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Report on the Status of the Project on

ENVIRONMENTAL CHANGE AND ACUTE CONFLICT

Jointly Sponsored by the American Academy of Arts and Sciences and the Peace and Conflict Studies Program of the University of Toronto

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Project Directors: Jeffrey Boutwell, American Academy of Arts and Sciences; Thomas Homer-Dixon, University of Toronto; George Rathjens, Massachusetts Institute of Technology.[1]

- In early November, 1991, the project convened a third research workshop in Kuala Lumpur at the Institute of Strategic and International Studies (Malaysia). The three-day meeting brought together 30 experts from North America and Southeast Asia to discuss "Environmental Change, Economic Decline, and Civil Strife." It included presentations of case studies on the Philippines and China. A summary of the discussion is attached.

- Following the Kuala Lumpur meeting, project co-director Thomas Homer-Dixon and commissioned researcher Celso Roque traveled to the Philippines to interview a broad range of authorities on the social effects of environmental change (especially upland deforestation and soil degradation) and the influence of these stresses on the country's rural insurgency. Homer-Dixon and Roque also visited the province of Negros Occidental to discuss environment-conflict linkages with the province's governor, rural activists, and land-owners.

- In May, 1992, the Brookings Institution hosted the project's final conference in Washington, D.C., to review its findings and policy recommendations. The two-day meeting included 45 participants and observers from North America, Africa, and South and Southeast Asia. Experts presented reports on energy demand and environmental change, on the social effects of greenhouse warming, and on the consequences of scarcity of environmental resources in the Senegal River basin, the Jordan River basin, the Philippines, and Mexico. A report on this conference is attached.

- The project has initiated collaborative arrangements with the Institute for Strategic and International Studies (Malaysia) and the Peace Studies Institute, Philippines. They join, as collaborating organizations, the Centre for Science and Environment in New Delhi and the African Centre for Technology Studies in Nairobi.

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[1]For more information on the project, contact Boutwell at (617) 576-5021; or Homer-Dixon at (416) 978-8148.

- Project organizers are actively disseminating the effort's findings. *Scientific American* hopes to publish an article by Homer-Dixon, Boutwell, and Rathjens that summarizes the project's theory, case studies, and recommendations.

- Homer-Dixon's article laying out an analytical framework and an agenda for environment-conflict research was published in the fall issue of *International Security* as "On the Threshold: Environmental Changes as Causes of Acute Conflict."

- This summer, the American Academy and the Peace and Conflict Program at the University of Toronto will jointly publish as Occasional Papers several of the project's commissioned papers, including "Water and Conflict" by Peter Gleick; "West Bank Water Resources and the Resolution of Conflict in the Middle East" by Miriam Lowi; and "Pressure Points: Environmental Degradation, Migration, and Conflict" by Astri Suhrke. These Occasional Papers will be circulated to about fifteen-hundred specialists in North America and overseas.

- The Foreign Policy Association in New York has contracted Homer-Dixon to write a monograph surveying the issue of environmental change and global security for high school and college students across the United States.

- Several commissioned authors plan to submit their papers to refereed journals. Sanjoy Hazarika has published excerpts of his work for the project on Bangladesh-Assam migration in the *New York Times* and in newspapers in India.

- This fall, project directors will submit an edited set of commissioned papers to Westview Press for review as a book.

- At the project's conclusion in mid-1993, project directors will prepare a succinct briefing document of findings and recommendations for policymakers in the United States, Canada, and overseas. They will present this document at small briefing sessions in Ottawa and Washington, D.C., and they will also disseminated it through the project's collaborating organizations in developing countries.

- The project has influenced other research efforts. The Center for Global Change at the University of Maryland hopes to begin a study of the links between energy development, environmental degradation, and national and international security in South Asia. Also, Jim MacNeill at the Institute for Research on Public Policy in Ottawa plans to lead an in-depth examination of environment-conflict linkages in Southeast Asia, in collaboration with research institutes in Malaysia, Thailand, Japan, and the United States. Both these efforts explicitly build on the analysis of the Academy/University of Toronto project.

- In Canada, the project has received funding from the Donner Canadian Foundation, the International Development Research Centre, the Canadian Institute for International Peace and Security, the Department of National Defence, and the Rotary Club of Toronto. In the United States, contributors are the Pew Charitable Trust, the W. Alton Jones Foundation, the John D. and Catherine T. MacArthur Foundation, and the Asia Foundation.

Summary of the Discussion at the

KUALA LUMPUR RESEARCH WORKSHOP
on Environmental Change, Economic Decline, and Civil Strife
(November 6-8, 1991)

General Themes

- Five types of conflict might plausibly result from environmental change:
  1. North-South conflicts over mitigation of, adaptation to, and compensation for global environmental problems like global warming, ozone depletion, threats to biodiversity, and decreases in fishstocks;
  2. local conflicts arising directly from local environmental degradation by, for instance, factory emissions, logging, or dam construction;
  3. ethnic conflicts caused by population displacement due to environmental change, both local and global;
  4. civil strife (including riots, insurgency, revolution, and coups d'etat) arising from environmental damage that affects the livelihood of local people, the vested interests of elite groups, and state capacity to meet these changing demands; and,
  5. scarcity-induced war over, for example, water.

- This research project has specifically addressed types 3, 4, and 5 (with the Kuala Lumpur workshop examining type 4). The project's evidence suggests that the fifth type is the least probable. Normal mechanisms of conflict resolution, negotiation, regulation, and cross-payment can be fruitfully used to resolve types 1 and 2. Types 3 and 4, however, are much more difficult to handle with current mechanisms.

- Some analysts of the social effects of environmental degradation argue that it is not so much the degradation *per se* that is important as whether or not people are harmed by it. Human suffering might be avoided if political and economic systems provide the incentives and wherewithal that allow people to alleviate the harmful effects of degradation. To address this argument, we need to know more about the variables that affect the supply and demand of human ingenuity in response to environmental change.

- Two kinds of ingenuity are key. Technical ingenuity is needed for the development of, for example, new agricultural and forestry technologies that compensate for environmental degradation. Social ingenuity is needed for the creation of institutions and organizations that buffer people from the effects of degradation and provide the right incentives for technological entrepreneurs.

- The role of social ingenuity as a precursor for technical ingenuity is often overlooked. The development and distribution of new grains adapted for dry climates and eroded soils, of alternative cooking technologies to compensate for the loss of firewood, and of water conservation technologies, depends on an intricate and stable system of markets, legal regimes, financial agencies, and educational and research institutions. Not only are poor countries underendowed with these social resources, their ability to create and maintain them will be weakened by the very environmental stresses they need to address. These stresses will increase the complexity and pressure of the policymaking setting, and they may

also weaken government institutions.

- The project must emphasize that it is examining the *long-term* linkages between environmental change and its social effects. Many of the social consequences identified by the project's researchers may not be visible for decades.

- Moreover, a longer time horizon resolves an apparent incompatibility between one of the project's central hypotheses and an assumption within conventional development theory. The Kuala Lumpur workshop was convened to examine the hypothesis that environmental change may produce a decrease in economic growth, which can lead to mass discontent, the weakening of the state, and social instability. Several workshop participants focused on a different causal sequence: a government's desire to increase social stability and/or state power will often lead it to promote economic growth, which in turn causes environmental damage. These two views are incompatible only if they are applied within the same short-term time-frame. However, if a longer time-frame is used, the two causal chains can be linked. A government's desire for increased social stability leads to badly planned economic growth, which causes environmental damage; this, in turn, decreases the economy's long-term growth potential, which may eventually contribute to social instability.

- In the short-term there is a perceived trade-off between economic development and environmental protection, which provides states with political and social incentives to degrade their environmental resources. But the real trade-off is between short-term unsustainable prosperity and long-term growth potential. This is a response to the common argument from the South that the North is trying to use environmental issues to deny the South the opportunity to grow: it is in the South's *self-interest* to prevent environmental decline.

- A longer-term perspective is also important when considering the supply and demand of human ingenuity in the face of environmental stress. The time-lags for the delivery of that ingenuity may not correspond to the political and social demands for ingenuity; that is, the ingenuity may not be there when it is needed.

- Over the long-term, four outcomes face a developing country with severely degraded environmental resources.
  1. It may be able to supply enough technical and social ingenuity to permit effective substitution of relatively abundant resources for degraded resources or to allow social adaptation to scarcity. For example, on the technical side, the country might use biotechnology to compensate for salinized land; on the social side, peasants and landowners might learn to share resource scarcity more fairly.
  2. The country might be able to "decouple" itself from dependency on domestic environmental resources by producing goods and services that can be traded for external environmental resources. The decoupling might, in fact, be achieved by rapid exploitation of environmental resources, which allows the accumulation of sufficient capital, plant, and intellectual assets to permit the shift to other forms or production.
  3. If the country is unable to do either of these things, its government's financial, administrative, and political capacity may be so eroded by environmentally induced economic stress that endemic and persistent violence arises, with the country eventually fragmenting as peripheral regions come under the control of renegade authorities.
  4. On the other hand, if the state can capture sufficient remaining resources to allow it to impose control over the society, it may respond to environmentally induced economic crisis by developing into a "hard" regime that is more authoritarian, less respectful of liberal democratic principles and human rights, and more inclined to distract attention from

internal stresses through external aggression.

- However, in terms of environmental change's impact on the security of the international system, perhaps more important are the huge migrations that may this change may produce, and the interruptions of trade that could accompany state breakdown and economic crisis.

- Experts on migration emphasize the importance of "push" and "pull" factors in the decisions of potential migrants. But researchers should also consider the capacity of people to leave their homelands. Many people do not have the financial resources to move; those who do leave are often the skilled and semi-skilled workers who can afford it.

- When considering the domestic economic consequences of environmental change, researchers must make a distinction between inequality and inequity. The crucial variable linking the former to the latter is people's subjective sense of what is just, of what they deserve, that is, their theory of the "social good." An increase in inequality and impoverishment may not be interpreted as an increase in inequity, and therefore may not pose a threat to the social system.

- For economic crisis to induce civil strife, it must be sufficiently severe, persistent, and pervasive to undermine the perceived legitimacy, or moral authority, of the existing social order and system of governance. Moreover, the structure of opportunities facing groups challenging authority must limit the peaceful expression of grievances but offer opportunities for violent action.

- Other factors influencing the development of civil strife include the extent to which the state is autonomous and centralized; the extent to which elites control sufficient resources to exert leverage over the state; the nature of civil-military relations and perceptions of the legitimate role of the armed forces; the autonomy and organizational coherence of peasant groups; and the nature of international shocks and pressures (such as changes in trade and debt relations, and in costs of imported factors of production like energy).

- Researchers should remember that in many developing countries, the state already controls the majority of natural resources. This makes the state an attractive political prize in situations of instability.

- Several participants suggested that the research project has been too negative about the consequences of environmental change. Population movements, economic decline, disruption of institutions, and even conflict can have positive as well as negative social effects. In particular, mass mobilization and some forms of civil strife can produce opportunities for constructive change in institutions, the distribution of land and wealth, and processes of government. It is important, therefore, to emphasize the different types of civil conflict that may result.

Case Study: The Philippines

- Celso Roque described the environmental situation in the Philippines and its social consequences. There are no large areas in the country that can be opened up for new agriculture; and the Filipino fisheries -- at 1.8 million metric tons extracted per year -- have reached the limit of sustainability. In general, the sustainable yield thresholds have been reached or surpassed for all Filipino ecosystems.

- He noted that interviews with Filipino insurgents suggest that their primary motivation is a desire for economic equality. He argued that environmental degradation reinforces economic decline and inequality.

- In the Philippines, the uplands are a public resource, yet many upland peasants are under the authority of concessionaires and absentee landlords who have claimed this resource. Some participants argued that mass mobilization and conflict might help solve these problems.

- Logging concessions are interpreted as encomiendas by Filipino concessionaires, which means they are regarded as exclusively available for private resource extraction. As a result, the central government captures little more than 10 percent of logging's economic rent; this revenue loss prevents the government from improving agricultural infrastructure and land distribution, policies which might, if implemented, encourage peasants not to migrate to the uplands.

- Some workshop participants argued that researchers must develop a political-economic analysis of environmental decline in the Philippines. They should in particular specify the roles of the state and class. The Filipino state, they suggested, has historically reflected the capitalist interests of the elite, and has been a mechanism for plunder not democratization.

- Significant and lasting resolution of environmental problems in the Philippines will require a revolutionary change of the country's social structure. The current system is fundamentally corrupt. For example, many of the regulators of resource extraction are intimately involved in the extraction process itself.

- Some participants suggested that even an immediate and sharp improvement in the social, political, and economic system will not produce quickly enough the needed changes in consumption and resource extraction behavior. Filipino population growth is still one of the highest in East Asia, and in many places the population density is higher than in China. The production of foodstuffs is virtually static. Hundreds of thousands of people are moving to Manila, where they have to be fed, housed, and employed. These physical trends have a momentum of their own that cannot be deflected through changes in the country's political economy in less than a generation.

- Other participants, however, held out hope for dramatic changes in social institutions and behavior in the Philippines. Good leaders might give people hope, inspire them to alter their lifestyles, and encourage them to work for truly democratic institutions. Several participants urged that we not underestimate human beings' vast capacity for learning and creativity in the face of severe difficulty.

- It was agreed, however, that the general public in the Philippines no longer expects their political leaders to produce substantial social change. One result has been an explosion of non-governmental activity. There are nearly 2,500 non-governmental organizations (NGOs) working on environmental issues in the Philippines. These groups are active from the village to national levels, but they do not effectively coordinate their actions. The Filipino Department of Environment and Natural Resources has deliberately tried to create an environmental constituency by encouraging the activity of environmental NGOs. In addition, some local politicians have started their own NGOs. Even these groups (established out of expediency) can become potent forces in their own right. Although there is not yet broad popular support for environmental issues in the general public, there is some evidence that environmental NGOs are influencing the behavior of politicians.

Case Study: China

- Vaclav Smil gave an account of China's dire environmental problems. In his view, the Chinese environmental situation will deteriorate much further, and, as a result, new conflicts will emerge at levels unseen in recent Chinese history.

- He estimated the combined effect of environmental problems on current economic productivity. The main economic burdens are reduced crop yields caused by water, soil, and air pollution; higher human morbidity from air pollution; farmland loss because of construction and erosion; nutrient loss and flooding due to erosion and deforestation; and timber loss arising from poor harvesting practices. Smil calculates the current cost to be at least 15 percent of China's GDP, and he is convinced that the toll will become much heavier during the coming decades.

- There are severe difficulties estimating gross economic activity in China and converting these figures into dollars. Perhaps because of this, the World Bank has not increased its estimates of per capita annual GNP in line with the rapid expansion of the Chinese economy over the last decade. Their current estimate of $300/capita/year may be too low by a factor of three to four.

- However, much of this new wealth has been concentrated in the coastal provinces, especially around Hong Kong, while many parts of the country remain desperately poor. In general, when examining the Chinese situation, researchers must try to disaggregate the national economic, morbidity, and mortality statistics to identify the extreme differentials of wealth in the country. Aggregated national statistics may conceal a rapid increase in hardship in certain regions affected by environmental damage.

- Birth rates peaked at the height of the cultural revolution between 1969 and 1972. This means than peak absolute population growth will occur between 1993 and 1997, at about 21 million/year. These estimates, however, assume that the one-child policy will continue. But market liberalization in the countryside has undermined this policy. In rural areas there is less scope for state coercion, except through fines, which the peasants can now more easily pay. In some provinces, therefore, it has become common for families to have two to three children.

- Over the next decades, tens of millions of Chinese will try to migrate from the country's impoverished interior and northern regions, where water and fuelwood are desperately scarce and the land often badly damaged, to the booming cities along the coast. Bitter disputes are probable among these regions over water sharing and migration. In combination, these economic and political stresses may greatly weaken the Chinese state.

- Population stress and social turmoil in China might also lead to a huge movement of population into Southeast Asia. Already, up to 10 million people have entered Thailand from China and Burma.

- Population growth will negate all improvements in energy and fertilizer efficiency in the next twenty years. Within that time, the country will double its coal production from one billion to two billion tons per year. China has just built six CFC plants. By 2010, therefore, the country could be producing 20 to 25 percent of the world's emissions of greenhouse gases, and this may lead to severe disputes with the developed world over responsibility for greenhouse warming.

- Only two countries in the world have less arable land per capita than China: Egypt and Bangladesh. In fact, 350 million people living in the provinces have less arable land per capita than even in Bangladesh. There is no significant prospect for extending irrigated and arable land in the country, although there is some possibility of increasing the intensity of irrigation. Every year, the country loses as much nitrogen and phosphorous from soil erosion as it applies in fertilizer. In many places, the quantity of fertilizer used per hectare is now 2 to 2.5 times as much as used in Japan, and the marginal returns are negligible.

- Ten to fifteen million people in northern China have insufficient drinking water. Some have to walk up to fifteen kilometers to get water.

- The scarcity of forest products -- whether as firewood, lumber, or pulp -- is critical and has become a major constraint on development in much of the country.

- Many experts and senior authorities in China are frightened by the environmental situation and believe that the society has already crossed critical thresholds of sustainability. "Grain" is a constant preoccupation of the leadership, and the country may soon have to import grain even into rich areas.

- Civil strife in China arising from environmental change has been rare, because until recently the government has had many mechanisms in place -- including ideology, bureaucratic control, and the police -- to suppress conflict. Consequently, when we find evidence of even small-scale conflicts arising from environmental damage, we can conclude that it is producing great social stress.

- The projections for China do not necessarily mean that large numbers of people will starve due to a simple scarcity of food. They might starve because the food is not distributed effectively or because they lack entitlement to it. Such a situation might arise, in part, from the indirect effects of environmental change on state capacity, elite competition, and economic policy.

Environmental Change and Acute Conflict
A Joint Project of the American Academy of Arts and Sciences and the Peace and Conflict Studies Program at the University of Toronto

Summary of the Discussion at the

REVIEW CONFERENCE
(May 11-12, 1992, Brookings Institution, Washington, D.C.)

The conference dealt with several key questions raised by the discussions in the previous workshops. These were:

1. Are scarcities of renewable resources more likely to produce severe social stress and conflict than scarcities of non-renewable resources?
2. What is the role of environmental change as a cause of conflict? Is it best seen as, for example, a trigger that releases accumulated non-environmental social pressures; or as an underlying stress that is causally distant yet powerful?
3. Will global warming and climate change increase the probability of conflict?
4. What are the policy recommendations of the project?

The following are some of the most important points raised at the review conference in response to these questions.

1. Scarcities of Renewable and Non-renewable Resources

- In his opening remarks, project co-director Thomas Homer-Dixon noted that in the course of the last two years, the project has coined the term "environmental scarcities" to refer to scarcities of renewable resources. This term encompasses scarcity of renewable "goods" such as fisheries and timber, and scarcity of renewable "services" such as agricultural soil and a benign climate.

- Human-induced environmental scarcity can arise in three main ways. First, human activity can either reduce the quantity or degrade the quality of an environmental resource faster than the resource is renewed. Second, population growth can reduce the per capita availability of a renewable resource. Over time, for example, a given amount of arable land might have to be divided among more and more people. Third, a shift in the distribution of a resource within a society can concentrate the resource in the hands of a few people, and subject the rest to extreme scarcity. The property rights that govern resource distribution often change as a result of large-scale development projects or new technologies that alter the relative values of resources.

- Homer-Dixon noted that many economists regard scarcities of renewable and non-renewable resources as equivalent: if either type of scarcity is fully reflected by market prices, it will stimulate conservation, resource substitution, and technological innovation. During the 1970s, many people holding the "limits to growth" view also made little distinction between the two types of scarcity, predicting that either would constrain economic expansion.

- The experience of the past twenty years has shown that market mechanisms can stimulate very powerful substitution effects for non-renewable resources. However, we appear to be rapidly approaching critical limits for renewables.

- Homer-Dixon argued that, in contrast to non-renewables such as fossil fuels and iron ore, the stocks of most renewables are sustained by flows generated within dynamic, causally interdependent systems of resources. These systems are characterized by many nonlinear and feedback relationships among their variables. The overextraction of one resource in such a system can lead to multiple, unanticipated environmental problems and sudden scarcities as the system passes critical thresholds. This combination of "concatenation" and "threshold" effects increases the complexity and urgency of the resource-substitution task and thereby decreases human capacity for substitution.

- John Holdren introduced a number of distinctions between non-renewable and renewable resources. In contrast to non-renewables, renewable resources tend to be harder to transport, harder to substitute, harder to stockpile, and harder to expand by technology and price. He argued that we are more dependent on ecosystem and natural processes and less on technology than we commonly believe; moreover, we are further along in eroding the integrity of these systems than commonly supposed.

- Historically, Holdren claimed, resource scarcities have caused conflict in four ways: 1. they have been the "root cause" of conflict (when one society has tried to increase its share of resources by seizing those of another); 2. they have been a proximate cause of conflict (when a resource scarcity has triggered a conflict that has had deeper roots in, for instance, ethnic or political rivalry); 3. they have served as the means for conflict (when a society has damaged or destroyed the resources of another to further its strategic aims during a conflict); and 4. they have served to rationalize conflict. In the past, 3 and 4 have been more important than the first two; but in the future, it appears, that 1 and 2 will become more important for renewable resources.

2. *The Causal Role of Environmental Change*

- Environmental change can play many different roles as a cause of social turmoil and conflict. In some cases, for example, it acts as a trigger allowing long-standing ethnic, political, and economic grievances to burst to the surface as violence. In other cases, environmental change produces powerful underlying stresses in a society -- such as population movements, economic hardship, and severe intra-elite competition -- that "set the stage" for other political or economic factors to trigger conflict.

- Homer-Dixon emphasized that researchers should therefore keep distinct in their minds a number of variables that can be used to describe the causal role of environmental change as a contributor to social conflict. Is the environmental change a *necessary* cause of the conflict? Is it a *weak* or *powerful* cause? A *proximate* or *distant* cause? Is the change *exogenous* or *endogenous* to the causal system? Is the causal model proposed *unicausal* or highly *multicausal*? Does environmental change *interact* with other variables to produce its effect, or is its effect *additive*? Are the functions describing the relations between the variables in the model *linear* or highly *non-linear*? Commentators on the social impacts of environmental change often conflate these variables. Researchers should recognize that although they cannot avoid using the concept of "cause," it is in many ways a fuzzy "folk" concept that is useful in our everyday folk explanations of physical and social events but is not always serviceable in more precise settings.

- Most participants agreed that complexity and context-dependency do not undermine the project's central conclusion that there are important linkages between environmental change and conflict.

- Stochastic effects and extreme events are particularly important as we investigate the social effects of environmental change. The buffering capacities of developing societies can be quickly overwhelmed when the "100-year" drought, flood, or storm starts to occur every 10 years.

3. *Population Displacement and the Causal Role of Environmental Change*

- Astri Suhrke addressed the issue of causal role of environmental change in the context of a presentation on environmentally induced population displacement. She had seven key points.
  1. Environmental change is just one of many factors that can cause population movements, and its principal role is to magnify the effects of other factors.
  2. Researchers should distinguish between migrants and refugees. Environmental refugees will appear only when there is a sudden and large environmental change. The principal population movement resulting from environmental change will be in the form of migration; and these migrants will tend to blend indistinguishably with migration streams due to other causes.
  3. The numbers of people displaced by environmental change are often very low, because the population densities in the affected areas tend to be low.
  4. Conflict is more probable if the receiving societies have low social and economic buffering capacity.
  5. Refugees tend to be weak, which limits there ability to organize and to make demands on the state of the receiving society. The likely result, therefore, is structural violence rather than overt violence. This will be in the form of silent misery and death, with little destabilizing effect on the receiving society.
  6. States play a critical role in determining whether population displacement causes conflict; displaced groups often need the backing of a state before they have sufficient power to induce conflict.
  7. Migration can ease labor shortages in the receiving society. The capacity of societies to absorb migrants and prevent conflict is often striking.

- Some of the experts on South Asia present at the conference argued that land scarcity was the main reason for migration from Bangladesh into India, combined with, perhaps, greater frequency of severe floods due to upstream deforestation. However, another participant suggested that there was easily enough land in the country. He stressed that Bangladeshi institutions impede effective water control and keep peasants from gaining full benefit from some of the most fertile land in the world.

- Despite popular perception and the claims of UNEP, the western Sahel is a robust ecosystem that does not exhibit extensive desertification. There is no southward march of the desert. The pressures on grazing resources, and the consequent migration of people from the region, arise from the expansion of sedentary farming and population growth that together concentrate pastoralists on smaller areas of land. In general, pastoralists are weak in face of modern African states; state development since decolonization has often changed property rights at their expense.

4. *Civil Strife and the Causal Role of Environmental Change*

- Jack Goldstone interpreted the causal relationship between environmental change and conflict in light of his research on population growth and civil strife. He noted that the

linkages between demographic change and conflict are non-linear and indirect, but strong and robust nonetheless. On the basis of his study of early-modern and contemporary societies, Goldstone emphasizes the role or population/resource ratios. A rapid deterioration of these ratios -- whether by population growth or resource decline (perhaps through environmental degradation) -- can induce daunting social and political stresses. Although habit and coercion can maintain the facade of state and system legitimacy, political conflict may become crippling well before resources are exhausted. Stochastic events (whether political, economic, or environmental) can provide challenger groups with an opportunity for action against a state whose capacity has been gradually eroded by deteriorating resource balances. Distributional conflicts may overpower institutions that normally resolve such conflicts.

- Goldstone noted that three factors appear to be key precursors to rebellion and revolution: mass mobilization, often because of economic discontent; elite disaffection; and decreased state capacity to allocate resources, regulate conflict, and support basic rights.

- The North often proposes to the South strategies for technological and economic development that were originally followed by the North in a context of low population/resource ratios. Today, population densities in the South are often much higher in relation to resources, and thus the Southern starting point for the implementation of economic development technologies is different than it was for the North.

5. *Climate Change and Conflict*

- A number of participants argued that the rate and magnitude of climate change will induce new stresses on human society at a time when they are already stressed by other demographic and resource pressures. The change may be too fast and complex for societies that have limited buffering capacity; and economic, political, and technical structural factors -- such as capital and information availability -- constrain societies' ability to react. Other participants responded that the economic impacts of increasing concentrations of greenhouse gases are as yet unknown, and some may be positive; the evidence, they suggested, does not yet justify large investments in controlling greenhouse emissions.

- Diana Liverman said that Mexico is extremely vulnerable to climate change. Historically, environmental degradation -- especially declining soil fertility -- appears to have played a key role in the collapse of mezzo-American civilizations. Today, we see people leaving Oaxaca in large numbers because of drought and soil erosion. Moreover, water scarcity is already a cause of real structural violence in many Mexican cities. In the future, global warming could produce a decrease of forty percent in Mexican rainfed agriculture, which, in combination with free-trade (Mexico's comparative advantage is in water-intensive fruits and vegetables) and the privatization of communal peasant lands, could bring great suffering and conflict.

6. *Policy Recommendations*

Many politicians and policymakers now perceive good environmental policy as a source of political legitimacy. Although the project has just begun to formulate recommendations on the basis of its findings, conference participants made the following suggestions.

- The intelligence community is an important target for the project's recommendations.

However, in contrast to the standard practice of intelligence organizations, openness and free-availability of environmental data must be an overriding norm in international discussions of environmental problems.

- In response to resource scarcity, policymakers tend to emphasize increasing supply rather than decreasing demand. In the future, policy solutions will have to be applied particularly to the demand side of the scarcity problem.

- Policymakers in North and South must change their conception of development to emphasize the value of natural resources and the importance of efficiencies in production as a way of conserving resources.

- If large-scale population displacement is induced by environmental change, countries should develop regional accords to stem the migration. Unfortunately, large movements of people can undermine goodwill and halt negotiations on regional cooperation. In general, when addressing environmental problems, regional, basin-wide, or ecosystem-wide resource management is preferable to solutions based at the national level.

- Some successful cooperative solutions to regional environmental problems -- like the International Joint Commission between Canada and the United States -- may be transferable from one region to another. Numerous international institutions exist to manage water supplies, but they are often inflexible. For example, the U.S./Mexico and Egypt/Sudan agreements allocate *fixed* amounts of water, where proportional allocation would be a more reasonable method in a situation of increased variability of precipitation.

- Population control requires collaboration between rich and poor countries. Wealthy countries can usefully supply financial aid and technology for population control, although the United States has sharply curtailed its support for such programs. Developing countries are often resistant to population control for political and ideological reasons; Islamic fundamentalists, for example, are opposed to birth control. In addition, population size is often an issue of "high politics," because it is perceived to bear on military security.

- Rich countries can also support land reform in developing countries, reduce the debt burden of these countries, and promote, through aid and transfers of appropriate technologies, rural industrialization projects. Poor nations under pressure from banks and international lending agencies to pay their external debts often use their best lands to grow cash-crops for export. As people are displaced from these lands, governments and development agencies can work to provide them with jobs. Ideally, land reform coupled with labor-intensive rural industries would boost incomes and stem the flow of people into ecologically vulnerable areas and into cities that are increasingly unmanageable.

- The developed world can help poor countries overcome their lack of expertise on environmental management. In the developing world, national inequality in expertise translates into inequality in national power. It is cost-effective for developed countries to provide funds for the training of environmental experts in the developing world, including hydrologists, soil and agricultural scientists, foresters, demographers, energy-systems engineers, and fisheries specialists. If research and teaching centers are adequately equipped and staffed, the brain drain from poor to rich countries might be stemmed. Moreover, networks of such centers established across national boundaries could initiate wider cooperation among a region's countries.

- Wealthy countries can also help environmental advocacy groups in developing countries by

supplying the basic communication and data processing technologies they need. In the Philippines, twenty-five hundred non-governmental organizations are involved in environmental research, education, and political action at all levels of society. Their effectiveness can be multiplied by aid for the purchase of personal computers for word processing, hard-disks for data storage, and printers and modems for information dissemination. The developed world should promote the work of these organizations within and across national boundaries.

- In light of her experience with the Academy/University of Toronto project, Diana Liverman offered some guidelines for future environment-conflict research: 1. it should explicitly search for a range of behaviors induced by environmental change, including adaptation and cooperation as well as conflict; 2. it should more precisely interrogate case studies, and environment-conflict linkages should still be framed as hypotheses; 3. researchers should ask people in the field -- peasants, farmers, and local government officials -- if environmental change leads to conflict; and, 4. they should be clear about the scale of conflict that might result from environmental change.

CONFERENCE PARTICIPANTS

Jeffrey Boutwell
James Boyce
Sergio Diaz-Briquets
Joshua Epstein
Leon Feurth
Peter Gleick
Jack Goldstone
Fen Hampson
Shaukat Hassan
Sanjoy Hazarika
John Holdren
T. Homer-Dixon
Michael Horowitz
Mohd Jawhar Hassan
Stephan Kloetzli
Mary Kritz
Shin-wah Lee
Mark Levy
Diana Liverman
Miriam Lowi
Irving Mintzer
William Moomaw
Thomas Naff
John Nielsen
Charles Okidi
George Rathjens
Laura Reed
Celso Roque
Blair Seaborn
Seth Shulman
Vaclav Smil
John Steinbruner
Astri Suhrke
Timothy Wichert