) the characteristics of the political system; (2) the existing knowledge about an issue; (3) the economic and technological options available; and, (4) the cultural and ethnic characteristics of the society or societies involved. Under the heading of framework conditions situational factors (e.g. a change of government, current diplomatic tensions, sudden increases/decreases of commodity prices, etc.) should also be considered. These framework conditions influence all other elements and relationships depicted in Figure 1. They build the foundation on which environmental

degradation and resource scarcities are generated and perceived. Resource scarcities might lead either directly to potentially violent conflict or to secondary social problems with the potential for causing violent conflict. Environmental degradation, including natural disasters, might result in secondary problems by means of which they become indirect causal factors of violent conflicts. Whether or not resource scarcities and/or environmental degradation will lead to the outbreak of violent conflict in a particular instance, however, is dependent on the framework conditions.

The influence pathways shown in Figure 1 are not always one-way relationships. At the most basic level, the underlying framework conditions might themselves be influenced by environmental problems, secondary social problems, or any resulting violent conflict. Furthermore, secondary social problems might feed back to the environmental problems that caused or contributed to them in the first place. For example, a country experiencing food scarcities as a result of soil erosion caused by overly intensive use of agricultural land may increase the intensity of agricultural land use even further. This results in further soil erosion, exacerbating the pre-existing food problems. This is also true with regard to the relationship between environmental degradation and the scarcity of natural resources. For example, global climate change might lead to reduced water availability in certain regions. Finally, violent conflict can also result in reinforcing social problems as well as environmental problems and resource scarcities by the destruction of societal structures and the environment.

These feedback relationships are not included in Figure 1 because its purpose is to depict possible pathways of environmental problems leading to violent conflict. Whether environmental change actually leads to social problems and, consequently, contributes to the emergence of violent conflict in a particular instance depends on the underlying framework conditions and on the political strategies and measures chosen to deal with the different issues. If preventive measures are taken and prudent policies are employed in time, the conflict potential emanating from environmental stress can be minimized.

At the same time, in cases where environmental problems are a major cause of the outbreak of violent conflict, such problems will hardly be the only factors that need to be considered. Usually, environmental problems will be only one of many factors and will be relevant to security issues only under certain circumstances. For example, sea level rise resulting from anthropogenic climate change may contribute to conflict in less developed countries where its destabilizing effect is reinforced by an unstable political system which is also experiencing distributional or ethnic problems.

...One question that has not yet been answered to any satisfaction is how can the relevance of environ-

Figure 1-The Role of the Environment in Contributing to Violent Conflict

mental problems in contributing to the generation of violent conflict be determined and measured, given that in any specific case environmental factors are only one part of a whole set of relevant factors. From a preventive perspective, it would be desirable to identify environmental problems or sets of environmental problems that—under certain framework conditions—are or might become particularly serious threats to security. Apart from the problems of measurement and quantification, there is currently no consensus concerning the threshold of severity above which environmental problems may be related to security. It is evident, however, that if too low a threshold is chosen, the analysis of the relationship between the environment and security would only duplicate the work which is carried out in the context of the discussions on sustainable development.

Although the sustainable development agenda should not be duplicated by the investigation of environment-security linkages, both issues are certainly closely related. In considering the role of environmental problems as threats to security, those items on the sustainable development agenda requiring specific attention because of their security relevance need to be highlighted. A list of the environmental issues which are most prone to becoming security threats remains to be determined. Tackling those environmental threats to security as a matter of priority might serve environmental as well as security purposes. Furthermore, achieving security in the military sense is a major precondition for the success of any strategy aimed at reaching sustainability. This is because violent conflict and

the destruction resulting from it necessarily counteract efforts to realize sustainable development. Thus, mitigating environmental problems that might cause or contribute to violent conflicts is itself a contribution to sustainable development. By the same token, sustainable development can be seen as a major precondition of security, and its realization will alleviate any environmental threats to security.

3. DATA IN THE FIELD OF ENVIRONMENT AND SECURITY

Explorative research on environment and security has primarily relied on case studies. However, in order to generalize across larger sets of cases, it is indispensable to build a stronger database. While there appears to be a lack of specific databases on environment and security, a variety of data sources has incorporated some relevant clusters of variables.

Variables of interest to the environment and security field range widely in the literature. Therefore, some delimitation is necessary. We focus on four major clusters of variables:

- human driving forces (pressures on the environment);
- state of the environment (environmental performance);
- policy response (e.g. instruments); and
- indicators of violence.

A brief review of prominent reports by international governmental and non-governmental organizations as well as relevant research projects shows that

existing data sets cover at least a minimum range of economic and demographic variables under the category of human driving forces. However, the data set most frequently used for research on international and civil war (Correlates of War data sets) omits environmental variables.

The geographical and temporal scope of the databases vary. In some cases, yearly variable scores are available since the early 19th century until 1995; other data sets include only the past decade or only a few time points from the post-World War II period. In terms of geographic coverage, data collection ranges from nine countries (for a structured comparative case study) to worldwide coverage.

Many of the data collection efforts have been inspired by the notion of sustainability. To this end, a variety of institutions—such as the World Bank and the World Resources Institute—have contributed frameworks of analysis which build on the first three clusters of variables mentioned above (human driving forces, state of the environment, and responses). However, no universally accepted indicators for sustainable development exist. Most prominent may be the attempts by UNEP to construct a “human development index” (HDI) which serves as an “early warning indicator”—especially in the context of “secondary social problems” (see Sections 2 and 4). Environmental sustainability indicators are neither integrated with indicators of violence nor with the HDI. Overall, research on sustainable development indicators is still at the stage of conceptualization rather than at the stage of mature data integration and evaluation. The review shows very few data sets *specializing* on environment and security.

In general, there is little integration of all four clusters of variables mentioned above. In particular, most datasets include either environmental policy response variables *or* variables of violence—but rarely both groups. This is regrettable since for the purposes of the Pilot Study, both groups of variables must be considered simultaneously to find the necessary and sufficient conditions for the onset of environmentally induced violence—and the ways to prevent its occurrence. Thus, the best approach to data integration appears to be consolidating databases which use the driving forces—state of the environment—response framework and integrating it with databases specializing on civil and international war. These attempts will be hampered by a lack of congruity of the temporal and geographical scope of present databases.

Data sets specifically covering environment and security are at an early stage of development. Furthermore, there appears to be a lack of universally agreed upon indicators and indexes on environment and security. In conclusion, the current data sources on environment and security are likely to be insufficient for *systematically* assessing the crucial link between envi-

ronmental pressures, state of ecosystems, related social problems, and governmental response, as well as the occurrence of violence. Therefore, more structured efforts have to be undertaken to substantiate findings in support of better informed public policy on environment and security.

4. MAJOR PROBLEMS AND PROBLEM REGIONS

The following discussion tries to reflect the emphasis of recent research activities, but does not pretend to present a comparative assessment of which issues might be the major environmental threats to security and which regions might be most seriously affected.

4.1 MAJOR PROBLEMS

A distinction has to be made between natural resource scarcities and environmental degradation as causes of violent conflict. As explained in Section 2, scarce natural resources and their distribution can be a direct and indirect cause of violent confrontation, whereas, in general, the causal pathway from environmental degradation to violent conflict leads through secondary social problems. Neither of these problems by itself necessarily leads to violent conflict. In fact most of them are dealt with successfully in a non-violent way. The significance of an environmental problem is dependent on the context it encounters—e.g. social, economic, political, cultural, religious, and ethnic factors. A water problem between Israel and Jordan has different implications than a similar dispute between Canada and the United States. In this Section, (1) selected social problems relevant to environment and security are discussed. (2) The main problems of environmental degradation and (3) resource scarcities are also reviewed.

(1) *Secondary social problems*

The most examined social problem that can be environmentally induced is *migration*. For example, environmental problems contribute to rural-urban migration in developing countries. This results in overflowing slums in large cities which in turn contribute to political instability. In rural areas, the loss of grazing land as a consequence of soil erosion may lead nomads to migrate into regions where farmers settle, thus creating conflicts over the distribution of the land which may become violent. In general, many environmental problems, including changes in the availability of water, land degradation, and natural disasters, etc., may cause or contribute to migration. Migration may become an even more serious issue if it moves beyond national boundaries. It may not only be the *result* of environmental problems, but may also be the *cause* of new environmental problems at the place of arrival.

Another secondary social problem that may feed back to political instability as well as environmental problems is *poverty*. As the economy and the environment are inter-related, it is often difficult to differentiate between their role in conflict. However, less developed countries earning a large portion of their national income by agricultural production may lose part of their income as a result of natural disasters or land degradation. In some African countries it has been estimated that dryland degradation has significantly reduced the gross domestic product.

Environmental degradation or soil salination may lead to *limited food availability and famines*, which in turn contribute to political instability. A well known example is Africa's Sahel Desert where overgrazing, droughts, and soil erosion have caused famines, and where examples of violent conflict are numerous. While such social problems are seemingly local or regional events resulting from overuse of certain natural resources, global environmental change might also contribute to social problems by shifting the balance between humans and their environment.

Changes in the environment and in human behavior can contribute to increased *health problems* that, especially if they are epidemic, may become security concerns. In particular, global climate change and changes in the water cycle may induce the migration of microorganisms into densely populated areas. Health problems, by enhancing the above mentioned social problems, can lead to violent conflict. Epidemic diseases might, for example cause people to migrate and may result in poverty and famines. Also, migration, poverty, and famines can easily feed back to health problems by contributing to the creation of squalid living conditions which promote the spread of infectious diseases.

(2) *Environmental degradation*

Regarding issues of anthropogenic *global environmental change*—ozone depletion, loss of biodiversity, climate change, desertification, deforestation—global climate change may be considered the greatest threat to security. Its consequences could easily alter the availability and distribution of resources. This could lead to the above mentioned social problems which may result in violent conflict. Changes in precipitation levels and desertification due to global climate change may, for example, affect the availability of freshwater and the capacity for vegetation growth. Change of ocean currents may result in changing or loss of fishing grounds. Sea level rise will lead to land loss, inducing a migration problem. The same might become true for regions affected by increased frequency and severity of extreme weather conditions, such as floods, hurricanes, droughts, and fires, due to global climate change.

Today, however, *local and regional environmental deg-*

radation, especially the erosion of arable and grazing land, have shown a particularly high potential to contribute to violent conflict. Large areas of degraded soil can be found around the world (e.g. Horn of Africa, Iran, Iraq, India, Mongolia, China, Central America, and the Amazon basin) and is one of the major environmental causes of migration. Land degradation may thus easily aggravate existing scarcities of fertile soil which is an ecological resource that has frequently been involved in war.

Pollution is another environmental problem that generally contains a potential for conflict because its costs may be distributed unevenly. The recent violent incidents in the Niger delta, for example, are partly due to pollution. Another example of pollution-induced conflict is the case of the Trail smelter in Canada which affected the United States. The dispute was settled by the International Court of Justice. Pollution might also contribute to the above mentioned social problems by triggering migration, damaging food production and human health etc.

Natural disasters, such as the eruption of a volcano, major storms, floods, droughts, fires, earthquakes, or massive pest attacks are also environmental factors that can contribute to political instability. The differentiation between natural and anthropogenic environmental catastrophes, however, becomes increasingly difficult because of increased human interference with ecosystems on a global scale. Thus, the numerical increase in natural catastrophes with disastrous consequences for people during recent years may be a first sign of this human influence.

(3) *Resource scarcities*

Natural resources—both renewable and non-renewable—may become issues of conflict when they are scarce. These resource scarcities can be caused by a decrease in the supply of the resource, an increase in the demand or by unequal resource distribution. Resource scarcities can contribute directly or indirectly to violent conflict. If violent conflicts are fought over natural resources (simple-scarcity conflict), the contribution of the environment to the conflict seems obvious. This might explain why resource scarcities have been of primary interest to research on environment-security linkages.

Fresh water, fish, and forests are *renewable natural resources* of special concern. Water shortage is generally seen as the environmental problem most likely to lead to violent conflict. According to the Secretary General of the UN Conference on Human Settlements Habitat II, Mr. Wally N'Dow, water is the critical factor threatening world peace.⁶ For example, the Middle East is known for its violent conflicts involving water issues. Another example of conflict over renewable natural resources is the recent dispute between Canada and Spain over fish. Scarcities of renewable natural

resources are in many cases closely related to environmental degradation because the latter can cause such scarcity by damaging or altering the regenerative processes involved.

Non-renewable natural resources such as oil, coal, iron ore and other minerals have been known through history for causing simple-scarcity wars between states. During World War II, for example, Japan sought to secure oil, minerals and other resources in China and Southeast Asia, and the 1991 Gulf War was partly motivated by the desire to secure oil supplies.

4.2 MAJOR PROBLEM REGIONS

The threat that an environmental problem poses to security depends on the degree of the threat to welfare and survival, (i.e. on the framework conditions.) Thus, the capacity to act on the environmental problem and its consequences, the promises of the application of force, the general conflict situation in the region concerned, and the institutions binding the possible adversaries together, all influence the eventual probability of violent conflict. In general, these conditions appear to be more prone to triggering violent conflict in developing countries than in industrialized states. Therefore, violent conflicts over environmental issues have been more notorious in the South than in the North. Most wars and violent conflicts identified as environmentally induced have been internal in nature and have taken place in ecologically sensitive regions of the developing world.

Regions of special interest to recent research on environment-security linkages have, not surprisingly, been regions with acute conflict where the environmental factor seems rather obvious, such as the Middle East and the Horn of Africa. Additionally, some regions are popular illustrations of the consequences of particular environmental problems. Bangladesh, for instance, is often mentioned in conjunction with sea level rise; Haiti and the Philippines for their problems of deforestation; the Sahel for its desertification; and again the Middle East in connection with water scarcity.

However, it has been left largely to the discretion and preferences of the researchers involved, which environmental problems and problem regions are pronounced in research. There exists neither a comparative assessment of the security threats posed by different kinds of environmental problems, nor research results available that would allow assessment of the severity of environmental threats to security on a regional basis.

5. POLICY RESPONSES TO ENVIRONMENTAL THREATS TO SECURITY

There are certainly countless policy options for responding to environmental challenges at every level, be it local, national, regional or international. In the

following discussion, the focus will be on action at the international level and on bilateral as well as multilateral policies. Several reasons can be given for this emphasis. First, insofar as environmental problems are relevant to security policy, they either have or acquire an international dimension, since it is, in the end, mainly peace among different states and societies that is of concern. Even violent conflicts that appear to be purely domestic are mostly of international concern. Second, the greatest risk associated with environmental problems has been identified in developing countries and in Eastern Europe. Thus, from the perspective of NATO and NATO member states, it should be the international level that is the focus of responses to environmental risks to security. Finally, most modern environmental challenges are international themselves and thus require an international or regional approach (i.e., climate change, stratospheric ozone depletion, but also shared water resources).

Furthermore, regarding more general policy strategies for coping with environmental change, a distinction has to be made between adaptation and mitigation and prevention. Policies can aim at adapting society to changing environmental conditions and resource scarcities without tackling the causes of the environmental change in question, or they can be directed at mitigating such causes or preventing the emergence of environmental problems and resource scarcities. The two approaches are not mutually exclusive.

. . . The following discussion will, first, deal with the international institutions concerned. This will include international *environmental* institutions in a narrow sense as well as other international institutions that are important for effectively dealing with environmental problems. Second, as to the substance of international environmental policies, the importance of capacity building as a fundamental approach to environmental policy will be highlighted. In general, the Pilot Study will put special emphasis on building and strengthening international institutions of regional or global scope.

(1) *International institutions in the field of the environment.*

International institutions in the field of the environment comprise international organizations and other international cooperative arrangements commonly referred to as "international regimes". International regimes are usually based on international conventions and other instruments of international law. The instruments of international law provide for general and specific proscriptions and prescriptions as well as decisionmaking procedures like voting rules of the members in specific issue areas of international relations.

More than 100 of these arrangements have been created based on international agreements which exist in the field of the environment at the regional or international levels. Most of the known important interna-

tional environmental issue areas are thus governed by international environmental regimes, including a number of arrangements for the common management of natural resources, most notably water. The issue area of climate change, for example, is governed by the United Nations Framework Convention on Climate Change opened for signature at UNCED in 1992; the depletion of the ozone layer is dealt with in the framework of the Vienna Convention for the Protection of the Ozone Layer (1985) and the Montreal Protocol (1987). Other global environmental agreements include the Convention on Biological Diversity (1992) and the Convention to Combat Desertification (1994). Protection of the oceans and their resources is regulated by a whole range of regional and global agreements. Several regional problems like long-range transboundary air pollution in Europe and North America, the protection of the Rhine and Danube rivers and the management of other freshwater resources are also regulated by regional or global agreements.

While the examples mentioned are only representative of the complete list of international environmental regimes, the United Nations Environment Programme (UNEP) is the only global international organization exclusively in charge of environmental issues. UNEP's role, however, is mainly confined to facilitating and supporting environmental protection by the catalyzing and coordinating functions assigned to it by the community of states.

Environmental matters have, however, become increasingly prominent in the activities of other international organizations. Environmental matters are now regularly considered in programs of the United Nations Development Programme (UNDP), the Food and Agriculture Organization (FAO), most other organizations and bodies of the United Nations, as well as of the World Bank and many other financing institutions including the regional development banks. The establishment of the Global Environment Facility (GEF) by the World Bank, UNDP and UNEP in November 1990 as well as its restructuring in 1994 provided an additional instrument for channeling resources from developed to developing countries in order to address global environmental issues. None of these organizations and bodies, however, is actively pursuing environmental regulation and its implementation.

Furthermore, the rules and activities of many international organizations and regimes that appear to be outside the realm of environmental policy do influence the environment directly or indirectly. The best-known examples are the General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO).

Since the Earth Summit in Rio de Janeiro in 1992, there has been some institutional reform to enhance the role and increase the weight of environmental considerations in international policy-making. The UN

Secretariat in New York was restructured to give the environment and sustainable development a more prominent role. In addition, the Commission on Sustainable Development (CSD) was established. It was hoped that the CSD would help solve the *problem of coordinating* different international policies and institutions relevant to the environment. Coordinating international policies has become more important with the increase in the number of international environmental regimes and the realization that many seemingly unrelated activities of other international institutions are indeed of great relevance to environmental matters. As a consequence, this problem is characterized by duplicated work, overlapping responsibilities, and incompatibilities and tensions among different environmental institutions. This is demonstrated by the great need for cooperation between environmental regimes and between environmental institutions and institutions mainly responsible for other policy fields. Despite the value of the CSD as a global forum for discussion, the many challenging issues on its agenda have not allowed it to make decisive progress in solving the problem of coordinating different environmentally relevant activities to the degree hoped for initially.

Much remains to be done regarding the two main problems of international environmental regulation and implementation. These problems are closely related to the lack of any central authority in the international system and which the CSD was meant to address. One constraint on the effectiveness of international environmental policy is related to the nature of regimes. Given the sovereignty of participating countries, they have to consent to an international agreement in order for the obligations included to become binding. Taking into consideration countries' differing degrees of knowledge and their varying interests and concern, reaching agreement in the negotiations frequently takes a long time and the resulting obligations are often "too little, too late". Second, implementation problems plague international efforts to protect the environment. As in the field of security policy, monitoring compliance with international agreements is a crucial issue in environmental politics. In the absence of adequate monitoring, states fear that some of the parties to the agreement may not comply and thus may save the costs associated with compliance. Effectively responding to known cases of non-compliance serves to promote that trust. However, the international system now offers little room for enforcing obligations.

In conclusion, the effectiveness of international environmental institutions is still very limited. The institutional reforms following the Earth Summit have not changed this situation fundamentally. More work needs to be done to evaluate alternative policy options in order to assist decisionmakers in setting priorities.

(2) Capacity building.

It is the capacities available that are of fundamental importance to the ability of societies and policies to respond to environmental challenges. Indeed, whether environmental policies are formulated and implemented effectively depends not only on the political will of decisionmakers but also on the availability of sufficient capacities. Therefore, capacity building can be seen as a major part of a strategy to combat environmental threats to security. This applies especially to developing countries. Emphasis needs to be placed on capacity building to enable the societies of concern to follow sustainable development paths in order to prevent environmental problems from becoming relevant to security policy at all.

Capacity building measures supporting sustainable development are addressed in Agenda 21. They can comprise a variety of different activities covering a whole set of areas, e.g. economic and technological development, institution building and institutional reform, diffusion of knowledge and know-how, health care, and the transfer of financial and technological resources. More specifically, training activities, financial assistance, transfer of suitable and adaptable technology, education programs, the strengthening of the role of important societal groups (e.g. children, women, indigenous people, NGOs), and similar measures are associated with the more general aim of capacity building. Thus, capacity building is a major aim of current efforts to confront global environmental change, especially at the national and local levels. Research must still provide some direction as to the building of which kind of capacities should be supported under specific circumstances to give optimal support to sustainable development.

6. RECOMMENDATIONS FOR STRUCTURING THE FUTURE DISCUSSION

To assist NATO in defining its own policy priorities with respect to the environment and security, it is essential to identify those environmental problems that merit special attention and are in need of urgent action because of their particularly high potential for triggering violent conflict. Furthermore, the different policy options, especially those concerning possible reform and restructuring of international institutions, should be evaluated as to whether and to what extent they are appropriate for addressing the most pressing environmental challenges in the context of environment and security.

This report identifies several gaps in existing knowledge that should be addressed in the Pilot Study on Environment and Security in an International Context. The questions to be addressed can be put into two distinct clusters. Cluster 1 would be science-oriented and would address methodological and concep-

tual problems as well as issues of data collection and availability, and the construction of appropriate indicators. Cluster 2 would build on the results of Cluster 1 by addressing policy-oriented questions of comparative threat assessments of different environmental issues as well as evaluating possible policy responses, particularly regarding international institutions. . . .

Cluster 1: Indicators and Data Collection

Cluster 1 on Indicators and Data Collection will deal in particular with the following topics:

Update existing lists of violent conflicts in which conflicts over natural resources and the environment played a major role.

Several lists of violent conflicts that were at least partly environmentally induced have been produced. None of them, however, appears to have been encompassing nor up to date. Thus, this step in the work program consists of compiling existing lists of environmentally induced conflicts and completing them with the latest research results on such conflicts.

Development of criteria for assessing the degree to which a conflict has been caused by environmental degradation and natural resource scarcities.

This task requires the identification of the major factors contributing to the emergence of violent conflict. Furthermore, a methodology for weighing the importance of the different causes of violent conflict needs to be developed.

Elaboration of criteria for assessing the security risks associated with environmental problems.

This analysis might include identifying the relevant variables and indicators that describe and explain the linkage between the environment and security. The possible causal chains leading from environmental problems to violent conflict need to be documented systematically and investigated in detail. Also, the structure of relevant framework conditions (e.g. economic, political, cultural) that either reinforce or mitigate the outbreak of violence should be identified.

Development of different categories of environmental problems according to the extent to which they are relevant to security.

Building on the previous step, this task may best be dealt with by developing taxonomies of (a) environmental stress, environmental risks to security and environmental threats to security; (b) attributes of environmental conflicts themselves; and (c) contextual factors more or less likely to help transform environmental problems into security threats.

Collection of data on a representative sample of environmental threats to security at different levels of conflict escalation.

This effort should start by exploring relevant existing data sources and determining gaps in data and should include cases that have not led to violent conflict. This will include collecting data systematically on the environmental problem in question, contextual factors, and attributes of the political conflict involved. The specific regions to be investigated will be defined in the course of the work. This data collection might best be done in case studies that are closely coordinated and use a common framework for analysis in order to facilitate comparison across cases. This common framework for analysis is yet to be elaborated.

Definition of indicators and reasonable thresholds of severity of environmental problems that indicate heightened danger of their causing or contributing to violent conflict.

The analysis should try to assess whether thresholds can be found that exist irrespective of framework conditions. In addition, constellations of contextual factors that reinforce or mitigate environmental threats to security should be identified and classified. This step will require integrating environmental and contextual factors. This might make it possible to determine certain context-specific thresholds of severity that indicate heightened danger of the outbreak of violence.

Definition of early warning indicators and ways of integrating relevant environmental factors into existing early warning systems.

Systems of indicators that are used to produce a timely warning in cases of a growing conflict threatening security exist, but need to include sophisticated environmental indicators. Thus, this task starts from developing such environmental indicators and integrating them into existing early warning systems.

Cluster 2: Evaluation of Environmental Threats to Security and Policy Responses

Cluster 2 on Evaluation of Environmental Threats to Security and Policy Responses will focus in particular on the following items:

Comparative threat assessment of major global and regional environmental problems in order to set priorities with regard to their security relevance.

The analysis has to draw on the work done in Cluster 1 and expand it. Relevant environmental problems might include climate change, depletion of the ozone layer, loss of biodiversity, desertification, deforestation, lack of water availability, and “classical” air pollution (SO₂, NO_x). It will have to take into account the current knowledge about the effects of the environmental problems under investigation as well as the structure and development of framework conditions in relevant regions.

Integrated threat assessment for the NATO region as well as for other regions particularly relevant to NATO.

Also drawing on the work done in Cluster 1, it is necessary to identify those regions particularly liable to become the location of violent conflict triggered by environmental problems. This step will be based on the comparative assessment of environmental issues which will allow one to identify those regions that will be most affected by the most severe environmental threats to security. In contrast to the previous step, this analysis will not focus on single environmental problems but will try to take into account the total amount of environmental stress to specific regions.

Developing a decision support system.

Based on the results of the work done in the context of Cluster 1, this task will include, *inter alia*, integrating early warning systems. Also, existing decision support systems that can provide meaningful support to policy-makers in the face of environmental threats to security may be evaluated and ways of integrating environmental considerations into these systems defined.

Evaluation of selected policy responses to environmental threats to security.

This assessment will focus on international organizations and international conventions (“regimes”). It might distinguish between different kinds of environmental degradation and resource scarcities. The evaluation should take into account the criteria for sustainable development as included, *inter alia*, in Agenda 21, and should encompass at least four steps: (1) taking stock of the existing system of institutions, (2) discussion and assessment of their effectiveness, (3) discussion and assessment of possible alternatives, and (4) judging all options discussed from the perspective of environment and security.

Elaboration of recommendations for improving and redesigning international institutions so as to effectively address environmental threats to security by supporting and strengthening sustainable development.

Recommendations for improving and redesigning international institutions for the environment will be based on the above evaluation and will generally flow from the work done in previous parts of the work programme.

ENDNOTES

¹ The Committee on the Challenges of Modern Society (CCMS). Acknowledgements: Laurie MacNamara and Brian Smith, Evidence Based Research, Inc., Vienna, Virginia Bertram Spector, Centre for Negotiation Analysis, Potomac, Maryland.

² <http://echs.ida.org/s05/biblio.html>

³ For the purposes of this report, we will thus distinguish “environmental degradation” (including “natural disasters”) from issues related to the scarcity and distribution of “natural resources.” Such scarcities may,

however, themselves be caused at least partially by environmental degradation. To refer to the aspects mentioned *in toto* we will use the term "environmental problem".

⁴ In the following discussion, we will avoid using the term "environmental security" of which, by now, no common definition has emerged. On the contrary, a variety of quite diverse understandings have been put forward. The alternatives range from defining "environmental security" as "the protection of armed forces from environmental threats" to a broader definition: basically the absence of severe environmental problems or, as the realization of sustainable development. Under these circumstances, instead of seeking to find a definition of environmental security that would suit everyone, it appears more fruitful to approach the issue of environment and security by differentiating analytically certain relationships between the two realms of environment and security in order to avoid confusion and to reach clarity on the subject to be investigated.

⁵ The environmental effects of the regular training activities of military forces in general and the pollution of military bases in particular have received increasing attention during recent years. This aspect of the relationship between the environment and security, however, is dealt with in the context of various defense-related CCMS Pilot Studies, e.g. the NATO/CCMS Pilot Studies on Environmental Management Systems, on Cross-border Environmental Problems Emanating from Defence-Related Installations and Activities, on Environmental Aspects of Reusing Former Military Lands, on Protection of Civil Populations from Toxic Materials Spills during Movements of Military Goods.

⁶ Declaration by the Secretary General of the UN Conference on Human Settlements Habitat II, Mr. Wally N'Dow, in New York on March 17, 1996.

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Task Force Reports on Environmental Change and Security

Dr. Richard A. Matthew

School of Foreign Service, Georgetown University

During the past three years the Environmental Change and Security Project has brought together representatives of the academic, policy, NGO and international communities to learn about and discuss a range of pressing issues of national and global importance.

In line with the general objectives of this Project, the following Task Force Reports provide overviews of three important issue areas: infectious disease, water scarcity in shared river basins, and military and intelligence activities. Due to space considerations, what follows are brief summaries of the original reports; the case studies in particular have been edited aggressively. In doing this, I have tried to provide an accurate sense of the general arguments advanced; I take responsibility for any omissions or distortions of these.

These Reports reflect an important commitment at Georgetown University's School of Foreign Service and, in fact, throughout the academic world to encourage research and education in the broad, interdisciplinary area of environmental policy. They have been prepared by individuals who, for the most part, have several years of relevant work experience and have returned to the academic world to spend two years in Georgetown's Master of Science in Foreign Service Program acquiring specific skills and knowledge that they will take back to the policy, NGO and private sectors in the United States and abroad. Research for these reports has involved extensive interviews and fieldwork, as well as published materials and internet sources.

Readers may recognize in these reports the influence of the pioneering work directed by Thomas Homer-Dixon at the University of Toronto over the past several years. Although these groups of researchers are not associated with any of Homer-Dixon's projects, they owe a large debt to the research he has directed. In particular, the analytical models developed in these reports reflect both relationships identified in the research conducted by each Task Force and those identified by Homer-Dixon and his co-authors.

Infectious Disease as a Global Security Threat

Task Force: Rohit Burman (Team Leader), Kelly Kirschner and Elissa McCarter

ABSTRACT

This report examines the resurgence of infectious diseases as a major threat to national and international security. Infectious diseases are the world's leading cause of death, killing at least 17 million people each year, most of whom are children, and the numbers only continue to increase. While developing countries are hit hardest, migration, the mass movement of millions of refugees, and increasing international air travel, trade, and tourism ensure that no country is safe from the spread of disease. More people in more countries are at risk of infectious diseases today than at any other time in human history. Diseases are threatening the young, working populations of many developing countries—which jeopardizes their social and economic stability and could have serious reverberations around the world. The United States is no exception, for it is seeing startling increases in tuberculosis nationwide and a continuing AIDS epidemic. Infectious disease is a global problem. It requires global action.

Despite the worldwide resurgence of infectious disease, there is still a lack of political will and resources to prevent disease outbreaks from occurring. This report attempts to underline how epidemics occur, what can be done to best prevent them, and who should take action. For illustrative purposes, the report uses three original case studies of the current AIDS epidemic in India, the tuberculosis crisis in South Africa, and the 1991 cholera epidemic in Peru. It is divided into several parts: 1) the variables which lead to a disease epidemic; 2) the variables which lead to a security threat; 3) the links between disease and security; 4) three specific situations where disease has threatened or is threatening a large population; and 5) policy recommendations to reduce the threat of infectious disease to national and international security.

Past experience shows that treatment-driven policies to combat disease are ineffective and more costly in the long run. Infectious disease must be stopped before it develops, meaning that prevention-driven policies

instead of “magic bullets” are the key to solving the disease problem. A prevention-driven policy includes action at international, national, and community levels to establish a foundation of community-based public health. Our findings show that the major contributors to disease epidemics are malnutrition, poor sanitation, poor hygiene, and lack of education; therefore any attempt to reduce the threat of infectious diseases must focus on improving living conditions and basic public health. We propose a disease prevention policy in which the central tenets are: education and awareness campaigns from the primary level onwards; empowering women and using indigenous skills to improve living conditions—this includes providing microcredit and initiating pilot projects in rural and urban communities alike; and utilizing private corporations, NGOs, national governments, and the international community for collaborative support and funding. Because neglect has jeopardized much of the progress achieved in the past decades towards improving human health, we must invest now in disease prevention to avoid even more serious consequences in the future.

INTRODUCTION

At the close of the 20th century, the world and the health of its citizens are under attack by the scourge of infectious disease. Despite the promises of modern medicine, disease and poor governmental policy are pushing many areas of the world to the brink of crisis. Infectious diseases kill over 17 million people a year, 9 million of whom are young children. Almost 50,000 men, women and children die every day from these diseases.¹ The microbes which cause the plagues transcend people, cultures, and borders within hours and the phenomenon is not isolated in the developing world; rather, it is a global menace that is a threat to all civilizations.

It is the obligation of all governments to meet and anticipate this threat by providing and protecting the safety and well-being of their citizens. To the extent that this obligation is not fulfilled, it is logical that dissatisfaction among people will grow towards their respective governments, leading to conflict and demands for change. This paper addresses three cases and demonstrates how they are all, indeed, menacing situations for national and global security. These cases are: AIDS in India, tuberculosis in South Africa, and Peru's cholera epidemic.

With the discovery of penicillin and other major pharmaceutical and medical innovations, public health officials long believed that the obliteration of viral, bacterial, and parasitic foes and the infectious diseases they cause was a goal within their reach. For a period, there was a general consensus that by the turn of the century we would achieve such a mastery over the major-

ity of infectious diseases that we could then devote our entire energies to research the intricacies of human genetics, cancer, and heart disease. Unfortunately, this overly optimistic sentiment rested on two false assumptions: that disease could be geographically isolated and that microbes were biologically unchanging organisms, which could be eliminated with the development of one drug.²

Today there is a much different, pessimistic outlook on the future of infectious disease. With the widespread introduction of AIDS in the late '70s and early-'80s, the public health community awoke to an incurable disease that, in a short period of time, was endemic to every country in the world. We have recently discovered how correct Charles Darwin was, as we are finding increasingly stronger, more resistant forms of bacteria and microbes that have arisen due to the uncontrolled and inappropriate use of antibiotics. Different strains of the hepatitis virus, herpes virus, tuberculosis, and cholera represent a few of these new and evolving diseases.

Used too often to treat the wrong kind of infections, with the wrong dosage and for incorrect periods of time, the antibiotics were sent to battle without the proper tools, giving the enemy time to evaluate its foe and regroup based upon that evaluation. Millions of dollars and years of work that were spent on the research and development of past antibiotics are ignored by mutating microbes, as they successfully find ways to continue their propagation. Pathogens' resistance to antibiotics improves and hence drugs grow obsolete. In addition, previously unknown infections are appearing in humans (29 new diseases since 1973) who are living or working amidst new or changing ecological conditions.³ These environments are exposing the individual to novel pathogens, as well as new and numerous animal and insect carriers. Poor hospitals and health facilities in the less developed world are also being used by these microbes as launching grounds into prospective hosts. These under-funded, unsanitary facilities often do more to disseminate diseases than control them.

Global warming brings with it a more conducive environment for the outbreak of mosquitoes, rodents, other insects, and ocean algae blooms, which bring with them different bacteria, protozoa, and viruses. At the same time, the increased warming can lead to changes in weather patterns, bringing periods of floods and drought which destroy crop yields, causing dramatic increases in starvation and malnutrition in the less developed world, thus weakening human resistance to disease.

Urbanization also enhances the presence of disease as a security threat today. In the next 20 years, nine of the top ten megacities will be in developing nations.⁴ This type of growth leads to the spread of urban slums and shantytowns. These areas usually do not have any

running water, electricity or any semblance of a sewage system. With immune systems that are already weakened by malnutrition and the overall poor sanitary conditions in which they live, people living in these areas are highly susceptible to being the hosts upon which new diseases prey. Overcrowding within the cities permits disease to spread rapidly. Rapid commerce, international air travel, and mass refugee movements all ensure that no country is safe from the spread of disease. With disease, risk is internationalized. Countries in the developing world are, at present, being hit the hardest. The economic losses from declining tourism and declining demand for possibly infected products disrupt fragile economies. This, along with the degradation of these countries' young, working populations, leads to economic and institutional breakdown. The risk is intensifying and in a global marketplace, its disturbing effects will be felt throughout the world.

Robert Kaplan's Hobbesian view of the world in the coming years is ominously taking shape in the global health arena. Items in the media, such as Kaplan's piece, "*The Coming Anarchy*," as well as calls from pop-culture, such as the recent movie, "*Outbreak*," and the best-selling novel by Richard Preston, *The Hot Zone*, all have attempted to frighten us into action by detailing specific infectious disease horrors of the day or through exploring "what-if" scenarios. This paper is not a continuation on that theme, but rather it is a sober reflection on three cases which unfortunately reflect this theme in today's world.

This paper begins with a discussion of a general model, detailing the variables which lead to the emergence of infectious diseases and how these diseases pose a threat to national and international security. This is followed by summaries of three case studies which depict three areas in the world where the interplay between disease and security is obvious and frightening. The current AIDS epidemic in India, the tuberculosis crisis in South Africa and the 1991 cholera epidemic in Peru, as an example of success, are presented as today's warning signals. We conclude by presenting a set of broad policy recommendations which address the common roots from which diseases spring. While these recommendations hold particular relevance to our three case studies, they are proposals which are applicable to all of the industrializing and industrialized world.

VARIABLES THAT BRING ABOUT DISEASES

There are numerous factors that bring about diseases. Many diseases share common factors whereas others are more unique with regard to their causes. However, there are certain variables that do contribute to the emergence of most infectious diseases. According to the Centers for Disease Control and the World Health Organization these variables can be divided into

three broad categories: social variables (such as education, lack of adequate health care facilities, cultural barriers); demographic variables (such as urbanization, population growth, migration, human travel); and environmental variables (such as sanitation, disruption of the ecosystem, access to clean water and safe food, drug resistance, new viruses).

SOCIAL VARIABLES

The lack of education about infectious diseases has been a primary factor that has led to the reemergence and explosion of infectious diseases around the world, especially in developing nations. A large percentage of the population in the world remains unaware and uneducated about the threat of infectious disease and methods of prevention. Low-income families do not have the resources to educate and protect their children. Moreover, schools often do not have any education seminars or programs on infectious diseases. The result is that people remain unaware of infectious diseases or in cases where they do hear about them, the information available is not accurate and no prevention methods are highlighted. Secondly, the lack of education coupled with cultural barriers often leads to the emergence of a disease. For example, in India, cultural barriers with regard to talking openly about sex have contributed to the AIDS epidemic. This is highlighted in the case study on AIDS in India.

Additionally, the lack of adequate health care facilities has proved to be a major obstacle in containing the explosion of infectious diseases in much of the world. Hospitals and health care centers in many developing countries do not have the facilities necessary to perform tests and treat infected patients. In many areas the number of clinics and hospitals is not enough to support the needs of the infected population. Furthermore, doctors and nurses are not trained or equipped to deal with many of the diseases. Until the necessary training and infrastructure are developed, infectious diseases are likely to perpetuate high mortality rates around the world. Currently, infectious diseases remain the leading cause of death worldwide. Of about 52 million deaths from all causes in 1995, more than 17 million were due to infectious diseases.⁵

DEMOGRAPHIC VARIABLES

Population growth has played a major role in the spread of infectious diseases. Population expansion raises the statistical probability that a pathogen will be transmitted, whether from person to person or from vector (insect or rodent) to person.⁶ Population density is rising worldwide. The population density exceeds 2,000 people per square mile in seven countries, and 43 countries have density greater than 500 people per square mile.⁷ If housing, public health provisions,

and sewage and water systems are adequate then a high population density may not doom a nation to epidemics. However, most of the areas where density is increasing today are not capable of providing such infrastructural support, and therefore have provided the perfect ground for the spread of infectious diseases.

Rural to urban migrations have also contributed to the rapid spread of infectious diseases. A large number of people from villages migrate to urban centers in search of better jobs. These centers of urbanization have become jammed together and typically lack sewage systems, housing, safe drinking water, medical facilities, and schools to support the burgeoning population. Close physical proximity leads to an astronomical increase in the transmission of infectious diseases that are airborne, waterborne, sexually transmitted, and transmitted by contact. Moreover, urbanization and globalization propel radical changes in human behavior as well as in the ecological relationship between microbes and humans. Often in large cities, sex industries rise and multiple-partner sex becomes common. Access to antimicrobials via the black market is common in urban areas, which leads to overuse of precious drugs and the emergence of resistant bacteria and parasites. Furthermore, intravenous drug users' sharing of syringes also provides a mechanism for the transmission of microbes.⁸ Thus, urban centers have become centers for dissemination of disease rather than control.

Human travel has also contributed to the spread

of infectious diseases to the remotest parts of the world. With travel in the jet age, a virus that originates in Burkina Faso can reach Australia within a day. Passengers flying from Japan to Uganda leave the country with the world's highest life expectancy—almost 79 years—and land in one with the world's lowest—barely 42 years. A flight between France and Ivory Coast takes only a few hours, but it spans almost 26 years of life expectancy.⁹

ENVIRONMENTAL VARIABLES

Environmental variables such as poor sanitation, disruption of the ecosystem and limited access to clean water and safe food have played a major role in the emergence of infectious diseases. Many infectious diseases such as malaria, cholera, and tuberculosis emerge or are exacerbated due to poor sanitation facilities. The lack of sanitation provides a breeding ground for germs. In many developing regions people do not have access to safe food and clean water, and this has led to a significant increase in infectious diseases.

Drug-resistant strains of microbes are having a deadly impact on the fight against infectious diseases, especially tuberculosis, malaria, cholera, diarrhea and pneumonia—major diseases that killed more than 10 million people in 1995.¹⁰ Some bacteria are resistant to as many as 10 different drugs. Thus, diseases previously under control are re-emerging at an alarming rate. Moreover, new viruses have also contributed to the

Table 1 Major Diseases that have Emerged in the last two Decades

(Source: World Health Organization, "Infectious Diseases Kill Over 17 Million People a Year," <http://www.who.ch/whr/1996/press1.htm>)

New Diseases

Some of the causative agents, and diseases associated with them, include in chronological order of their identification:

1973	Rotavirus, a major cause of infantile diarrhoea worldwide
1976	<i>Cryptosporidium parvum</i> , a parasite which causes acute and chronic diarrhoea
1977	<i>Legionella pneumophila</i> , the bacterium which causes potentially fatal Legionnaires' disease
1977	Ebola virus, which causes haemorrhagic fever—fatal in up to 80% of cases
1977	Hantaan virus, which causes potentially fatal haemorrhagic fever with renal syndrome
1977	<i>Campylobacter jejuni</i> , a bacterium which causes diarrhoea
1980	Human T-lymphotropic virus I (HTLV-1), which causes lymphoma-leukaemia
1982	<i>Escherichia coli</i> 0157:H7 strain of bacteria, which causes bloody diarrhoea
1982	HTLV-2 virus, which causes hairy cell leukaemia
1983	<i>Helicobacter pylori</i> , the bacterium associated with peptic ulcer disease and stomach cancer
1983	Human immunodeficiency virus (HIV), which causes AIDS
1988	Human herpesvirus 6, which causes fever and rash
1989	Hepatitis C virus, which causes liver cancer as well as liver disease
1991	Guanarito virus, which causes Venezuelan haemorrhagic fever
1992	<i>Vibrio cholerae</i> 0139, which causes epidemic cholera
1994	Sabia virus, which causes Brazilian haemorrhagic fever
1995	Human herpesvirus 8, associated with Kaposi's sarcoma in AIDS patients

spread of infectious diseases. Table 1 lists some of the new diseases that have emerged in the past two decades.¹¹

Finally, resource depletion and degradation have led to the spread of infectious disease. Our societal needs are constantly increasing, especially with the growth in population, but we are faced with limited resources. This, has resulted in scarcity of food, limited access to clean water, and a surge in pollution levels. Malnutrition in particular greatly weakens the immune system, which leaves people vulnerable to disease and infection. All of these factors have interacted to facilitate the emergence of disease.

VARIABLES THAT AFFECT THE STABILITY OF THE INSTITUTIONAL STRUCTURE

The United States Central Intelligence Agency and academics such as Thomas F. Homer-Dixon, Ted Gurr, and Nadir A.L. Mohammed have identified several key factors that affect the stability of the social and economic system in a country. These are: population pressures; poverty; ethnic tensions and social strife; and economic and political crises. In the case of infectious diseases, resource depletion and degradation, mortality, and health care costs also affect the stability of social and institutional structures.

POPULATION PRESSURES

According to Homer-Dixon, population pressures are a key factor which affect the stability of social and economic systems. The population in developing regions of the world has been increasing at an alarming rate. Currently, approximately 75% of the world's population lives in these regions.¹² This has resulted in a fierce competition for resources. Population pressures on a nation's resource base results in people migrating to areas where resources are still not fully exploited. In many cases, this leads to rivalries between groups and regions as people indigenous to a region find migrants encroaching on their land and exploiting their resource base. The cumulative effect of these pressures and rivalries is that the stability of social and economic systems is challenged.

ETHNIC TENSIONS AND SOCIAL STRIFE

A second factor that affects the stability of the social and institutional structure is ethnic tensions and social strife, according to Ted Gurr.¹³ We live in a world that is culturally and ethnically diverse. Each state, and often regions within a state, has its own distinctive culture and language. However, not all groups are tolerant of diversity and this has often led to ethnic tensions and social strife within a state or between states. With the current increase in population and mi-

gration there is likely to be an increase in ethnic tensions as the interests of different groups come into conflict due to greater interaction and competition for limited resources. Therefore, increased ethnic tensions could lead to a breakdown of social and institutional structures.

POVERTY

Poverty is another important factor that can lead to social and institutional collapse in a country.¹⁴ The majority of the population of the developing world lives in poverty. These people do not have access to proper shelter, safe food and water, and health care facilities. Resentment and frustration permeate societies in which the majority of individuals are deprived of basic human needs. This resentment and frustration is often expressed through violent acts, especially if the individuals have access to arms. Many countries in South Asia, parts of Africa, and Latin America have seen a surge in violence in recent years, an increase in the number of strikes, and a growing resentment against institutions which are apathetic to the condition of the majority of the population.

MORBIDITY AND MORTALITY

John Cuddington, an economist at Georgetown University, has shown that morbidity and mortality affect the social and economic growth of a country. The rise in morbidity has two immediate effects: it reduces labor productivity and increases spending on health care.¹⁵ The worst case scenario for the social and economic structure of a country would be a dramatic drop in the life expectancy of its people. Not only does this reduce the working age population dramatically, it also puts a strain on the economy. As more money is spent on health care due to illnesses, the resources of individuals and society at large are drained. This affects the economic growth of a country and threatens the stability of its economic institutions, as it may need to borrow from other countries and international institutions to provide for the health care needs of citizens.

ECONOMIC AND POLITICAL CRISES

Nadir A.L. Mohammed and others have argued that economic and political crises are major factors that affect the stability of social and economic structures.¹⁶ When a country is faced with an economic crisis such as hyper-inflation, currency devaluation, and deficit or debt, the economic security of its citizens is challenged. Moreover, in situations of political crisis such as revolts against the government, government shutdown or corruption in the government, the safety net that a government provides for its citizens may no longer hold. Under these circumstances a country could be faced with collapse of its social and economic system.

INSERT FIGURE 1.1**RESOURCE DEPLETION AND DEGRADATION**

Finally, resource depletion and degradation not only lead to the spread of infectious diseases, but also pose a security threat to the stability of the social and economic systems. This is supported by Robert Kaplan and Homer-Dixon. Kaplan asserts that environmental degradation will be *the* national security issue of the 21st century.¹⁷ With the expanding needs of our society, the resources that we have are being drained. Resource depletion and degradation are severe problems in many countries of the developing as well as developed world, largely because of the surge in population growth. If sustainable practices are not undertaken and population growth remains unchecked, it may not be long before our resource base is exhausted. Already, urban centers across the developing world are faced with scarcity of food, lack of clean water, and record pollution levels. These problems are gradually moving into the rural areas. Thus, the intense competition for limited resources and degradation and depletion of environmental resources in order to maximize individual benefits present a serious challenge to the stability of our social and economic systems.

THE LINK BETWEEN DISEASE AND SECURITY

Infectious diseases may be an increasingly significant variable that puts pressure on the security variables and thus threatens the stability of social and economic structures. Figure 1.1 provides a model of these relationships. First, an increase in population coupled

with an increase in infectious diseases will result in the spread of these diseases to all corners of the world. Population expansion raises the statistical probability that pathogens will be transmitted.¹⁸ Hence, as population increases more people are likely to be exposed to microbes. Moreover, with population expansion comes migration, and as people who are infected travel to different regions, they are likely to transmit diseases to others. Every day one million people cross an international border. In 1994 at least 110 million people immigrated, another 30 million moved from rural to urban areas within their own country, and 23 million were displaced by war or social unrest.¹⁹ Most people move to urban metropolises. The United Nations estimates that urban populations will continue to soar and that five billion people, or 61 percent of humanity, will be living in cities by 2025.²⁰ These new centers of urbanization typically lack sewage systems, housing, safe drinking water, medical facilities, and schools to support the ever increasing population. Such conditions will only increase the transmission of infectious diseases.

Infectious diseases often strike the poor hardest, since they have limited access to health care, safe water, and food. As infectious diseases spread more among the poorer people in the world, the productivity of a large segment of the population is likely to drop. These individuals may already feel deprived and harbor resentment for the status quo. Poverty coupled with disease increases the marginalization of these individuals, which in turn could increase their feeling of resentment against society. Moreover, a growing number of

people means a growing need for treatment and health care. Thus, the social and economic structures in regions where a large percentage of the population is poor, uneducated, and suffering with disease are likely to be under severe strain.

The explosion of infectious diseases diverts national resources from education and infrastructure investment to health care for individuals who are infected. Analysts at McGraw Hill estimate that over the next six years Asian countries will spend between \$38 and \$52 billion on health care for AIDS patients.²¹ The Centers for Disease Control (CDC) states that infectious diseases in the United States increasingly threaten public health and contribute significantly to the escalating costs of health care.²² Many regions of the world are in dire need of investment in education and infrastructure; therefore increased expenditure on health care is likely to exert pressure on the social and economic system.

Infectious diseases can also exacerbate social tensions in society. In the case of AIDS, individuals infected with HIV are often stigmatized and looked upon as evil. Many individuals believe that AIDS is a way for god to punish the evil. Thus, the lack of awareness about AIDS and other infectious diseases generates numerous myths and misconceptions which results in people afflicted with the disease being considered as social outcasts. A clear line is drawn between those suffering with disease and those who remain uninfected. Therefore, infectious diseases could potentially exacerbate social tensions and hence affect the stability of the social structure.

Finally, infectious diseases increase the mortality rate, which in turn affects the social and economic system. Life expectancy is already expected to drop dramatically in Africa and India over the next decade if AIDS and TB continue to spread unchecked. By reducing life expectancy and increasing mortality, diseases present a threat to the economic growth of countries, as a large percentage of the working-age population will no longer be able to work or will have succumbed to the disease.

The above account illustrates the potential threat that infectious diseases present to the social and economic system of countries and to the international system. It is evident that special attention at both the national and international level is required to combat the spread of infectious diseases and the security threat it poses to our society. Within this context, the following summaries of three case studies illustrate how infectious diseases can pose a threat to national and international security.²³

CASE STUDY SUMMARY: AIDS IN INDIA

INTRODUCTION

AIDS represents a serious but underestimated and

neglected health problem in India. Around 1.6 million people in India are now estimated to be infected with HIV. Current research indicates that India will have the unfortunate distinction of being the HIV capital of Asia, with 4 million cumulative infections by the year 2000. AIDS poses a major security threat to the stability of the social and economic system in India.²⁴

The purpose of this case study is to examine what has led to the rapid growth of AIDS in India and the security threat it presents to the stability of the country's social and economic system. The effect of HIV/AIDS in the social, political, and ecological realms is elucidated via a formal model. Moreover, recommendations for policy makers and health officials are made, based on the research done, to counteract the increasing threat that HIV/AIDS presents to the region and the world.

HIV/AIDS IN INDIA

India is now at the epicenter of AIDS in Asia, with the maximum number of cases having been reported in Bombay. The number of HIV positive and AIDS cases recorded in Bombay in 1995 were 7,000 and 1,200 respectively. The estimated number of HIV positive cases in Bombay increased from 150,000 in 1994 to 200,000 in 1995, and the estimated number of AIDS cases in Bombay increased from 15,000 to 20,000 during the same time period.²⁵ According to estimates from the Indian Health Organization (IHO) around 65 percent of the 70,000 prostitutes in Bombay have tested positive for the HIV virus. The IHO estimates that there are currently 4 million cases of HIV in India and that figure could reach 15 to 20 million by the end of the century.²⁶ It is clear that India is faced with an AIDS crisis. There are a number of factors that have led to the rapid emergence of AIDS in India.

VARIABLES THAT HAVE LED TO THE EMERGENCE OF HIV/AIDS

The main factors that have caused an explosion in the number of HIV/AIDS cases in India fall within the broad categories of demographic, social and environmental variables. These factors are: (1) Education; (2) Cultural barriers; (3) Sexual Contact; (4) Blood transfusions; (5) Intravenous drugs; (6) Childbirth and breast-feeding; (7) Rural to urban migration; and (8) Lack of adequate health care facilities.

VARIABLES AFFECTING THE SOCIAL AND ECONOMIC STRUCTURE

The variables that affect the stability of the social and economic structure in India are the same as those outlined in the general model. These are: (1) Population pressures; (2) Ethnic tensions and social strife; (3) Poverty; (4) High mortality, which effects the labor force

and increases expenditure on health care; (5) Economic and political crises; and (6) Resource depletion and degradation.

THE RELATIONSHIP BETWEEN HIV/AIDS AND SOCIAL AND ECONOMIC STABILITY

This section examines how HIV/AIDS threatens the security of the social and economic structure in India by either affecting the variables that impact the stability of the social and economic system or by acting directly on the system. Thus, the relationships between the variables that have brought about the AIDS epidemic in India, their impact on the disease, and in turn the effect of the disease on the stability of the nation are elucidated.

AIDS is not only a threat to India but also to the region and the international system at large. With ever increasing globalization, diseases that originate in one country or region can reach the farthest corners within a matter of hours. With global travel and migrations, a disease like AIDS can be easily transmitted to individuals in other countries. Thus, if the AIDS explosion continues in India, the security of the international system and developed countries is likely to be threatened. AIDS requires special attention at both the national and international level.

POLICY RECOMMENDATIONS

No single HIV/AIDS prevention strategy is likely to be effective on its own. Instead what is needed is a combination of strategies, backed by resources to stem the spread of AIDS. Among the key strategies to control AIDS in India is education. Without substantial political commitment, leadership, and resources HIV/AIDS will not only be a health disaster, but also a development disaster in India.

If governments, corporations, NGOs, and international organizations can come together and work effectively there is hope that the threat that AIDS poses to India, and world society, can be substantially reduced. While researchers look for medical solutions and health care professionals cope with the treatment for those already infected, the general public and policy makers can facilitate HIV prevention through education and information. We cannot and do not need to wait for scientific breakthroughs. We must act now.

CONCLUSIONS

The key points that emerged from this study are: AIDS is problem that has reached critical dimensions in India; if the spread of AIDS continues unchecked there is likely to be a breakdown of the social and economic system in India; enhanced cooperation is essential among policy makers at all levels and among gov-

ernments, NGOs, corporations, and international institutions to counteract the spread of AIDS; and that resources need to be directed towards prevention and control of the spread of AIDS.

CASE STUDY SUMMARY: TUBERCULOSIS IN SOUTH AFRICA

In 1993 the World Health Organization declared a "global tuberculosis emergency," hoping to draw attention to the increasing severity of the TB epidemic. This warning went unheeded; three years later, WHO's 1996 report concludes that TB now affects more populations in more countries than at any other time in history. TB kills three million people each year, and as many as 1.9 billion people—one third of the world's population—may be infected with TB. TB is now the leading killer of women and of HIV-positive individuals. It is the biggest single infectious cause of adult deaths worldwide.²⁷

Tuberculosis is an air-borne disease caused by the bacillus *Mycobacterium tuberculosis*, which attacks the lungs 85 percent of the time. TB bacteria destroy living lung tissue, causing blood vessels to rupture and blood to collect in the lung cavities. If left untreated, TB sufferers will die by asphyxiation—literally drowning in their own blood.²⁸ Once TB bacteria infect a person, most healthy immune systems can keep them in a state of dormancy. In fact, only five to ten percent of people infected actually become sick with active TB.²⁹ This emphasizes the importance of nutrition, lifestyle, and other factors that contribute to a strong immune system, since a person cannot pass the disease to someone else if he/she does not develop active TB.

Until recently, there has been a steady decrease in TB mortality rates in industrialized nations. Reliable evidence shows that this decrease had begun before the discovery and implementation of anti-TB chemotherapy in 1945, suggesting that the decline of TB was due to improved nutrition, behavioral changes, and overall better living conditions rather than to the impact of medical treatment.³⁰ But recent statistics show that tuberculosis is on the rise again in industrialized countries. For example, from 1985 to 1993, the number of cases in the United States increased 14 percent. Increases have been reported in Denmark, Holland, Norway, Switzerland, Italy, Spain, and Portugal; and TB is rising rapidly in Eastern Europe and the former Soviet Union. In developing nations, TB rates are highest in parts of southeast Asia and Africa. Of the estimated 1.9 billion people infected with TB today, 95 percent are in the developing world.³¹

In June 1996, WHO announced that South Africa had the worst known TB problem in the world, with the highest documented infection rate of 350 cases per 100,000 population. The variables which have contributed to the TB crisis in South Africa are primarily popu-

lation growth, migration, urbanization, malnutrition, poor education and hygiene, poor health care, drug resistance, and the HIV/AIDS epidemic. The two latter variables deserve special attention: Multidrug-resistant tuberculosis (MDR-TB) arises when doctors or health workers prescribe the wrong drugs, wrong combination of drugs, or if anti-TB drugs are not taken for the complete duration of treatment. Recent outbreaks of multi-drug resistant TB have occurred in New York City, London, Milan, India, Thailand, South Africa, Estonia, and Pakistan. Although exact numbers of MDR strains of TB are unknown, WHO estimates that 50 million people are already infected with MDR-TB.³² The other variable which exacerbates the TB crisis is AIDS. WHO estimates that approximately 5.6 million people are co-infected with HIV and TB.³³ An HIV-positive individual is 30 times more likely to develop active TB. With both population explosion and the HIV epidemic in sub-Saharan Africa, the annual number of TB incident cases is expected to more than double from 1990 to 2000.³⁴

Tuberculosis puts great strains on the social and economic structures in South Africa. The most serious consequence of a TB epidemic is its financial burden on the country. TB hits the most productive sector of South Africa's population—people between the ages of 18-45. UN Food and Agriculture Organization has estimated that by the year 2010, Africa's labor force could be reduced by 25 percent.³⁵ A shrinking labor force will severely limit South Africa's ability to service its huge national debt, to maintain a stable currency, and to support the rising cost of labor. In a country which has a tendency toward violent outbreaks and civil unrest for political reasons, economic hardship only fuels popular discontent.

Clearly, tuberculosis poses a threat to the security of South Africa. It is also a threat to other countries—even in the industrialized world. The unprecedented resurgence of TB in the United States during the 1980s and early 1990s illustrates the threat of TB to industrialized nations: From 1985 to 1992, TB cases increased as much as 30 percent in some parts of the U.S.—namely New York, New Jersey, and Florida. An alarming outbreak of TB occurred in New York City during the late 1980s which caught health workers unprepared to deal with the crisis. As a result of neglect to public health systems in New York, the prevalence of HIV, and the inability of health workers to enforce completion of treatment programs, up to one million New Yorkers may now be infected with the TB bacillus.³⁶ Other outbreaks of drug-resistant TB have occurred in Florida and New Jersey, and increasing evidence indicates that drug resistance is on the rise nationwide.³⁷

The experience with TB outbreaks in New York City along with the lessons of rising TB in South Africa show that treatment-driven control programs as opposed to prevention-driven programs are more costly and inef-

fective in the long run. Especially in light of TB-HIV/AIDS coinfection, real prevention means building up immune systems and awareness of both TB and AIDS to prevent active TB—rather than curing TB after it has developed. An effective policy starts at the community level and targets the conditions which allow TB to develop and spread. A community-based public health campaign requires a collaborative effort between the international community and national governments, under the direction of indigenous experts and involving members of the local population, particularly women, who are key to ensuring proper public health. Addressing the global problem of TB means looking at individual needs. Nutrition, sanitation, and proper hygiene are therefore key to building healthy immune systems and reducing the risk of TB.

In conclusion, TB is a danger to all nations, not simply in the developing world where it is currently most prevalent. With open trading policies and the intertwining of global markets, economic instability caused by a TB epidemic in one country could have repercussions on the world at large. The presence of HIV in all regions of the world make nations doubly susceptible to a tuberculosis epidemic, and the emergence of MDR-TB jeopardizes even the most advanced nations' ability to cure TB. The battle against TB will tilt in our favor only when we alleviate the conditions in our environment which invite disease and allow it to spread.

CASE STUDY SUMMARY: CHOLERA IN PERU

In late January of 1991, cholera was re-introduced to Peru and Latin America for the first time in 90 years. Within months, Peru faced a spreading "medieval plague" that had accounted for more than 160,000 cases and over 1,500 deaths. Health-watch groups converged on Peru, as the world's health community feared that the disease would become endemic and spread throughout the entire hemisphere within one year. Many experts believed that by 1992 the number of cases in the hemisphere would reach 6 million, with a possible 40,000 deaths.³⁸

Peruvian exports of fish, fruit, and other horticultural products were virtually shut down. Tourism to Peru, as well as its neighboring countries in South America, was relegated to a slow crawl. In 1991 alone, economic losses were estimated at \$1 billion, equivalent to almost half of Peru's 1989 export earnings. Peru's economy had been in a severe crisis from the beginning of 1982 and this plague could not have hit the nation at a worse time. Social expenditures on health, education, housing, and employment had been reduced tremendously—in 1990, social spending was equivalent to only 28% of 1980 levels, as the nation tried to come to terms with the strict macro-stabilization policies of the World Bank and International Monetary Fund (IMF). A 1991 Standard of Living Survey found

that 21.7% of the total population was living in *extreme* poverty (total per capita expenditure below the per capita cost of the basic food basket), while a frightening 53.7% of the population was in a state of *critical* poverty (total per capita expenditure below the basic shopping basket, including food and nonfood items).³⁹

During the same period, Peru was facing a political upheaval with the entrance of newly elected president Alberto Fujimori, as well as sustained fighting and terrorist attacks from the Maoist guerrilla group, Sendero Luminoso (Shining Path). There is a sharp divide between Peru's rich and poor, not to mention the systematic racism experienced by the nation's indigenous peoples. The introduction of cholera at this period was a very heavy straw to be placing on an already burdened camel's back.

This case study examines how Peru persevered in the face of this terrible epidemic which raged through most of the country in 1991 and 1992. The menace of cholera, seen at this time in Peru's history, was a definite security threat. The national economy, in terms of internal and external consumption of Peruvian agri/aquacultural goods; Peru's national workforce; the health care system; urban/rural sanitation and drinking water; and continued depression of Peru's poor were all variables upon which this epidemic put an added strain. Nonetheless, the disease was contained and violence and chaos did not encroach further into Peru. The case study provides the Task Force Report with analysis of a disease and region where all indicators seemingly pointed to a security crisis, but through rapid and efficient recognition and response to the disease, the problem was solved. It also analyzes the roots of this disease. It is these roots, that are much like those of the other two case studies in this report, that, in many ways, continue to lie dormant in Peru's social soil. As the other cases demonstrate, it is these roots which are present throughout much of the developing world. Cholera, tuberculosis, AIDS, and other infectious diseases are leading the global community into a more difficult age. These diseases are the manifestations of the ill-health of society and its environment, and the cholera epidemic in Peru is only one example of this.

The economic, social and political setting in Peru in late January of 1991 was highly conducive to the rapid expansion of a cholera epidemic. Kaplan's Dark Ages' scenario was unfolding in Peru in 1991, with all of the warning signs for an imminent security crisis: extreme poverty, large proportion of youth relative to total population, and rapid urbanization, coupled with a disease epidemic. The next phase of collapse and

violent conflict seemed imminent.

Demographic, social and environmental variables led to the outbreak of cholera in Peru. In turn, cholera exacerbated the variables which led to its emergence and placed a tremendous pressure on the economic, political and ethnic variables affecting national and international security. Specifically, cholera intensified Peru's economic and political crisis; forced health care costs to skyrocket; led to greater unemployment and, therefore, greater levels of poverty; exacerbated

We are standing on the brink of a global crisis in infectious diseases. No country is safe from them. No country can any longer afford to ignore their threat

Dr. Hiroshi Makajima, World Health Organization,
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ethnic tensions and heightened the possibility of armed resistance with the support of legions of sick, impoverished, indigenous people; hit Peru's urban slums and spread rapidly, creating greater population displacement pressures, while widening the gulf between rich and poor; and finally, offered the illegal drug industry further prospective employees—disgruntled citizens who were desperately seeking a reliable source of income.

Through competent domestic leadership in the Peruvian Ministry of Health (MOH), the assistance of domestic NGOs and community-based organizations, and the effective use of international health diplomacy in garnering support from international organizations (IOs), neighboring and developed countries, Peru was able to quickly address the disease and bring it under control. Beyond this, it was able to bring direly needed international attention to Peru, which helped push the nation back into a positive direction.

The individual response at a grass-roots level in Peru was also very impressive. In urban shanty-towns and rural villages alike, health, women's, and neighborhood committees were formed in response to the epidemic, and also in response to the nation's dire economic state and wide-spread infiltration of drugs. These committees independently assisted Peru in educating the public and aiding the MOH in areas where insufficient funds did not allow them to go. In areas which could have been hot-beds for rebel insurrection and recruitment, the people chose rather to opt for their health and stability.

By April of 1991, the UN Disaster Relief Organization reported total assistance at \$5.5 million, with 21 governments and the EU donating more than \$4.5 million; the Pan American Health Organization (PAHO), UNICEF, and the Inter-American Development Bank provided more than \$1.5 million; while 15 NGOs had given nearly \$1 million.⁴⁰ The United States view that the cholera epidemic was indeed a security threat is evidenced by the convening of a Congressional hearing on the epidemic on May 1, 1991. Following that

hearing, continued aid flows rushed into Peru through the auspices of USAID, the CDC, and federally supported NGOs such as Catholic Relief Services and CARE. Bilateral treaties with Brazil also provided Peru with more funds, as well as more surveillance powers for the isolated Amazonian region. By August of 1991, a senior UN administrator officially declared that the spread of cholera had been controlled within Peru.

Peace was maintained and Peru has emerged from the crisis in a state that is, in many ways, better than when the disease had struck. In an interview with Dr. Julio Sotelo, national president of the Peruvian-American Medical Society, he mused in retrospect, "I don't know the reasons, but a country devastated by terrorism, hyperinflation and lacking the appropriate infrastructure, could not have done better [in addressing the crisis]."⁴¹ As an example to other developing nations and the developed world at large, the Peruvian cholera epidemic serves as an instance of success which should be re-examined for future global crises and which, as a still-fragile, developing nation, should not be forgotten as quickly as it was recognized. At the same time, it is important to note that many of the underlying conditions that enabled the epidemic remain. Until these are addressed, Peru remains especially vulnerable to the threat of infectious disease.

GENERAL POLICY RECOMMENDATIONS: LINKING THE CASE STUDIES

No one policy can pertain to every type of infectious disease, each disease having its own particular characteristics and requiring a particular set of solutions. However, the three case studies we have summarized above share a similar focus for policy recommendations. That focus is on prevention instead of treatment, and lies in the socioeconomic roots of the emergence of all three diseases. There are, however, three general approaches one could take to reduce the security threat which disease epidemics pose to a particular nation or region. These are: (1) a demographic approach, (2) a clinical approach, and (3) a socioeconomic approach.

A DEMOGRAPHIC APPROACH

A demographic approach includes border controls, immigration limits, and population controls. Border controls, for example, aim to keep disease out by preventing infected people from coming into a particular area. This is currently the strategy used by Russia to limit the spread of HIV—strict border controls to keep out HIV-infected people. But this method can prove difficult to implement, is politically controversial, and is ineffective in diminishing the prevalence of disease elsewhere. All three diseases in this study have certain incubation periods, and it is often impossible to

detect if a person is infected, especially if he or she shows no symptoms whatsoever. Border controls require extensive, high-tech screenings and tests to effectively detect disease-infected individuals.

Limiting immigration does not fully address the problem either. While it could help reduce the incidence rate in one country as opposed to another, tightening immigration laws does nothing to prevent the disease from escalating elsewhere and causing indirect economic consequences. Controlling population growth through family planning programs could significantly alleviate the population pressures which put stress on already overcrowded cities which breed diseases. But experience shows that contraceptive programs face huge barriers due to social and cultural traditions of large families and the importance of having many children. While family planning is desirable in the long run, it is an indirect action to combat disease and does not guarantee results. Thus, a demographic approach would be not only expensive, but also difficult to implement and most likely ineffective.

A CLINICAL APPROACH

A clinical approach to reducing the threat of infectious disease relies on the use of science and technology—it is a treatment-based approach. For diseases that have a cure, like tuberculosis, effective treatment is possible when all the necessary resources and infrastructure are present to ensure that a disease-infected person is completely cured. For most developing countries, a well-managed health system does not exist, and resources are severely limited when large debts already burden their struggling economies. The cases of both TB and cholera prove the danger of ineffective treatment resulting from poorly-managed health care systems. The appearance of drug resistant strains of TB, cholera, and several other diseases today threaten to undermine even good health programs. A clinical approach ignores the lessons of history—the fact that the decline of infectious diseases at the turn of the century began before drugs were discovered. While medicine and technology helped speed up and reinforce the decline, they were not the reasons for the decline as many had assumed. The fact is, we cannot be overly optimistic about the capabilities of science and technology, because in many cases the microbes outsmart us.

The United States has recently proposed an "Inter-agency Task Force" which would mobilize several U.S. agencies—the Centers for Disease Control, the Department of Energy, the Federal Drug Administration, the Department of Defense, and others—to "help build an international network for infectious disease surveillance and response."⁴² The Task Force would provide a mandate for U.S. agencies to coordinate communication networks to detect disease and to mobilize a concerted response when outbreaks occur. While it re-

mains to be seen if the proposal for a disease Task Force will actually be put into practice—since it is still in its infancy stage—it could serve as an effective tool to help prevent the spread of infectious diseases to the U.S. and to other countries as well. But even this does not address the heart of the problem. Surveillance and response teams are not unimportant; the problem is that they are still reactive methods of dealing with disease. The root of the disease crisis stems from the conditions, or the disease variables in our model, which allow it to develop and which perpetuate its spread.

The lessons of AIDS, tuberculosis, and cholera stress the importance of prevention-driven health policies in light of the relationship between environmental conditions and epidemics. The term “environmental conditions” refers to the general surroundings in which a person lives, involving such things as access to food, water, housing, sanitation facilities, education, and general public health. A third approach then, and we believe the most effective one, is a socioeconomic approach which deals with the conditions that allow disease to spread and develop.

A SOCIOECONOMIC APPROACH

An effective socioeconomic policy to combat disease must look at individual needs and should target the community level. Because infectious disease is a global problem, this requires the involvement of a variety of actors at all levels—international, national, and community levels. In this way a concerted effort and combination of strategies together can fight to prevent disease before it has a chance to become a security threat. These strategies include education, improved living conditions, and community-based public health.

EDUCATION

First, a key element in the prevention of all infectious diseases, especially in the case of HIV/AIDS, is improved education and awareness of disease. This includes disease awareness programs from primary school onwards and practical health training for mothers and youth alike. Here, non-governmental organizations (NGOs) can play a key role. NGOs can provide training in areas that governments find difficult to deal with—such as promoting the use of condoms or discussing issues related to sexual behavior. Because they often involve volunteer action, NGOs can be more dedicated, flexible, and cost-effective as executing agencies. They also provide a voice for those who otherwise might not be heard, and can bring local concerns to the attention of national and international audiences. Indigenous organizations and local volunteers who identify with a particular cultural community can provide an important liaison between education efforts and the local population.

EMPOWERING WOMEN

Attention should be directed most to women, since throughout the developing world women are the ones who nourish their families, collect water and firewood, and clean and maintain their homes. Ingar Brueggemann, Secretary General of International Planned Parenthood Federation, states that women provide “more health care than all organized health services put together.”⁴³

IMPROVED LIVING CONDITIONS

Alleviating the poor living conditions from which most developing populations suffer is crucial to disease prevention. Overcrowding, poor sanitation, malnutrition—all of these create the perfect environment for endemic disease. Here, a government policy committed to increasing employment, securing access to education and training, and giving the poorest members of society access to land and credit will integrate the poor into both the economy and the community. Community-based training programs, sponsored by the national government, have the potential to eliminate “pockets” of peasants, refugees, and ethnic groups in order to prevent the trap of poverty and isolation which characterizes many inhabitants in urban centers. Private corporations and international organizations can assist with housing projects to alleviate overcrowding in the cities. Projects like these are already happening. For example, residents in a slum community in Poona, India “designed their own small but airy brick houses, bought cheap materials, and then constructed them with residents and neighbors pitching in.”⁴⁴ Similarly, slum dwellers in Orangi, a squatter community in Karachi, Pakistan, laid their own sewage pipes and installed toilets. Using cheap materials and simplified technology, the residents themselves built 5,400 sewers and 94,000 latrines with \$1.8 million of their own money. The project was directed by a research organization called the Orangi Pilot Project, “backed by \$105,000 in private funds, which operates with little government help and often refuses foreign aid.”⁴⁵ In addition, providing the poor members of society with credit, as is the practice of the Grameen Bank in Bombay through its micro-lending policies, can help empower the local people and relieve governments of the some of the burden and responsibility. Providing job opportunities and training at the community level in regions outside of large urban centers can also diminish the adverse effects of urbanization and reduce migration. The net effect of these improvements in social and economic conditions will alleviate tensions in society and prevent violent outbreaks which could result from continuing poverty and social discontent.

PUBLIC HEALTH

Finally, disease prevention requires good community-based health care that has frequent and direct contact with the local population and is in touch with individual needs. Often foreign consultants and foreign experts in various fields, including the field of disease control, are sent to work in a country they know very little about. Foreign donors often prefer entrusting their funds to a consultant with whom they are familiar; and as a result, they send foreigners to implement elaborate control programs which simply do not work in certain communities.⁴⁶ For this reason, indigenous consultants should assist in the direction of foreign or government-funded projects and should oversee the implementation of those projects. For improving community-based public health, all members of the local population, in addition to indigenous consultants or experts, should be mobilized to join the effort. Local members of society who are engaged in health education campaigns, food preparation, water filtering, and other activities can influence greatly the behavior patterns of neighbors and friends. Establishing an environment for the development and use of indigenous skills is crucial for the success of public health.

FUNDING

Underfunding is a major obstacle to the progress of public health in both developing and developed countries. Typically, very little money is given to health care and disease prevention; even less money is provided for developing countries as more and more industrialized nations make cuts in foreign aid. The UN Special Initiative on Africa is a positive sign, but it is an exception to the rule. Because corporations have a large stake in the success of disease control, as their labor force depends on a healthy population, they also should play a part in education and awareness. Private businesses often have more liberty to allocate resources for educational facilities and other programs. Because funding is crucial to the progress of disease control, contributions of both the private sector and governments are necessary for effective prevention.

While infectious disease is most serious in developing countries and most efforts must be focused on this part of the world, industrialized countries have a clear interest in helping to fund and to implement disease prevention. Recent outbreaks of tuberculosis in New York and the growing AIDS epidemic nationwide testifies to the danger of spending cuts to health facilities and insufficient commitment to disease prevention. Even a nation as technologically equipped and economically strong as the United States is not excluded from the threat of diseases at home. The fight against infectious disease needs a leader, and the U.S. is in the best position to lead. Collaboration among govern-

ments via the United Nations and the cooperative effort of health institutions like the World Health Organization, the Centers for Disease Control and Prevention, the London Institute for Hygiene and Tropical Medicine, and Institut Pasteur could provide the direction needed to instigate disease prevention programs and improve the living conditions of many of the world's population. Because disease does not discriminate among its victims, all nations should commit to maintaining public health in their own communities and to cooperating with international efforts as well. Preventing outbreaks before they occur will be more cost-effective in the end. We either pay now or we will pay much more later—in both money and human lives.

CONCLUSION

In this report, we have attempted to demonstrate that infectious disease is a global threat, and that as a global threat, it requires global action. But global action does not mean guarding ports of entry to keep out infectious germs nor sending a few teams of experts to treat a disease when an outbreak occurs. It does not mean financing expensive after-the-fact control programs nor searching for "magic bullets" to cure every illness. The lessons of history teach that this approach is both costly and ineffective in the long run. For HIV/AIDS, there is no cure as of today. But if there is a cure eventually, would it mean that AIDS would no longer pose a threat? If it follows the patterns of other "curable" diseases in the past, like tuberculosis and cholera, the answer is "no." Human neglect caused these and other "conquered" diseases to return, often in much deadlier, incurable forms; and there could be many more AIDS lurking in the future. As Thomas McKeown stated, "the health of man is determined essentially by his behavior, his food and the nature of the world around him."⁴⁷ If humankind is to keep its health, these are the things it must consider. Fortunately, these are also within human reach. If we had the power to create the conditions in which we live today, then surely we must also have the power to correct these conditions. Our very survival may, in fact, depend on it.

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⁴⁶ Rweyemamu, "Dump the Foreign Experts." *The East African*. 13-19 May 1996. In *World Press Review*. August

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Report On Applying Military and Security Assets to Environmental Problems

Task Force: Nathan Ruff (Leader), Robert Chamberlain and Alexandra Cousteau

INTRODUCTION

With the end of the Cold War, the United States military and intelligence communities have been searching for new enemies and new roles. The demise of the Soviet Union presented an opportunity to revisit traditional conceptions of security and consider new missions such as heightened counter-terrorist activities and protection of U.S. firms against economic espionage. In this project, special attention has been given to the importance of environmental change. The exploration of linkages between environmental change and security has developed into a complex debate focused on two fundamental and interrelated questions:

- Is environmental change a “traditional” security threat?
- In any case, what role is best played by the military and intelligence communities?

Consideration of the natural environment and security together is certainly not a new phenomenon. Natural resources and strategic minerals have long been considered vital to a nation’s security, and well within the realm of military attention. In addition, states’ actions in pursuit of security or the prosecution of war have been harmful to the natural environment.¹ Dabelko summarizes the idea of environmental security as follows:

Environmental security has emerged as a transnational idea, the core of which holds that environmental degradation and depletion, largely human-induced, pose fundamental threats to the physical security of individuals, groups, societies, states, natural ecosystems, and the international system. Security institutions in particular are currently failing to redress these threats. All institutions, according to the central tenets of the idea, must better address these threats. The alternative if these threats are not addressed will likely be economic, social and/or political conflict that will continue and increase as human, societal, and ecosystem health and welfare decreases (Dabelko, 1996, p. 2).

The aim of this report is to examine what the military and intelligence communities can do to alleviate or solve the problems identified under the rubric of environmental security issues. It presents three approaches to understanding environmental security, offers a synthesized model that underscores environmental factors as threats to security, and applies this model to two cases. The case studies examine varying environmental problems, and yield a number of general prescriptions for policy makers.

THREE PERSPECTIVES ON LINKING ENVIRONMENT AND SECURITY

ECOLOGICAL SECURITY

Ecological conceptions of environmental security focus on a competitive environment in which humankind and nature are at odds. Some proponents of this perspective take an uncompromisingly ecocentric view, maintaining that the environment must be protected from human intervention at all costs.² Less exclusive viewpoints include “microsecurity,” the competition between man and microorganisms as identified by Dennis Pirages; concern over man’s continued extermination of thousands of plant and animal species (biodiversity loss); and concern with the irrevocable tampering with the assembly rules of ecosystems planetwide.

To mitigate and end mankind’s assault on nature, ecological interpretations of environmental security place value on cooperation as the most appropriate means for achieving their goals, largely through multilateral mechanisms focused on the root causes of environmental change.

HUMAN SECURITY

The human-based concept of environmental security concentrates on the minimization of human suffering and addresses issues related to environmental cleanup, economic sustainability, and the emergence of exotic diseases.³

Norman Myers is perhaps the best known advocate of this approach to environmental security. Myers, in his efforts to emphasize individual well-being as the guiding principal for national security, seeks to radically redefine the very notion of “security,” shifting its focus from territorial sovereignty to individual welfare. Dabelko believes that whereas ecological approaches treat the underlying causes of the environmental crisis, human security approaches are generally reactive, responding to degradation that is already apparent.

MILITARY SECURITY

A third approach adopts a conventional military security focus. At the center of U.S. military conceptions of environmental security is research on environmental change as a cause of conflict. Although current research does not support the idea that environmental stress can trigger interstate conflict, it has indicated that, in league with other contributing factors, environmental conflict can lead to subnational, or intrastate violence (Homer-Dixon, 1994).

In view of this research, environmental variables are being identified by some within traditional security institutions as a threat that must be added to the list of traditionally established threats that analysts and military planners consider when attempting to anticipate coups, political instability, mass migrations, and violent conflicts (Butts, 1994a).

Another aspect of military security deals with “greening” the military. For example, the Clinton Administration’s Office of the Deputy Under Secretary of Defense for Environmental Security is charged with, among other responsibilities, compliance with national environmental regulations, taking a more ecological approach to doing business, and cleaning bases where military excesses threaten civilian populations.⁴

In summarizing current thinking on the role of the traditional security community, Gary Vest, the Principal Assistant to the Deputy Under Secretary, has outlined a six-point Department of Defense (DoD) conception of environmental security:

DoD’s view of Environmental Security is comprised of the following: (1) ensuring environmentally responsible action by military units wherever they may be; (2) ensuring adequate access to land, air and water to conduct a defense mission; (3) protecting the DoD’s war-fighting assets (people, equipment and facilities); (4) understanding where environmental conditions contribute to instabil-

ity, and where the environment fits into the war and peace equation; (5) bringing defense-related environmental concerns to the development of national security; (6) studying how defense components can be used as instruments of U.S. global environmental policy (ECSP *Report 2*, 133).

At least in theory, it would appear that Vest’s six-point program could be compatible with any understanding of the linkage between environment and security. Many are skeptical, however, that the military and intelligence communities can or should play a constructive role in addressing environmental problems. We have identified five specific ways in which those assets could be—and to some extent are being—used effectively (see Matthew, 1996). These are:

- support R & D—the Administration can use military research to broaden technological solutions to problems of environmental scarcity and degradation;
- transfer skills—the U.S. military can work closely with other militaries to “green” their institutions by fostering environmental sensitivity and training others in environmental impact assessments and environmentally sensitive techniques;
- make better use of National Technical Means (NTM) data—the United States can monitor and report on many aspects of the environment, from soil degradation to population migration;
- threaten force to compel compliance from other nations on environmental agreements;
- conflict resolution—in cases where environmental scarcity does lead to conflict, the United States can apply security assets to monitor cease-fires, troop movements, and provide logistical support to humanitarian efforts.

The following case studies of Russia and Rwanda underscore the value of using military and intelligence assets, describe current activities along these lines, and suggest directions for the future.

CASE STUDY ONE: RUSSIA

INTRODUCTION

Russia is an unstable country that continues to “control” the largest stockpile of nuclear weapons in the world. It is undergoing a transformation that threatens to tear apart the very fabric it is attempting to restitch. Its governing body is factionalized, rogue leaders operate with impunity, the economy is in ruin, and its military assets are guarded with less vigilance than would be recommended by the world community.⁵ Add to this scenario environmental conditions that border on unlivable, and a picture of impending disaster begins to crystallize.

Russia represents a unique situation in which the epitome of traditional security concerns, the nuclear threat, blends with newly developed ideas of environ-

mental security. The fusion of these two terms yield an enhanced threat to the United States. Not only does the fear exist that the Former Soviet Union (FSU) could slip back into a state of Cold War antagonism against the United States or that nuclear weapons might fall into the wrong hands, but these possibilities are exacerbated by the strains of economic and environmental stress Russia is undergoing. The United States has an obvious interest in disarming these problems before they reach a critical threshold. Russia's instability cuts across all fronts, political, economic, military and environmental; a satisfactory response must address all four sources of instability. This case study examines the specific role that military and intelligence assets do and can play in achieving this goal.

THE MODEL—"FOUR FRONTIERS OF INSTABILITY"

The model that is presented in Figure 1 shows how environmental instability (comprised of pollution, radiation, and resource scarcity) can work to directly destabilize Russia as well as enhance political, economic, and military destabilization vectors. This same environmental instability can affect the United States directly by disrupting international environmental in-

tegrity through ozone depletion, global warming, and deforestation. An unstable Russia promotes fears of "loose nukes," and ultimate failure of the state would result in a destabilized world community. This would create intense, detrimental effects to the United States. Finally, this world destabilization would cycle back in a negative feedback loop and exert renewed stress on the four frontiers of initial instability.

RUSSIA, 1996

The conditions in the FSU have eroded to a level at which human existence is being threatened. This may seem an extreme statement, but there are a number of Western experts, as well as the Deputy Minister of Public Health in Russia, Nikolay Vaganov, who believe that the Russian gene pool is on the verge of irreparable damage. The cause of these conditions has not come from the West, as so many Soviets foresaw; rather, in an ironic twist of fate, the destruction of Russia's motherland has developed as a byproduct of Soviet attempts to achieve national security and economic growth. At present, Russia's continuation as a sovereign and stable country is being severely threatened by its lack of environmental management. The stress on its internal

FIGURE 1

security is developing into a pressure felt throughout the entire world system.

Unfortunately, problems have been amplified, rather than alleviated, by the collapse of the Soviet Union due to the difficulties Russia has had in restructuring its command economy into a free market economy. Quite simply, there is not enough money available in the government to move Russia through its transition. Taxes are not being collected effectively, huge expenses are still being devoted to an oversized military machine, and corruption has reached unprecedented levels and organization. Steve Blank of the U.S. Army War College in Pennsylvania has described Russia as a "failing state." These dire economic conditions have further degraded an environment in which Russian health and the longevity of its people are being threatened.

As Murray Feshbach states, "reproductive health is one of the most accurate indicators of public health overall, as well as of local ecological conditions. Probably no other statistic epitomizes the current societal crisis facing Russia than that there are two abortions for every three pregnancies (1995, p. 10)." Infant mortality is at an all time high, the morbidity and mortality of the general public are rising, and birth defects from radiation poisoning are creating a situation in which "there is a danger of the nation's physical degeneration, of irreparable damage to its genetic fund (p. 12)."

The lakes, seas, rivers, wetlands, and public water supply are nearly all contaminated with chemical, radioactive, and human waste. The great forests in Siberia, second only to the Brazilian rain forests as a source of planetary oxygen production, are under attack from acid rain, pollution, and industrial clearing. Air quality has deteriorated to such an extent that a popular belief in Russia is that "living longer means breathing less." The dumping of nuclear byproducts is unsupervised, nuclear power plants are run "blindly," and the fear of fissile material smuggling has put the entire world community on alert. In essence, the evident deterioration of the last five years which has brought the continued existence of Russia as we know it into question is, in part, the culmination of 50 years of environmental mismanagement and abuse.

THE THREAT TO UNITED STATES SECURITY

The situation in Russia is unstable. General environmental degradation in Russia is a cause of internal distress as well as external pressure. Not only are national concerns an issue, the overall welfare of the global system as linked by oceans, jet streams, and ecobalance is in jeopardy. For these reasons, the security of the United States is being compromised by four major threats. The first two fall under the aegis of traditional security issues, while the second two reflect environmental security concerns.

First, the nuclear threat from the FSU has been transformed from fear of a nuclear strike to fear of nuclear ineptitude. Chernobyl-like accidents in the future are seen as an eventuality if old and unsafe RBMK reactors are not shut down in Russia. In addition, the economic stress that Russia is experiencing opens the door to organized crime, the smuggling of fissile materials to terrorists, and the enticement of unpaid nuclear specialists to aggressive Third World countries as consultants to their growing nuclear programs. Many divisions of the Russian army have not been paid in three months.

Second, the fear that Russia could revert back to Cold War status is a priority concern. The sociopolitical threat of internal revolt lends itself to the possibility that a successful coup could take place in a country that has the military might to throw the world into a nuclear winter. If a small number of hard-line, old-school military leaders, or an unstable militant faction, takes control of Russia's stockpile of weapons of mass destruction, they would be in a position to blackmail the world community and especially the United States. The advantages that the U.S. military and intelligence community provide in addressing these first two concerns are evident and fall into the category of traditional national security issues.

Third, United States national security is threatened directly by environmental degradation as shown in the model. Global warming, ozone depletion, global resource pollution, and ecobalance destruction all affect the collective future of the planet directly. The consequences may vary from increased incidence of skin cancer to lower crop yields and worse. Regardless, the results are negative.

Fourth, environmental stress can adversely affect U.S. security indirectly by causing regional instability at an international level. Certain areas of the world will succumb more rapidly than others to the tensions created by environmental stress. This can trigger secondary effects which ultimately result in international conflict. The Arab-Israeli War in 1967, often dubbed a water war, represents a perfect example of this scenario. If one is to believe the dire predictions of Robert Kaplan (1994), this type of war is a prototype for armed conflict in the 21st century.⁶ The reasoning follows a linear progression of cumulatively critical conflicts: for example, global warming exacerbates the necessity for water in various regions of the world, resulting in mass migrations; these migrations put undo stress on neighboring countries which are forced to aggressively stem the human tide; this conflict escalates into local wars, and it ultimately destabilizes the region. As recent history has shown, this would pull the UN and the United States into the fray and could lead to an international systemic crash. Thus, it is in the United States' national security interest, in both traditional and revised forms, to follow a policy of pressure point intervention in or-

der to defuse such situations before they reach critical threshold. Before precautions can be taken, pressure points must be identified where resources can be applied most effectively. It is at this point that the military and intelligence community can provide invaluable assistance.

THE ROLE OF THE MILITARY AND INTELLIGENCE COMMUNITIES

A major role of support can be undertaken by the intelligence community and the military establishment though the identification of present and future areas of concern (an early warning system), the monitoring of Russian deterioration as well as environmental treaty compliance (space based observation), and the provision of archived environmental information (bilateral information transfers—BITs).

The feasibility of having the military and intelligence community address these environmental security concerns, as opposed to traditional national security threats, was the topic of a study conducted in 1992. Under the urging of Vice President Gore and the blessing of then Director Robert Gates, the CIA chose 70 civilian environmental scientists with whom they paired CIA officials to create an unprecedented task force—now known as the Medea Group. The goal was to answer the question of whether the U.S. Cold War spy equipment could be used effectively to combat environmental degradation. The scientists were given security clearances and allowed to examine the CIA's archives of photographic and radar images, atmospheric data, and undersea records. In addition, they were allowed to access the spy satellites directly through their control at the National Reconnaissance Office (NRO). As Robert Dreyfuss makes clear in his article, "Spying on the Environment," the scientists' initial report leaves no doubt that the intelligence community's archives and collection devices could provide invaluable clues to understanding global environmental change. Unfortunately, the task force's findings may never be productively used by the environmental community at large because of the CIA's fear of revealing too much information regarding their collection processes. Their chief worry concerns compromising the United State's ability to successfully collect information pertinent to immediate national security issues. They fear that if reconnaissance pictures fall into the wrong hands, certain of their gathering capacities will be compromised. Just as one can tell where a photographer is standing by looking at a normal picture, so too can experts triangulate the locational path of remote sensing satellites from the images they record. Thus, if satellite imaging was made public, this information could be used to inhibit the United States in obtaining information later. This fear is not unfounded.

During the 1992 Gulf War, Saddam Hussein is said

to have been able to protect a trove of scud missiles from allied attack based on information he received from unclassified satellite reconnaissance. "The Iraqis demonstrated on numerous occasions their accurate understanding of the limitations of U.S. technical collections systems and of how data gathered by such systems were interpreted. The catalogue of techniques used by the Iraqis to thwart these systems includes construction of buildings within buildings; deliberately making buildings designed to the same plans and for the same purposes look different; and dispersing and placing facilities underground" (Godson, p. 109).

Certainly security concerns of this nature must be contrasted against the potential benefits of making satellite imagery public. Ideally, sensitive information could be kept "in-house" and only cleared members of the scientific community and policy makers could access it. In this way, environmental degradation could be effectively attacked using our extensive intelligence resources without compromising their integrity.

APPLICABILITY OF REMOTE SENSING AND INTELLIGENCE ASSETS

The benefits of remote sensing are quite impressive. Robert Dreyfuss was able to obtain an eight-page draft summary of the Medea Group's findings which laid out the possible applications that the United States remote sensing capabilities have to fight environmental degradation. The report says that "[c]hanges in vegetative and desert boundaries, which may be sensitive indicators of global climate change, can be tracked over time by satellite systems. The monitoring of changes in ocean temperature could provide a direct measurement of global warming. Undersea listening systems also may be able to detect this effect by measuring changes in ocean sound speed over long distances." Where civilian satellites such as LANDSAT can produce color images of land areas and oceans, "the NRO's satellites can actually zoom in and count the number of trees in a certain area and even determine what species they are." In addition, if the satellites are programmed to "take a reflection of, let us say, sunlight off the top of a forest canopy, you can do a spectral analysis of the composition of the forest," says Bruce Berkowitz, the former CIA analyst (as quoted by Robert Dreyfuss). "That will tell you if [the forest] is deficient in certain chemicals that are associated with healthy vegetation." These are all pertinent and highly valuable tools that could be used to analyze Siberian deforestation and sea pollution in Russia (Dreyfuss, 1995, pp. 28-35).

Other dynamic applications were discovered by the CIA. Again from Robert Dreyfuss' access to the report, "satellite radar devices and submarines could combine to measure the thickness of the polar ice pack, whose variation provides a good indicator of climate change"

(p. 31). Ice floes, undersea volcanoes, whale migrations, earthquakes, and scientific buoys that monitor ocean temperatures, salinity and currents are all trackable with our intelligence/military assets. More specifically, remote sensing activities could be used in Russia to accomplish the following specific goals:

- Tracking of impending ecological disasters;
- Determination of ecological disaster areas and land degradation;
- Reaction to emergency situations;
- Tracking of global geological processes such as earthquakes, volcanoes, etc.;
- Monitor forest diseases, pest infestation, pollution impact on tree cover;
- Monitor pollution of surface and underground water;
- Assist in cartography, locate mineral deposits, track ice floe movements.

If this information was continuously declassified to the extent that it could be shared by scientists across national boundaries, not only would Russia benefit, so too would the United States and the world community as a whole.

Further destruction of common resources could be addressed rapidly, accurately, and more effectively by employing this specialized space-based monitoring technology. In particular, the assistance that this information could provide to Russia's State Committee on Protection of the Environment (*Goskompriroda*), the agency in charge of environmental clean-up and protection, might enable it to target areas of immediate concern, convince Politburo diplomats of the urgency of environmental concerns, and lend credibility to the institution's overall mission.

U.S.-RUSSIA COOPERATION

Positive steps in this direction are already being undertaken by Vice-President Al Gore and Russian Prime Minister Viktor Chernomyrdin. The Gore-Chernomyrdin Commission was developed by Vice-President Gore, who recognized that underlying environmental problems are linked directly to the future stability and security of Russia, and in part to address the United States' and Russia's shared concern of global degradation. In January 1992, in a meeting of this commission, the value of bilateral intelligence assets was demonstrated. Maps prepared from classified assets that depicted environmental contamination at Eglin Air Force Base in Florida and Yeysk airbase in Russia were exchanged. Speaking at the National Defense University on August 8, 1996, Sherri Wasserman-Goodman, Deputy Under Secretary of Defense (Environmental Security), said that the administration "hope[s] to continue this cooperation and develop our respective capabilities previously used exclusively for intelligence purposes to support creation of warning mechanisms for potential crises. . . . Last year DoD co-

sponsored a conference with the Intelligence Community on environmental security and national security. The conference participants concluded that the Intelligence Community has the information-gathering infrastructure and the ability to perform integrated analysis on linkages between environmental problems and other instability factors necessary to contribute to an indications and warning system."

This type of arrangement seems to represent a prototype for future BITs and multilateral information swaps. Former Secretary of Defense William Perry advocated a policy of "preventive defense" in which promoting military environmental cooperation would contribute significantly to the overall security of the United States. "All over the world, American forces are sharing the wealth of their environmental experience with foreign militaries, showing them by example and instruction how to protect and preserve the air, lands, and waters in their own countries."

The Department of Defense has established a number of environmental defense relationships that seek to achieve Secretary Perry's "preventive defense" policy. One of the most important of these relationships involves the U.S. and Russia bilaterally, and the addition of Norway to form a trilateral arrangement, focused on the environmentally fragile and militarily active Arctic region. Arctic Military Environmental Cooperation (AMEC) was begun in 1994 and has already evaluated specific projects to reduce environmental degradation caused in the Arctic by defense activities. Secretary Perry signed a memorandum on Cooperation in Environmental Protection Issues with the Russian Minister of Defense in 1995. Goodman states that the "U.S. and Russia are utilizing the MOU's information exchange mechanisms as the beginning of a new bilateral environmental relationship." In late October, 1996, she led a delegation to Russia in order to exchange experiences in environmental education and training.

THE COUNTER ARGUMENT

Ronald Deibert represents those opposed to obtaining environmental assistance from the military and the intelligence communities. He proposes that "the use of U.S. satellite reconnaissance offers a clear illustration of the perils of redirecting military expertise towards the environment. This argument rests on the belief that military and civilian approaches are incompatible in fundamental ways" (unpublished manuscript, "Out of Focus: U.S. Military Satellites and Environmental Rescue").

In part, this group believes that the existing technology and skills in use by the CIA and NRO were not designed for scientific applications, and thus the data recovered may be of limited value. This fear would seem to be dispelled by the optimistic reports from the 70 scientists who worked on the CIA project. More problematic is the resistance of the military and intelli-

gence agencies to releasing data. Even when the data is released, important information on how the data was gathered is often omitted for security reasons. The scientific community is then left with no way to evaluate the accuracy of the information or to determine its origin. John Pike of the Federation of American Scientists (as quoted by Dreyfuss) adds, “[t]he cultural antagonism here is that the fundamental tenet in science is that you tell everyone everything, and the fundamental tenet in intelligence is that you don’t tell anyone anything” (1995, p. 34).

Finally, there is the fear that the military/intelligence community will mislead the scientific community by altering or selectively passing on certain information to advance other goals. This concern could be alleviated if the NRO, CIA, or whichever agency was charged with dissemination of important environmental security information cleared a number of scientists who would be integrally involved in the collection and assessment of the significant information. Deibert would probably argue that the fundamental dilemma remains; if the CIA has been able to evade Presidential scrutiny in the past, what chance do a handful of scientists have at playing the role of task-master. A more effective solution might be to apply the expertise that the United States has developed in building international regimes to this problem. Through incremental and cumulative steps, confidence could be built between the scientific and intelligence communities. Creation of an institution that would act as a central clearing house for declassifying and disseminating intelligence on a continual basis would create an environment where distrust and uncertainty would be greatly reduced through a gradual, collaborative, confidence-inspiring process of incremental gains. Both sides would realize that they had to cooperate over time, and the traditional “we versus they” mindset of the military and intelligence sectors would prove itself inefficient in this institutionalized setting.

RELiance ON MILITARY/INTELLIGENCE SPACE BASED TECHNOLOGY?

An important question remains to be addressed: Does the scientific community *really* need the satellite information gathered by military means when there is a large, public sector, space-based collection network. Meteorological satellites, such as the GOES (Geostationary Operational Environmental Satellite) and POES (Polar-orbiting Operational Environmental Satellite) series of weather satellites, the non-meteorological U.S. LANDSAT and the French SPOT satellite series, as well as the European ERS-1, the Japanese JERS-1, and the Canadian RADARSAT SAR satellites perform a vast array of environmental missions for scientific users.

In addition, NASA is in the process of expanding the amount of earth science data available to scientists

through the development of its Earth Observing System (EOS) and the EOSDIS (Data and Information System) which will serve as the key link between the data collected by the satellite systems and the scientists working on global change research. The \$8 billion EOS project is the centerpiece of NASA’s Mission to Planet Earth (MTPE). “In conjunction with its international partners, the U.S. plans a program of civilian Earth observation to provide, by the early years of the next century, the comprehensive collection of data on resources, weather, and natural and human-induced physical and chemical changes on land, in the atmosphere, and in the oceans. These programs are unprecedented in both their scope and cost,” as described by the Office of Technology Assessment to the U.S. Congress (Congressional Report, Failure of Remote Sensing from Space: Civilian Satellite Systems and Applications Office of Technology Assessment 1988). Unfortunately, the limitations of satellite based platforms and budgetary cutbacks “will prevent process-oriented studies from being performed at the level of detail that is required to address the most pressing scientific questions.” Although MTPE total budget has increased as a percent of its total project balance, its funding was cut from \$11 billion to \$8 billion. Intelligence community funding is estimated at \$23 billion, of which a large portion goes to space-based technology. For financial reasons alone, continued reliance on the military and intelligence community’s technology is likely to be necessary for supplemental information.

Although great advances are being made in the non-classified public and private sector, the technology costs a great deal of money and a long lead time is necessary to bring it to operational status. The scientific community will need to continue to strengthen its ties with the military and intelligence community in order to access important environmental information for at least the next five years. In addition, certain technologies will always remain under the aegis of the military/intelligence realm due to their extraordinary cost and levels of advancement. Even when EOS is up and operating, scientists will need to supplement the system’s vast reconnaissance with specialized information from the NRO, NIMA, and others. Because global degradation is a problem now, immediate cooperation between the public and military sectors needs to be continued and improved.

CONCLUSION

The case of Russia demonstrates the need and early success of U.S. military and intelligence activities in support of environmental security policy. New satellite information and the archived trends with which it is contrasted present an important way in which the military and intelligence community can assist present day concerns and help to defuse potential future problems that will affect U.S. national security. To further

their contribution, the military and the intelligence sectors need to coordinate their efforts through a centralized institution that can work directly with the scientific community. Through the application of their analytical skills and expertise in crisis management, monitoring technology, and extensive databases of archived information, they can play a major role in addressing national security concerns of an environmental nature. By developing an early warning system that could project potential hot-spots internationally, Perry's idea of "preventive defense" can be achieved. Military-to-Military Contact and Security Assistance Programs will enable our non-sensitive expertise and environmental assessment technologies to be utilized to restore acute areas of foreign degradation. By targeting pivotal states such as Russia and China, the interests of U.S. security will be directly served. Finally, by incorporating environmental expertise into all aspects of U.S. foreign policy and international negotiation, a strong, healthy, safe United States will be maintained for future generations. The application of these ideas requires long-term thinking, vision, and leadership; attributes that are becoming more and more dominant in the policy leaders we elect to steer our country into the next millennium.

CASE STUDY TWO: RWANDA

INTRODUCTION

The tragedy that unfolded in Rwanda in 1994 is widely accepted as an example of environmental scarcity combining with population pressures to precipitate intrastate conflict. Along with many others, the Clinton Administration has expressed its belief that environmental factors were significant contributors to the genocide.

This case study suggests two things. First, policy makers need to be careful about assuming that conflict in the Third World is the result of environmental problems. The case of Rwanda suggests that environmental factors played a small role in contributing to the violence. Second, there remains a significant gap between the position of the Administration and the behavior of the security community. In this case the military responded in a conventional manner. Perhaps it recognized the problem for what it really was; more likely it has not yet adequately accepted and internalized the concept of environmental security.

RWANDA AS A NATIONAL SECURITY THREAT?

States once regarded as inconsequential to American national interest are being given a closer look as environmental factors have been identified as a key to understanding the causes of conflict. One reason for this is the belief that environmentally related conflict may increase in the near future. If this is true, it is important to study cases as they arise. Moreover, such

cases are of general interest because they involve an issue—environmental change—that is increasingly central to U.S. foreign policy. Consequently, although far removed from direct contact with the United States, Rwanda, under this new understanding, did indeed merit American interest.

At first blush, the case of Rwanda appears to fit the model of environmental change and conflict developed and popularized by Thomas Homer-Dixon. Homer-Dixon's research has indicated that environmental scarcity, defined as degradation or depletion of a resource (scarcity of supply), increased consumption of a resource (scarcity due to demand—brought about by population growth or high per capita resource consumption), and uneven distribution that gives relatively few people disproportionate access to the resource and subjects the rest to scarcity (structural scarcity), affects the intermediate social variables often believed to be the underlying causes of subnational conflict (Homer-Dixon, 1996). These intermediate social variables include endemic poverty, weakened institutions, and increased inter-group competition that can ultimately lead to instability and civil conflict (Homer-Dixon, 1996). It is important to note that rather than a linear progression of primary environmental stressors leading to secondary social effects that result in tertiary results, these factors all interact, and can amplify and reinforce one another in a cascade series that ultimately will result in the negative outcomes described.

The Clinton Administration believes that what this research portends for the rest of the world is clear: increasing competition for resources will mean that civil conflict and failed states will increase, placing a heavy burden on those countries in the North which, less vulnerable to this sort of problem, may nonetheless suffer indirectly and be called upon to help resolve it. What this means for the United States is also clear: increasing global misery will eventually affect not only the American economic way of life, but also prospects for global democratic governance, as developing states lose the capacity to govern effectively. In the long term, global instability will come to greatly affect U.S. national security. In the short term, responding to complex disasters precipitated by environmental factors will require expensive humanitarian relief operations that, more often than not, do not work out as planned.

ADMINISTRATION UNDERSTANDING OF RWANDAN EVENTS

Robert Kaplan's 1994 *The Atlantic Monthly* article, "The Coming Anarchy," caught the imagination of the Clinton White House, and resulted in a greater Administration focus on the environment as a cause of conflict. In addition to Clinton's speech before the National Academy of Sciences, Timothy Wirth, the Under Secretary of State for Global Affairs stated:

Resource scarcities are a root cause of the violent conflicts that have convulsed civil society in Rwanda, Haiti, and Chiapas. These conflicts could intensify and widen as ever-growing populations compete for an ever-dwindling supply of land, fuel, and water....In Rwanda, the unspeakably brutal massacres of recent months have occurred against a backdrop of soaring population growth, environmental degradation, and unequal distribution of resources. Rwanda's fertility rate is among the highest in the world—over eight children per woman. The nation's once rich agricultural land is so severely depleted and degraded that between 1980 and 1990, during a time of unprecedented population growth, food production fell by 20 percent (*ECSP Report*, 1995, 54).

Further, and more importantly:

In the newly configured world, national security is closely linked to human security. Human security is built on a foundation of peace and political stability, physical health, and economic well-being....[W]e are coming to understand the close connections between poverty, the environment, the economy and security. This historic transformation demands that we now liberate ourselves—from outworn policies, from old assumptions, from fixed views that only yesterday seemed to be the dividing and defining lines of our politics (*ECSP Report*, 1995, 54).

Even as recently as April of 1996, Secretary of State Warren Christopher noted that "We must not forget the hard lessons of Rwanda, where depleted resources and swollen populations exacerbated the political and economic pressures that exploded into one of this decade's greatest tragedies" (Christopher, 1996). The solutions to these problems were to include multilateral diplomatic initiatives, environmental conditionality applied to aid packages, and comprehensive approaches to sustainable development (*ECSP Report*, 1995; 1996).

As outlined above, the Clinton Administration believed environmental factors to be key to the conflict in Rwanda. Despite the new solution-sets outlined by administration officials to counter the underlying causes of conflict, the Clinton Administration waited and pursued the option of assisting a humanitarian program only once the conflict had sufficiently abated. Given the Clinton Administration's understanding of the underlying causes of the conflict, was this support for the humanitarian program the most efficient use of resources? Could resources have been brought to bear sooner?

THE CASE OF RWANDA

Details of the tragedy in Rwanda are relatively well-known and have been adequately documented

elsewhere. This case study will highlight events from the crisis and focus on the Clinton Administration's understanding of the Rwandan crisis and its response to it. (See Figure 2)

Environmental variables (*Ai*) through (*Aiii*) are interrelated, with population growth and land degradation contributing to declining agricultural production (*Aii*), and lead to the first of three intermediate social effects, population migration (*Bi*). Professor Homer-Dixon also notes that other effects included the weakening of the legitimacy of President Juvenal Habyarimana's regime (Percival and Homer-Dixon, 1996).

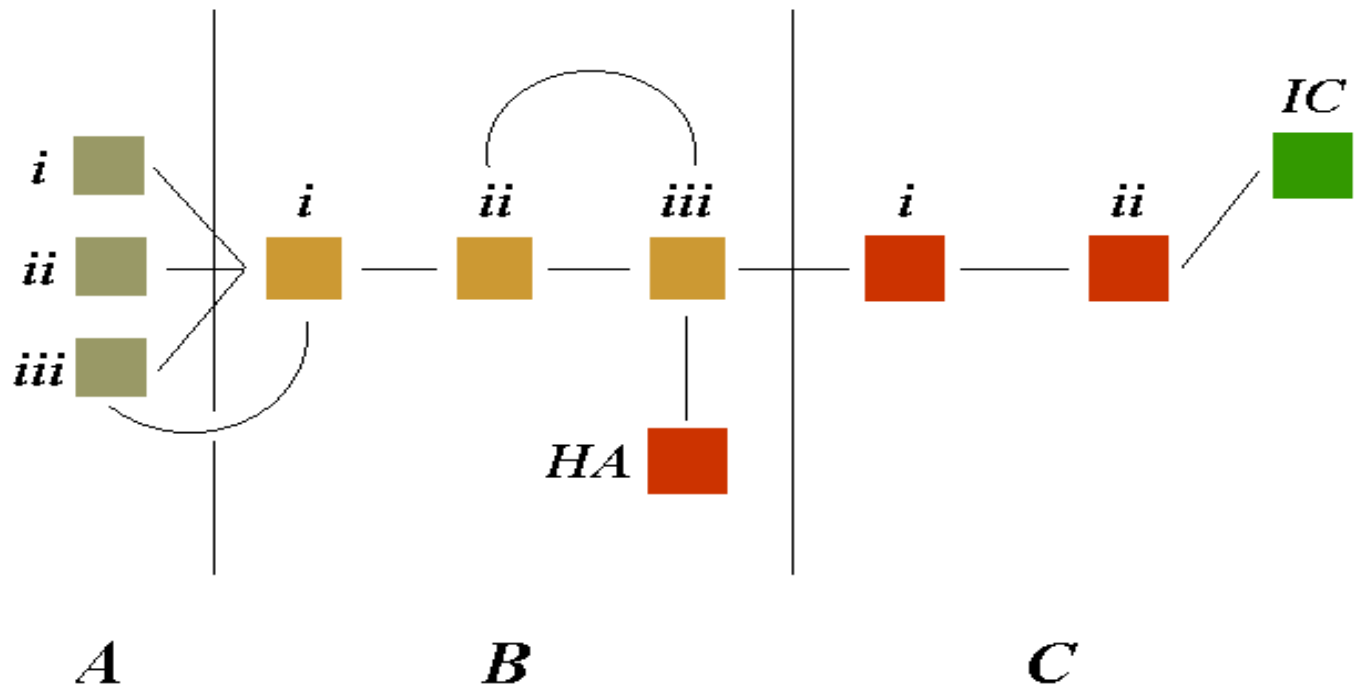
Note also that (*Aiii*) and (*Bi*) closely affected one another, as land degradation led to population migration, which induced further land stress, contributing to another cycle of migration. Population migration, in turn, contributed to existing inter-group competition (*Bii*) among the northern and southern Hutu and Tutsi. The latest wave of this competition dated back to the 1990 invasion from Uganda of the mainly Tutsi Rwandan Patriotic Front (RPF). Fighting also contributed to further population migration. This civil war placed a great deal of institutional stress (*Biii*) on the Hutu Habyarimana regime, which responded by forming the *interahamwe* ("those who attack together") militias to counter antigovernment sentiment among the population.

After much of the fighting, and once a tentative cease-fire and peace negotiations were under way, elements of the regime felt that President Habyarimana had given too much away at the Arusha peace conference signing in Tanzania. The accords would have acceded too much northern Hutu power and control to the rebel Tutsi and southern Hutu, and so to derail the Arusha Accords, President Habyarimana was assassinated (*HA*). The hard-line elements within the northern Hutu regime then attempted a wholesale eradication of the Tutsi minority (*Ci*), their "final solution" to the Tutsi problem, resulting in the humanitarian crisis (*Cii*) to which the international community (*IC*), including the United States, finally responded.

INACTION THEN ACTION

Based on the eventual U.S. response to the humanitarian crisis after the genocide in Rwanda, this case is best categorized as falling under a *military* conception of environmental security. Geoffrey Dabelko described military conceptions of environmental security as requiring the least amount of discomfort to traditional security specialists. Further,

The referent object of security remains the state as it has been in the dominant, military-centered definition (Buzan, 1991). As the object of what is to be made secure, the state, and its military forces, remain the primary actors when pursuing these con-



Model Components

- *Ai*—Population Growth
- *Aii*—Declining food production
- *Aiii*—Land degradation
- *Bi*—Population migration
- *Bii*—Inter-group Competition
- *Biii*—Institutional stress, in this case, that of the ruling regime
- *HA*—Habyarimana’s assassination
- *Ci*—Organized civil conflict
- *Cii*—Humanitarian emergency (Internally displaced persons and refugees)
- *IC*—International Community Response

Figure 2

ceptions of environmental security. Competition and conflict are the *modus operandi* for this class of environmental security conceptions as the actors and institutions attempt to address the *symptoms* of “environmental scarcity”....By focusing on mitigating the symptoms of environmental scarcity, this class of conceptions is primarily reactive to already existing problems (Dabelko, 1996).

During this crisis, however, *two* views of environmental security were at play. High-level Clinton Administration officials held to a human security viewpoint, focusing on underlying causes, while it is likely that U.S. military institutions found no compelling reasons to intervene from their military security viewpoint.

From a *human security* perspective, then, appropriate intervention points could be identified among four temporal periods; *pre-civil war*, *civil war*, *genocide*, and *refugee crisis*. These intervention points are significantly modeled after some of the recommendations made in the Synthesis Report of the Joint Evaluation of Emergency Assistance to Rwanda. These intervention points could have included the following:

Before the civil war

- more agricultural aid tied to sustainable development conditionality;
- health and education funding to alleviate stresses from migration and population displacement;
- general infrastructural aid to the government tied to human rights conditionality;
- urging the World Bank and IMF to take into account potentially harmful social effects in their structural adjustment program for Rwanda;

During the civil war

- taking leadership in stopping arms shipments to the combatants in the civil war;
- tying all aid to the Hutu Rwandan government to human rights conditionality;
- committing to a strong multilateral and comprehensive approach, incorporating the United Nations (UN), the Organization for African Unity (OAU), and local African states, to settling Hutu and Tutsi differences;
- coordinating and contributing to the financing, equipping and tasking of UNAMIR I to implement the Arusha Accords;
- more rapid and concerted initiatives following the assassination of President Habyarimana;

During the genocide

- organizing a multilateral coalition, incorporating the United Nations, the Organization for African Unity, and local African states, that would in no uncertain terms have told the Rwandan regime to cease their massacre;

- expanding the support to, scope, and mandate of UNAMIR II;

During the refugee crisis

- coordinating and contributing to the financing, equipping and tasking of a police force to separate militants from noncombatants in the camps;
- providing more support to the new Tutsi Rwandan government to recover, rebuild, and prosecute criminals, and also to repatriate refugees in Zaire.

When the United States *did* finally act, it was after the genocide was over, and as part of the humanitarian effort to assist the refugees, including retreating Hutu government forces and perpetrators of the genocide, that streamed into Zaire around July of 1994. From a *military* security standpoint, the crisis was not an appropriate subject until the solution-set fit a more traditional mission profile of support to a humanitarian operation. The United States provided logistical support to what was, on the whole, an impressive and effective relief operation.

RWANDA REVISITED

It is ironic that the very researcher whose ideas are quoted for Administration understanding of the crisis in Rwanda actually found that environmental factors did *not* play a significant role in the genocide. In a 1995 Occasional Paper from the University of Toronto titled “Environmental Scarcity and Violent Conflict: The Case of Rwanda,” researchers Valerie Percival and Thomas Homer-Dixon came to conclusions very much apart from the Clinton Administration’s understanding of the series of events. Of four hypotheses with various environmental factors accorded varying degrees of import, the most likely series of events entailed elite insecurity in the context of the Arusha Accords, where environmental factors played a minor role. Homer-Dixon and Percival concluded that:

The Rwanda case tells us important things about the complexity of causal links between environmental scarcity and conflict. Scarcity did play a role in the recent violence in Rwanda, but given its severity and impact on the population, the role was surprisingly limited. The role was also not what one would expect from a superficial analysis of the case. Although the levels of environmental scarcity were high and conflict occurred, the connection between these variables was mediated by many other factors. This complexity makes the precise role of environmental scarcity difficult to determine....Although the recent violence occurred in conditions of severe environmental scarcity, because the Arusha Accords and regime insecurity were the key factors motivating the Hutu elite, environmental scarcity played a

much more peripheral role (Percival and Homer-Dixon, 1995).

The fact that the Clinton Administration and the Homer-Dixon research team could come to opposite conclusions regarding events in Rwanda is indicative of what Richard Matthew has criticized as lack of adequate scientific understanding on the part of policy makers (Matthew, 1996, p. 41). Matthew suggests that enthusiasm for “environmental security” be tempered by more clearly delineating and distinguishing between “environment *and* security,” that is, emphasizing that the environment contributes to security issues, not that it should somehow supplant or redefine security (Matthew, forthcoming).

CONCLUSIONS

Was the application of United States military logistical support for the international humanitarian effort the best, most efficient use of security resources in Rwanda?

From the human security standpoint of Clinton Administration officials, no. Clearly more could have been done sooner. That more was not done implies a variety of factors at work—perhaps in keeping with a bureaucratic politics understanding of the situation, U.S. military institutions successfully resisted attempts to engage them in non-traditional military or support enterprises. More likely, there was insufficient political will among members of the Administration to impose a solution-set evocative of similar circumstances in Somalia. That more was not done even before the civil war began is indicative of the cost-cutting trend in Congress for foreign aid appropriations.

From a military security standpoint, yes. Attempting to apply force sooner would have entailed far higher risks for the assets applied, coupled with a vague exit horizon. As it was, U.S. support to the international relief effort in Rwanda reflected U.S. logistical expertise and military engineering skills.

Most important, as Homer-Dixon has underscored in much of his writing, it is misleading to suggest a simple, direct relationship between environmental security and conflict. However, environmental problems are prominent features of the general context in which conflict often occurs. Analysis and response need to be fully cognizant of the difference between background conditions and immediate causes.

The Clinton Administration must articulate more clearly a national environmental security policy, one to which it can steadfastly and sincerely commit, and communicate its resolution to the public and Congress. The Administration must reassess its aid program cutbacks and priorities, and realign them more in keeping with this national environmental security policy. It must communicate and educate effectively members of the Executive and the security community, so that

there is a clear and concerted effort in pursuit of this policy.

POLICY RECOMMENDATIONS

Clearly the Administration has indicated its interest in addressing the root causes of environmental change as much as possible. Sustainable development, and all that the term entails, is—rightly—the linchpin of the Clinton Administration’s multilateral approach. During this period of transition to an “earth in balance,” the traditional security community can play an important role. Specifically:

- The Clinton Administration must clearly articulate its vision of the interplay between the environment and security, and throw the full weight of the Office of the President behind it. Kent Butts has a few excellent suggestions for raising the national profile of the environment and security, even suggesting a Presidential Decision Directive (PDD) as the most effective vehicle (Butts, 1996);
- In line with the first recommendation, the Clinton Administration must educate policy makers, the Congress and the public about the key interrelationships between the environment and security, and justify the expense of scarce resources more clearly. Educating policy makers would enable them to more effectively task military and intelligence assets;
- Although employing National Technical Means (NTM)—basically, U.S. satellites and other remote sensing assets—can be somewhat problematic, the United States should nonetheless explore the feasibility of establishing an interagency imagery and environmental data clearinghouse tasked with the timely dissemination of environmental information to relevant and interested scientific and social institutions. In addition, the United States should fill any environmental data gaps with partially publicly funded commercial data gathering ventures, along the line of Mission to Planet Earth;
- In emphasizing that the environment relates to security, the Clinton Administration should ensure a thorough “greening” of the security community. Many recommendations have already been put forward, but one that is missing involves greening the service academies. Each new crop of officers should be exposed to issues of the environment and security right from the beginning;
- Finally, the United States must ensure that environmental experts are included in any international negotiations, whether trade related (as in NAFTA), or in the event of interstate or regional conflict resolution.

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ENDNOTES

1 U.S. military bases face monumental cleanup costs, a legacy of the belief that environmental issues needed to take a back seat to earnest prosecution of the Cold War. Also, most recently, Saddam Hussein set the oil fields of Kuwait afire in an attempt to divert U.S.-led coalition resources away from continuing battle against the Iraqi leader's forces.

2 The group Earth First characterizes this viewpoint, as evidenced in their (revised) motto, "no compromise in defense of Mother Earth."

3 As mankind pushes into previously remote or inaccessible terrain, "new" deadly diseases are discovered, with a serious potential for introduction into the wider population via the planet's well-established air transportation network.

4 It is interesting to note that the United States military has not taken this same mandate to heart overseas. Many international bases remain terribly polluted, and do not adhere to domestic U.S. environmental guidelines.

5 The number of near "compromises" to nuclear materials security demonstrate this fact. Please refer to the USAWC briefing in the bibliography.

6 See Robert Kaplan, "The Coming Anarchy," *The Atlantic Monthly* (February 1994): 45-76.

Water Scarcity in River Basins as a Security Problem

Task Force: Sophie Chou (Team Leader), Ross Bezark, and Anne Wilson

By 2025, chronic water scarcity will affect as many as three billion people in 52 countries. It is a pressing issue that demands the committed attention of governments of water-scarce nations and of regional and international institutions. In spite of numerous calls for decisive and collective action, however, water scarcity is worsening on a global scale. Demand for water is growing along with populations and economies, while sources of water are being rapidly degraded and depleted. Inequalities in the distribution of water supplies also are increasing, exacerbated by poor water management. In consequence, human welfare, ecological health and economic potential suffer. Under certain conditions, water scarcity threatens national security. This report examines the role of water scarcity in shared river basins in triggering, intensifying and generating regional instability and other security problems.

Three case studies have been selected to illustrate how various factors interact with water scarcity to threaten national and regional security. In the Jordan River Basin conflict has resulted from water scarcity combined with certain catalytic conditions. A lack of cooperation sustained by historical tensions could prove to be detrimental to regional and even global welfare. In the Nile River Basin, water scarcity exists, but conditions have not yet brought it to the level of conflict present in the Jordan River Basin. The nine countries in this basin, however, have been stalemated by political inertia, although there have been some recent indications of a growing interest in pursuing cooperative solutions to water problems. The Mekong River best exemplifies the potential for both conflict and cooperation in a shared river basin. Water-sharing mechanisms exist; the question is whether they can defuse the tensions posed by water scarcity.

The importance of this issue is hard to understate. Water is a vital resource upon which all organisms directly depend. River basins have been referred to as “cradles of human civilization,” sustaining productive, prosperous societies throughout human history. As these vital areas have been stressed by pollution and growing human demands, the world has witnessed growing competition and conflict over their water. So serious is the problem that the United Nations Commission on Sustainable Development has initiated a global freshwater assessment; it is currently underway and a report will be submitted to the U.N. General Assembly later in 1997.

INTRODUCTION

Water is essential for human and ecological health. It is vital for nutrition, food production, sanitation, and economic production. It is used for recreation, power generation and transportation, and embodies symbolic and cultural value. Water is a vital component of ecosystems, contributing to climate control and the hydrologic cycle. These processes profoundly affect the characteristics of the natural world of which human beings are a part.

As a natural resource, water has unique characteristics. From a global perspective, it is renewable and abundant; in regional settings, however, it is often finite, poorly distributed, and subject to the control of one nation or group. It is difficult to redistribute economically and has no substitutes. River flows in particular are uneven over time and poorly matched to human needs.

Reliable access to water supplies has long been a human concern because deprivation can cause illness, death and economic hardship. Yet given that water covers over 70 percent of the Earth's surface, scarcity might appear to be a low priority issue. The ostensible abundance of water is misleading. Fresh water comprises only 2.5 percent of the Earth's total water supply. Of this, 79 percent is locked in ice caps and glaciers. Groundwater comprises 20 percent; this leaves only one percent as easily accessible. Thus, only 0.000008 percent of the Earth's water is readily accessible for basic human use.

Historically, human welfare and progress have been closely associated with access to this small fraction of the world's total supply of water. Today, changes in the factors that determine water scarcity and in the manner

in which scarcity is being handled ensure that the familiar problem of reliable access persists. Addressing this problem requires new approaches to managing water-scarce situations so that threats to international security are minimized. As world population skyrockets and increasing numbers pursue material wealth, high quality accessible water is likely to be the subject of competition and conflict. Unfortunately, simple solutions may not be adequate to address contemporary water scarcity conditions. Water scarcity problems are complex, subject to competing interests, and often entrenched along sensitive ethnic, religious, or social class divisions. They exacerbate interclass or interstate tensions where they exist, and create new tensions where previously there were none.

Water disputes are currently proliferating in several arenas, from oceans to lakes to rivers basins. Degradation of oceans and lakes has severely damaged marine ecosystems, eliminating or diminishing numerous fish species and igniting hostilities between countries vying for the declining fish stocks. The shrinking of the Aral Sea in central Asia has attracted worldwide attention for having depleted, diverted, and poisoned the maritime ecosystem, but it is only one example of water depletion due to human diversion and contamination. The relationship between water scarcity and regional security, however, is most transparent in the cases of rivers shared by multiple countries. Nearly 40 percent of the world's population rely on shared river basins; this percentage jumps to 50 in northeast Africa and the Middle East. Rivers flow across political boundaries, usually giving upstream countries a distinct advantage over downstream neighbors. As rising demands strain river water supplies, international friction intensifies.

ANALYTICAL MODEL

In discussing the causes of water scarcity and how it may become a security issue, it is necessary to elaborate upon what is meant by "scarcity" and "security." Quantitative definitions of scarcity range from less than five to seven liters per person per day (the amount required to sustain a human being) to less than 2,740 liters per person per day (based on the average amount required to sustain a Western standard of living). A number of specialists describe a state as "water-stressed" if renewable runoff per person is less than 1,700 cubic meters annually, and "water-scarce" if renewable runoff is below 1,000 cubic meters per person annually. But given the diversity of agricultural and industrial practices and expectations throughout the world, it is not especially useful to assign a specific value to water scarcity. We argue that water scarcity exists when demand (which varies considerably) exceeds supply. It is resolved by establishing a balance between supply and demand.

We define a security threat as a threat to the values in the defense of which a country will use violence. These values include sovereignty, territory, public health, economic prosperity, and cultural identity. Situations that potentially or actually threaten such values are considered threats to security. It is important to note, however, that while security problems have the potential to lead to violence, they may also act as a stimulus for cooperation.

Variables that Cause Water Scarcity

There are three categories of variables that cause water scarcity: increased demand, decreased supply, and impeded access to available supplies. (Homer-Dixon, 1994)

Increased demand generally results from population growth, economic growth, and/or poor water resource management. There are 95 million people added to the planet each year, increasing the demand for water; throughout the world economic growth is a top priority; and all too often poor water management adds inefficiency to the other pressures for more water. Per capita use today is almost 50 percent higher than it was in 1950, and in most of the world it continues to rise (*Dimension of Need: An Atlas of Food and Agriculture*, p. 43).

Decreased supply is caused by the pollution, diversion, and depletion of water. Pollution degrades water quality, often so much that it is unsafe to drink, use for hygiene and sanitation, or use for fishing, agricultural and even at times industrial purposes. Water pollution can decrease the amount of employable water by means of domestic waste, industry, and agricultural runoff. This is particularly true in developed countries; in Poland, for example, the share of river water of drinking quality has dropped from 32 percent to five percent during the last two decades, and around three quarters of Poland's river water is now too contaminated for even industrial use (Postel, p. 21, 1992). Diversion occurs in river systems when an upstream water user alters the flow such that downstream users receive a diminished volume of water. Depletion occurs when ground water is pumped to the surface at a rate that is too quick to be replenished. Ground water and aquifers are recharged and purified through percolation of precipitation through layers of soil and rock; because the hydrological cycle takes a long time to complete, based on a human time frame, severe depletion of groundwater means not only a diminished supply, but also an unclean supply. Severe depletion can also permanently abate natural water storage capacity, further jeopardizing the amount of water available for human use.

Unequal access to available supplies causes the unfortunate conditions of water scarcity only for certain portions of the population, regardless of the aggregate availability of water. This is the case in many

places, and the inequality can be due to natural irregularities in precipitation, seasonal river flows, or human activities.

If the access problem is due to natural causes, catching and storing water when it is available is a critical factor in determining how much human suffering and damage will result from scarcity. If the problem is human-induced, access to water supplies is usually tied to political and economic power. In this situation the poor and marginalized subsidize the water use of those who have access to power. Thus, unequal access frequently creates water scarcity even in places where overall water scarcity may not exist.

Variables that Affect the Stability of Institutional Structures

The consequences of water scarcity can be severe. Populations can be displaced, as people migrate in search of water and new livelihood, or even as a result of attempts to remedy the scarcity situation, such as the construction of dams, the flooding of reservoirs, and the diversion of rivers from their natural river beds. As water scarcity causes water to be more highly valued, water prices increase and controlling water supplies becomes increasingly lucrative and may exacerbate existing forms of competition based on ethnic or

other social divisions. As a fundamental component of the natural resource base which supports agricultural and industrial activities, production and growth are likely to be threatened. Finally, institutions are weakened as the various burdens placed on them increase; in the most severe cases they may fail or resort to violence.

The Link to Security

Water scarcity poses a clear threat to internal or domestic security by contributing to health problems, civil strife, economic crises and institutional failures. Water scarcity may expand into the international realm, however, if certain conditions exist. The extent to which a river is shared by more than one country, disparate relative strengths of the countries sharing the water source, and the lack of equitable water-sharing agreements among all water users can catalyze a situation of water scarcity into one of regional insecurity. Moreover, water scarcity may amplify conventional international security problems related to militarization, weak institutions and ethnic and other sources of hostility and tension. Conceivably, the forces that prevent countries from resorting to violence to protect their interests and core values may be overwhelmed.

Model 1

CASE STUDY SUMMARY: THE JORDAN RIVER BASIN

Water in the Jordan River Basin is a limited resource whose scarcity has been a contributing factor to conflict between states in the past. The Jordan River Basin states are Israel, Jordan, Lebanon, Syria and the Occupied Territories. The upper Jordan is fed by three major springs: the Hasbani in Lebanon, the Banias in Syria, and the Dan in Israel. The major tributary of the Jordan, the Yarmuk River, originates in Syria and Jordan and constitutes part of the border between these countries and the Golan Heights before flowing into the Jordan River. The quality of Jordan River water is good up to the point where it enters the Sea of Galilee but by the time it arrives into the Dead Sea, the water has become too salty to use (Gleick, 1995, p. 9).

The surface and hydrological formations in the Middle East are nonhomogeneous discontinuous, meaning some sections of the region are dependent upon others for water supply (Ghezawi, 1994, p. 3). Those nations geographically situated upriver are gradually diverting more water from shared water resources in the Jordan River Basin for themselves, decreasing the available water for downstream users, while region-wide demands are swelling. Therefore, the control and allocation of water has evolved into an issue of high politics with global consequences and it has been explicitly made a part of the ongoing bilateral and multilateral peace negotiations (Gleick, 1995, p. 99).

Complicating the problem of water scarcity, the Jordan River is historically and culturally important to the region and the world, as some of the most ancient civilizations of the earth formed and grew around the river basin. Judaism, Christianity, and Islam consider the Jordan holy and it plays a role in national ideological objectives, such as settling border areas and population distribution, fanning ancient rivalries and disputes.

Since the establishment of Israel in 1948, interstate disputes over the Jordan River and its related ground water basins have played a role in ensuing violence in the area. In the 1960s, for example, the Arab League attempted to divert the waters of the Jordan River into Jordan, preventing the waters from entering Israel. Water-related tensions between Israel, Jordan and Syria contributed to the atmosphere which led to the 1967 war.

Problems continue over the control of water resources in the region and have begun to deteriorate at an even more rapid pace, due to the almost complete exploitation of local resources. Palestinians on the West Bank and Gaza Strip compete with Israelis for dwindling groundwater supplies. Much of the water supplying northern and central Israel comes from aquifers that originate on the West Bank and drain west-

ward towards the Mediterranean Sea (Brown, 1993, p. 130). Overpumping of the aquifer underlying the Gaza Strip has caused sea water to intrude and partially contaminate this source. As extraction from ground and surface water continues to increase, so do problems associated with low water levels, decreased quality, overflowing waste, and contamination from pesticides and fertilizers. Negotiations over water rights between Palestinians and Israelis were postponed in 1995, along with the issues of Jerusalem and Jewish settlements, indicating how important the subject of water is to the region and the diametrically opposed positions held by each side (Gleick, 1995, p. 8).

Though it may seem as such, this is not only an Arab-Israeli phenomenon. Tensions also exist between Syria and Jordan over the construction and operation of a number of Syrian dams on the Yarmuk River, which would allow Syria to regulate the Yarmuk's flow, which feeds the Jordan (Gleick, 1995, p. 11). If Syria acts aggressively to combat its own water shortages, violent conflict between the two states is possible.

Estimates suggest that fresh water deficits are increasing rapidly in the region and that if current water policies continue unchanged, the nations of the Jordan River Basin may begin to "experience acute and progressively worsening perennial water shortages and quality degradation analogous to the areas running out of renewable sources of fresh water within the next decade" (Naff, 1993, p. 116). Rapid population growth in the region, caused by elevated birth rates, reduced infant mortality rates, improved access to health care, and increased rates of immigration will place even greater burdens on all of the nations that utilize the water supply of the Jordan River Basin. Along with this population explosion, increased rates of urbanization and the growing demands of the agriculture and industrial sectors of these economies are placing further pressure on existing water reserves.

The United States, as the main mediator in Arab-Israeli negotiations, has an interest in assisting the parties to manage regional water scarcity obstacles because any factor which could derail the progress of the peace process would hinder the prospects of a lasting peace accord and perhaps damage U.S. prestige worldwide. Miriam Lowi, a professor at the College of New Jersey, argues that solving problems of water scarcity in the Jordan Basin are "specific to the task and cannot be viewed as an avenue towards political settlement" (Lowi, 1993, p. 204). But unless the issues involving water scarcity, especially those between Israelis and Palestinians, are rectified in some manner, which will only occur in the foreseeable future with the assistance of the United States, the chances of resolving political problems in the region will be restricted. This is in part because of the high priority given to Palestinian problems in the negotiations and in part because the dilemma of water in the West Bank is integral to the dif-

facilities of the Jordan River Basin as a whole (Gleick, 1995, p. 101).

While unilateral steps will assist in improving water management, cooperative efforts will be the ones which bring lasting success to the Jordan River Valley Basin. As the former Agriculture Minister of Israel, Meir Ben-Meir, said, "If the people of the region are not clever enough to discuss a mutual solution to the problem of water scarcity, war is unavoidable" (Brown, 1993, p. 128).

CASE STUDY SUMMARY: THE NILE RIVER BASIN

It is not unreasonable to assume that the world's longest river would offer the inhabitants of its banks an abundant and unlimited water resource. For millennia this has been the case in the Nile River basin. In the past several decades, however, this basin has suffered from enormous pressure from increased demand and reduction in supply. Not only does this pose a direct threat to the health of the humans and wildlife who depend on it for water, but it also poses the indirect threat of strained relations among the nine nations of varied levels of development that lie on the river's banks. This is no esoteric, whimsical notion; in 1989 Boutros Boutros-Ghali (then Egypt's Minister of State for Foreign Affairs) addressed the U.S. Congress and maintained that "The next war in our region will be over the waters of the Nile, not politics" (Gleick, 1994, p. 14).

Although the Nile passes through a multiplicity of nations (Rwanda, Burundi, Tanzania, Zaire, Kenya, Uganda, Ethiopia, Sudan, and Egypt), only two of these cooperate in its management: Egypt and Sudan, a result of the 1959 Nile Waters Agreement which allotted each a certain amount of water per year. The Nile has two sources. The Blue Nile originates in the Ethiopian highlands and meets the White Nile (the headwaters of which is Lake Victoria in Tanzania) at Khartoum, Sudan. The White Nile has actually demonstrated an increase in flows over the past 60 years, and thus the immediate problem is limited to Egypt, Sudan, and Ethiopia. The difficulty lies in the fact that, the 1959 Agreement notwithstanding, these nations, which demonstrate a wide range of development levels, have historically relied on a local approach to water allocation as opposed to a concerted, basin-wide approach. The local approach, however, does not take into consideration the other users of the waters, as witnessed in the case of Egypt's construction of the Aswan High Dam in the late 1950s. This type of approach caused no serious difficulties until this century, but recent developments that increase demand and reduce supply have deemed this an unsustainable method of allocating resources.

One of these recent developments is population

growth; Egypt's population is growing by another million *every nine months*. Despite famine and civil wars in Sudan and Ethiopia, their populations have grown steadily since 1960. This growth has increased and will continue to increase water demand for human and livestock consumption and for industrial and agricultural activities. Since there is a finite amount of water, this poses a serious problem.

In addition to the demand pressure caused from population growth, economic growth (or in the case of Sudan and Ethiopia, the *desire* for economic growth) presents another strain, as industry usually requires extensive amounts of water. Thus, the problem is two-fold; for Egypt, which is relatively industrialized, a decrease in flow due to elevated upstream consumption establishes constraints on economic options. Countries such as Sudan that strive for economic strength will vastly increase their consumption of water as electric power generation and manufacturing materialize. Another ominous strain is Egypt's intent to reclaim desert land for agriculture in order to reduce its dependence on imports for food; this would substantially increase its demand for water supplies. Taking into consideration the projected growth in population and its current per capita water use, Egypt's total water demand in 20 years will exceed its allotted share by almost 60 percent (Postel, 1992, p. 188).

To make matters worse, the actual supply is being reduced. Water is of no use to a thirsty person if it is polluted; degradation, as much as if the water simply disappeared, therefore decreases the available supply. In Egypt, for example, 117 factories dump their wastewater directly into the Nile (Postel, 1996, p. 143). Egypt is the last in line for the Nile and thus currently suffers from only self-inflicted injury. However, as the upstream countries nurture their interest in economic growth, they may be tempted to subsidize industrial water use, which would render degradation of the upstream waters (and thus further degradation of Egyptian water) inevitable.

In addition, a *potential* usurper of supply is global warming. It is almost impossible to predict exactly *where* changes resulting from this development will take place, but it is certain that where less rainfall is the outcome, periods of shortages may result if they are at or near water supply limits. With the inevitable increase in potential and actual evaporation that would result from higher surface air temperatures, the best guess for greenhouse-induced change in Nile flows would be a reduction in Blue Nile flows and constant or slightly increased White Nile flows (Howell and Allan, 1994, p. 159). Thus the current situation would only be aggravated.

As our general model suggests, each of these factors that are bringing about scarcity are affecting and will continue to affect security in the Nile basin. The decreasing supply of Nile waters in conjunction with

an unlimited demand poses several types of security issues: those on the human, individual scale; the security of the ecosystem itself; and the security of nations. Clearly, the first two security issues are the most immediate and tangible. Along with the obvious consequences (dehydration, disease, and hunger) that result from water scarcity, unemployment and other factors that negatively affect the economy could threaten the security of the lives of Nile basin inhabitants. Also, although ostensibly not of much immediate interest to the countries involved, water scarcity in the Nile basin and unnatural attempts to alleviate it could have serious detrimental ramifications on the ecosystems and consequently on the inhabitants of the region, as intact ecosystems play a vital role as water purification systems.

The indirect threat of international insecurity is, however, the most sweeping. If current circumstances persist, Egypt and Sudan will experience a severe deficit in water resources by the year 2010. The seven "lesser" countries have expressed a desire to increase their use of the river water source. Such an occurrence, especially by Ethiopia, could reduce water available to the downstream nations and significantly increase tensions. Mutual fear proliferates; although the Ethiopians understandably fear that Egypt could resort to violence, Egypt has little control over the water-related actions of the eight upstream governments. It may not have been an exaggeration when Boutros-Ghali declared that "The national security of Egypt is in the hands of the eight other African countries in the Nile basin" (Postel, 1996, p. 73). Despite the existence of several cooperative opportunities, policy-makers can expect the risk of conflict among the countries to grow. Egypt, though more developed in almost every aspect, is extremely vulnerable to water withdrawal by upstream countries and will be vigilant and apprehensive as she warily watches the growth spurts of her neighbors.

Several possibilities exist to mitigate scarcity and therefore the threats posed to the security of the Nile countries and their inhabitants. They fall under three principal approaches: increasing the supply of water (through purification and other projects and by controlling pollution); decreasing the pressures of demand for water by reducing population and eradicating wasteful use domestically and agriculturally; and formulating cooperative water management agreements. There is widespread support for emphasizing cooperation and reducing demand and contamination rather than searching for new supplies in this basin. Since most of the solutions dealing with demand and cooperation are similar for all river basins, they will be discussed in the "Policy Recommendations" section of this report. States depending on the Nile River basin, plagued with political inertia, need to be particularly concerned with sitting at the table and conducting co-

operative, basin-wide negotiation; only after doing this can discussion of an overhaul of policy and of new projects begin. There currently exists a stalemate as Egypt refuses to renegotiate its 1959 Agreement allocation and as Ethiopia refuses to sit at the table as long as it is excluded from new allocation agreements. A useful actor could be the international community in the form of aid and technological assistance to Ethiopia to give it an edge. All things considered, it is essential that these countries realize that one's gain does not necessitate another's loss; otherwise, this malignant suspicion will protract the lack of coordination that in the long run just may well prove to be disastrous as water scarcity and its consequent security troubles continue to be exacerbated.

CASE STUDY SUMMARY: THE MEKONG RIVER BASIN

The Mekong River basin is a water scarce region where increasing competition for water threatens South East Asian security. The Greater Mekong Sub-region covers 2.3 million square kilometers, is home to 325 million people, and is Asia's southwest growth region. 52 million people, mostly small-scale farmers and fishermen, are directly sustained by the river. At 4,800 kilometers in length, the Mekong is the world's 12th longest river, flowing through the Yunnan Province of China, Myanmar, Laos, northeastern Thailand, Cambodia, and southern Vietnam. The Mekong provides the natural resource base for agriculture, fishing, transportation, economic development, and ecological systems maintenance. As a freshwater ecosystem, virtually every human action is eventually reflected in the functions of the Mekong River (Abramovitz, 1996, p. 10).

Potential for development along the Mekong is great but the river's turbulent annual flood-drought cycle renders harnessing its waters for human purposes expensive and problematic. The diverse interests and needs of the countries in the Mekong Basin have the potential to create and exacerbate existing intraregional tensions. Conflicts of interest are developing over use of the river. Mekong development is thus an opportunity for conflict as well as for cooperation. The diverse needs and interests in river development represented by riparian nations, the political relationships among the Mekong countries, and the ability of the Mekong to meet the current and projected demands for its services are all uncertain.

What is certain is that the Mekong is being used unsustainably. It cannot supply the water demanded by human users and the ecological functions it provides. Declining productivity in fisheries, the intrusion of salt water into previously fresh surface water and groundwater, the recession of fertile coastal deltas due to the reduced ability of lower water volumes to

flush sediment into the sea, and the declining diversity of wildlife species all indicate that water resources are overexploited and stressed in the Mekong River basin. The region displays many of the characteristics that indicate or lead to water scarcity.

Population growth rates in the Mekong basin are high. In the lower Mekong countries, the annual growth rate averages 2.29 percent (Environmental Almanac, 1994). This means that the regional population increases by 2,550,870 people per year in the lower Mekong basin alone.

The rate of economic growth in the lower Mekong countries is also high. In 1995, GDP grew at an average rate of 8.18 percent. Average growth in the industrial sector in the lower Mekong countries averaged 11.75 percent (Asian Development Outlook 1996 and 1997). With the economic expansion of the economies of the lower Mekong countries, water pollution increases and higher per capita consumption rates contribute to water scarcity through increased demand. In addition, rates of access to safe water supplies in the lower Mekong region, excluding Cambodia, range from 47 to 67 percent in urban areas and 25 to 85 percent in rural areas. Including China and Myanmar, these figures range from 47 to 87 percent in urban areas and remain unchanged in rural areas (Environmental Almanac, 1994). Segments of populations in both urban and rural areas of the Mekong basin are water scarce due to lack of access to existing supplies.

Water scarcity and its adverse impact on the people, economies and ecology of the Mekong River basin have the potential to generate or exacerbate an international security issue. This possibility amplifies existing political and ethnic tensions and weakens institutions that mitigate the negative impacts of water scarcity on social, political, and economic systems. Of vital concern today are proposed dam, reservoir, and irrigation development projects which threaten the per capita share of safe drinking water. Lack of access to safe water is destabilizing through its weakening of the productivity of the labor force through mortality and morbidity. Centuries old political and ethnic tensions in the Mekong basin may be exacerbated by increased competition for scarce water and by increasing inequality in distribution and access of water. The inevitable population displacements that will result from the projected infrastructure projects will further exacerbate these tensions as thousands of people are simultaneously evicted from their homes. Institutional weakening may plague governments, NGOs, regional and international development organizations, disaster relief agencies, and even the Mekong Committee.

From the perspective of water scarcity, the Mekong River basin is a danger zone. Mekong River development is imminent. Countries in the region are approaching an important decision point. In order to prevent an international security issue over water scarcity

in the Mekong River basin, policies to govern Mekong development must be formulated that promote efficient technology, especially for agricultural and industrial uses, to enable efficient use of water; protect ecological and human health; and strengthen existing water regimes.

Decisive, proactive action is necessary in order to prevent water scarcity from developing into an international security issue. Policies focused on the causes of water scarcity and causes of insecurity will prevent instability and violence in the region and enable the region to reap tangible and long-term benefits. Prevention is effective and cost-effective relative to retroactive, crisis-driven reactions. Preventive policies grounded in human and ecological needs reflect the vision and leadership demanded for future regional and international peace and prosperity.

POLICY RECOMMENDATIONS

Given the importance of the particular context in which water scarcity becomes a threat to international security, this report recommends that policies consider the particular physical, geopolitical, and cultural conditions of each case. Thus, this report emphasizes a case-by-case approach in policy-formation. Policy recommendations fall under five umbrella categories: promoting education, improving living conditions, protecting human and ecological health, allocating sufficient resources to address water scarcity, and building international water regimes.

Education

First and foremost, education should encourage the use of more efficient technology and improved resource management suited to the particular conditions of each case. Determining and implementing efficiency standards can be achieved through information-sharing and technology transfers. Policy-makers should support technology transfers as well as the research and development of new technologies. Focus should be on agricultural improvements, as the sheer volume of agriculture's share of water render this area one in which the most benefits can be reaped per technological innovation.

Improvement in Living Conditions

Improving living conditions in the affected areas must be a policy goal. It can be achieved in part by preventing the human suffering that results from population displacement and the marginalization of poor people. Because living standards rise with increasing incomes in the long run, sustainable economic development must be encouraged. Wasteful, short-term economic gains should be regarded as future threats to human well-being and thus discontinued.

Human and Environmental Health

Policy must protect human and ecological health. Inadequate drinking water supplies and poor sanitation facilities can have devastating impacts on mortality, morbidity, and the economy. A healthy population contributes to the productivity of a country, which strengthens societal institutions and promotes stability. Robust institutions are more effective in withstanding stresses when they occur. Ecological health, aside from its inherent importance, must be maintained since it forms the natural resource base upon which human and economic well-being depend.

Allocation of Sufficient Resources

Policy-makers, both local and international, must commit the resources necessary to collectively correct this urgent state of affairs. Informal promises will only exacerbate the problem as the causes of water scarcity worsen.

Creation of Effective International Water Regimes

Basin-wide water regimes must be designed so that all stakeholders have the opportunity and are given an incentive to contribute to effective water allocation agreements. All stakeholders should be obliged to participate and comply with agreements.

The problem of water scarcity *will* be resolved; the question is *how*? By acting collectively and decisively, humans relying on shared water basins can ensure their continued well-being and development. By acting unilaterally and indecisively, the probability of a military solution increases.

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The Natural Heritage Institute

U.S.-Mexico Case Study on Desertification and Migration

by Michelle Leighton Schwartz and Heather Hanson

The Natural Heritage Institute (NHI), a non-profit public interest environmental organization in San Francisco, California, has spent several years investigating the links between agricultural dryland degradation and rural migration within Mexico and across the border into the United States. Results of NHI's research, including analysis of national survey data on land use and migration in Mexico, will be released by the Institute in May 1997 and suggested policy reforms will be presented to the Congressional Commission on Immigration Reform, Clinton Administration officials, and Mexican officials and organizations. The following is a brief overview of NHI's work and findings to date. Portions of NHI's final report will be published in the forthcoming issue of the *Environmental Change and Security Project Report*.

A growing number of experts believes that the national security interests of many countries will be affected in the coming century by environmental scarcities and associated conflicts, by local and regional level population pressures, and by economic policies exacerbating patterns of inequitable resource distribution. International organizations estimate that 25 million people have been displaced by environmental problems.¹ Some researchers estimate that those displaced by land degradation in dryland areas could top 100 million in the coming two decades.² This phenomenon has been termed "desertification," and is the subject of a global treaty which entered into force in December, 1996.³ The international Food and Agriculture Organization (FAO) estimates that 70% of the world's dryland agricultural areas are degraded, placing roughly 1 billion people at risk. This is compounded by chronic water shortages currently facing roughly 550 million people; these threaten both human health and farming possibilities.⁴

Desertification has profound social and economic implications. Because rural communities depend on local land and water resources to ensure their continued subsistence, soil erosion contributes significantly to declines in rural incomes. This decline in incomes, combined with factors such as population growth (which can increase land use and subdivision) and access to labor markets, can exacerbate conflicts over land resources and stimulate migration. Conflicts may also arise as new migrants attempt to integrate into established communities. Moreover, developed countries have responded adversely to increased migration: almost 1 in every 3 developed countries is restricting immigration from developing countries.⁵ These policies can serve to increase conflict between developed and developing countries, particularly those with shared borders.

Desertification is a growing problem in the Americas, affecting much of the Peruvian coastal areas, 20% of Argentina's territory, and all of Northeast Brazil. Haiti has experienced a 2/5 decline in productive lands over the last several decades, and only 2% of its territory is currently forested. Mexico, which shares a 2,000-mile border with the United States, is one of the most affected countries in the region: 60 percent of lands are severely degraded and drought is a persistent phenomenon. These concerns, as well as the tensions created by population movements along the border, led NHI to investigate the dryland degradation in agricultural regions as a "push" factor for urban and cross-border migration, and to investigate links with associated factors, such as population trends and economic reforms.⁶ Work has been undertaken to improve understanding of environmentally induced migration and to identify policy alternatives for the United States and Mexico that could also be relevant for other countries suffering similar problems.

THE U.S.-MEXICO PROFILE

Mexico's natural resources are coming under increasing threat of destruction, not unlike those of the United

Michelle Leighton Schwartz is Senior Legal Counsel and Director of International Programs at the Natural Heritage Institute. Ms. Schwartz serves as a consultant to environmental and human rights organizations, and intergovernmental agencies such as the International Organization for Migration and the United Nations Environment Programme. Heather Hanson is Research Coordinator for the environment and migration project at the Natural Heritage Institute.

States.⁷ Over 1,000 square miles of lands are desertified annually, forcing more than 260,000 hectares of grazing and crop lands out of production. In addition, only 50,000 square miles of forest are still standing and much of these forest lands are likely to be gone by the year 2000 if cutting continues at current rates. This degradation is largely caused by unsustainable land use practices, but climate also plays an important role. Experts attribute more than 10% of the changes in vegetative cover to climatic conditions. Climate models project that Mexico may become dryer and 2-5 degrees warmer by 2025, with precipitation becoming more erratic. A drought is experienced every five years in one or more regions of Mexico.⁸ Because the majority of Mexican croplands are rain-fed, climatic changes could reduce crop yields by up to 40%, compounding the income risks of 30 million rural residents who are dependent on agriculture. Moreover, this has led to increasing dependence on groundwater, which is now being pumped at rates exceeding recharge. In some principal aquifers, water tables are dropping 1-3 meters annually. The problem is exacerbated by high rates of population growth in poor rural areas—nearly twice the national average. Population trends remain highly correlated with poverty, lack of education and diminishing resources: while the national birth rate stands at 2.5 children per women, in the poorest regions of the country it remains above 4.5.

To keep pace with population growth, the Mexican government will have to create 1 million new jobs each year. Given that at least half of the labor force is already unemployed or underemployed, this level of job creation will be enormously challenging for Mexico. In these circumstances, migration may be inevitable. Moreover, these problems are exacerbated by increasingly uneven resource distribution: between 1990 and 1993, 27 new billionaires were created in Mexico, while millions of Mexican incomes fell to below the official poverty line. Conflicts over land in Mexico are becoming more acute. Many analysts link conflicts in Southern Mexico, particularly Chiapas, to natural resource scarcity arising from land degradation, population growth and economic inequality.

As immigration has increased to the United States, so have tensions over border issues. This is evident in the new U.S. legislation passed by Congress last session. Under the new reforms, only the U.S. Supreme Court will be allowed to issue injunctions against INS policies, severely limiting immigrant access to the U.S. court system. In 1997, the INS budget will rise to \$ 3.1 billion. The INS will expand the number of Border Patrol agents upwards from the 5,100 in 1995 to 10,000 by 2001. The INS will also increase their workplace enforcement activities. In addition, the INS has unveiled an electronic device called the "car stopper," which will help to eliminate high speed chases by allowing Border Patrol agents to electronically disable a

suspect's automobile.

ADDRESSING THE PROBLEM: DEVELOPING INSTITUTIONAL AND POLICY RESPONSES

To the extent that they contribute to migration, current environmental, demographic and economic difficulties in rural Mexico pose serious challenges to reducing migration flows and resolving the long-standing migration conflict. Cooperating with Mexico to meet these challenges should become a high priority among U.S. officials, not only in seeking to address the migration dilemma, but also because Mexico remains important to U.S. geopolitical and economic interests. Our shared border will continue to present opportunities for economic cooperation through many vehicles, including the North American Free Trade Agreement (NAFTA) and the newly created North American Development Bank, a binationally financed effort to promote more equitable development throughout the border region. Moreover, Mexico has ratified the new global Convention to Combat Desertification and Drought. If the United States ratifies the Convention, this treaty could serve as an immediate vehicle for joint programs.

Laws, policies and institutions play an important role in advancing or mitigating environmental degradation, population growth, and outmigration. For this reason, NHI's research program focuses on explicitly determining the existing incentives and disincentives to sustainable management. Regardless of the differences of opinion regarding population, environment and migration, there is a remarkable degree of agreement among scholars that policy changes play an essential role in creating "vicious and virtuous circles" of response.⁹ This means that positive changes tend to be self-reinforcing, as do negative ones. The example of land degradation in Mexico illustrates this well; desertification contributes to climate changes, leading to decreases in rainfall and higher temperatures which then exacerbate existing erosion. Likewise, once migration becomes a well established community strategy, human capital resources and migrant networks make it increasingly difficult to slow or stop migratory flows. This snowball effect also works in the other direction: with positive steps towards soil conservation and greater rural productivity also producing feedback loops for greater positive change, such as reducing migration.

In sum, policies and activities in both the United States and Mexico can create conditions for construction of either vicious or virtuous circles. There is substantial momentum for continued migration: the large wage differential between the two countries, extensive migrant networks, and historic policies to provide cheap labor for agriculture in the United States act as an enormous "pull" in motivating many in Mexico to migrate, while poverty, economic disparity and increas-

ing loss of agricultural lands in Mexico, fueled by population trends, are strong factors which “push” migrants from rural to urban areas and toward the United States.

In stopping this “vicious circle” and in assuring that people are not forced from their homelands in order to make a living, policy makers on both sides of the border will need to address the connections between population trends, environment, trade and migration directly by investigating how to promote the sustainability of livelihoods in rural Mexico. Clearer understanding of the links between these factors is essential to developing policy responses in Mexico and bi-nationally.

NHI’s effort to document this problem, both causes and consequences, also recognizes that analysis of the U.S.-Mexico case study may inform similar work in other regions by improving understanding of conflicts related to environmentally induced population movements. Mexico suffers from many of the same problems endemic in other regions, such as widespread desertification, high rural population growth, and an increasing rural migration.

To accomplish its goals, the Institute has organized a team of researchers to undertake a larger and more in-depth investigation of the physical and human dimensions of desertification in Mexico. The team includes economists, environmental scientists, demographers, and lawyers. NHI has also secured commitments for the participation of officials on both sides of the border, including the U.S. Commission on Immigration Reform (CIR) and U.S. Department of State, Mexican National Population Council, Mexican Secretariat of Government, Mexican Secretariat of Environment, Natural Resources and Fisheries (SEMARNAP). In addition, the team will receive input from the International Organization for Migration (IOM), and the United Nations Environment Programme (UNEP). The investigation will also expand our binational network of NGOs.

Currently, NHI is working with Professor Alain de Janvry of U.C. Berkeley to undertake environmental, economic and demographic analysis of variables from a recent national survey of farm households in Mexico related to land use and cross-border migration. This analysis and data will be the first of its kind and the results will be combined with other research to develop potential policy reforms for both Mexico and the United States. NHI’s findings will be published in a report and presented to officials in both countries, including the U.S. Congressional Commission on Immigration Reform, which has provided support for this study.

ABOUT THE NATURAL HERITAGE INSTITUTE

Founded in 1989, NHI is a non-profit public interest law and consulting organization dedicated to conserving the world’s natural resources. The Institute spe-

cializes in managing multidisciplinary teams of researchers, legal specialists and officials in the study of global environmental issues. Its technical teams are comprised of hydrologists, biologists, water project engineers, modelers, lawyers, sociologists, political scientists and economists. NHI currently collaborates with and counsels over 20 resource management and regulatory agencies at the local, state, and national levels throughout the United States and internationally in Asia, Latin America and Eastern Europe. NHI is also currently undertaking similar efforts in its binational program with the U.N. Development Program in Africa. NHI collaborates closely with local communities and NGOs to exchange experiences, information and technologies for sustainable natural resource management.

Copies of the Natural Heritage Institute’s report, *The Desertification and Population Root Causes of Migration: A Report on Indicators in Mexico and the United States*, can be ordered from the Natural Heritage Institute, 114 Sansome Street, Suite 1200, San Francisco, CA 94104; phone (415)288-0550; fax (415)288-0555; email <nhi@igc.apc.org>.

ENDNOTES

¹ See, “Statement of Principles,” at 7, Report of the International Symposium on Environmentally-Induced Population Displacements and Environmental Impacts Resulting from Mass Migrations, Geneva, 21-24 April 1996 (convened by the International Organization for Migration, United Nations High Commissioner for Refugees, and the Refugee Policy Group).

² Gregoire von Kalbermatten, “Desertification, Environmental Migrations and Conflicts,” *Environmentally-Induced Population Displacements and Environmental Impacts Resulting from Mass Migrations*, *Id.*

³ 50 nations had ratified the treaty by the end of September 1996, the required number to ensure that the treaty would enter into force three months later.

⁴ N. Myers, *Environmental Exodus: An Emergent Crisis in the Global Arena* (Climate Institute, Washington, D.C. 1995).

⁵ *Ibid.* 9.

⁶ While our investigation does not undertake comprehensive analysis of “pull factors,” such as the wage differential, U.S. labor needs, and other U.S. policies, these are also recognized as significant contributors to the problem.

⁷ Much of the western United States continues to be plagued by soil erosion in agricultural areas, deforestation, and excessive siltation of rivers and streams.

⁸ See, Michelle Leighton Schwartz and Heather Hanson, “The Desertification and Population Root Causes of Migration: A Report on Indicators in Mexico and the United States (NHI, October 1996).

⁹ See Robert Repetto, *The Second India Revisited: Popu-*

lation, Poverty and Environmental Stress Over Two Decades.
World Resources Institute, Washington, DC, August
1994.

Erratum

In "The Project on Population, Environment and Security: Key Findings of Research" by Thomas Homer-Dixon in the Spring 1996 issue of the *Report* the diagrams of Figures 2 and 3 were reversed. The corrected version follows:

Figure 2: The Process of Resource Capture



Figure 3: Ecological Marginalization

