The North-South Knowledge Divide: Consequences for Global Environmental Governance

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SUMMARY

This chapter argues that there is a knowledge divide between the North and the South resulting from the substantial difference in accumulated scientific knowledge about the two regions and their current unequal capacities for generating new knowledge. It outlines the consequences of the divide for global environmental governance, including the risk that (1) issues of the South will be less visible on the global governance agenda, (2) that "globalized" knowledge generated in other ecological zones and socioeconomic settings is less representative for conditions in the South, and (3) that as a result, the South is unable to participate on equal terms in global governance.

This chapter further discusses two main strategies for addressing these consequences. The first strategy involves improving the generation of new knowledge about the South. This could be accomplished by strengthening the scientific community in the South, encouraging the scientific community in the North to carry out more research on the South, and expanding the groups that participate in the generation of new knowledge. The second strategy entails changing how decisionmakers in global institutions deal with scientific knowledge. This could be done by facing uncertainty with greater resolve, making better use of existing knowledge about the South, and incorporating alternative sources of knowledge.

THE NORTH-SOUTH KNOWLEDGE DIVIDE

> I see not just a gulf, but a yawning gulf, between the industrialized countries and the developing countries in terms of sheer numbers of scientists and engineers. (Serageldin, 1998: 43)

The world's scientific community is heavily dominated by developed countries, whether one looks at resources, the number of researchers, or scientific "production." OECD countries contribute ninety-four percent of the indexed scientific literature. Moreover, measures of inequality between countries are more pronounced in scientific expenditures than in income: although the average per capita income of the thirty OECD countries is about sixty times greater than that of the roughly fifty countries classified by the World Bank as "low-income economies," average expenditures on science and technology per capita in the former are 250 times greater than those in the latter (Sagasti and Alcalde, 1999). More than ninety-six percent of world patents are registered by Japan, the countries of Western Europe, and the United States (Shrum and Shenhav, 1995).

The number of scientists/engineers per million inhabitants in developing countries is 200 on average, while in developed countries, it is 2,800 on average (Serageldin, 1998). Of course, the picture varies greatly across developing countries, and a number of them have significant research capacity. India, for example, has the third most populous scientific community in the world (Kandlikar and Sagar, 1999: 121). Africa, on the other hand, with fifty-three countries, has only nine merit-based science academies (Hassan, 2001).

Developed and developing countries tend to group into two very rough physical and climatic categories. Developing countries, which I refer to here as the "South," are primarily located in sub-tropical or tropical ecosystems. Developed countries, or the "North," occupy mainly temperate and arctic climates and ecosystems.[1] Many commentators point out that the amount of research in environment-

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1 Obviously this categorization of the world into South and North is a gross simplification. Exceptions, for example, include Australia and the southernmost parts of the United States in the North, and the extensive arid regions of the South. Both categories encompass countries with vastly different levels of economic development, among other differences. The World Bank, for instance, uses four categories in its classification of economies by income (World Bank, 1999). Nevertheless, because I wish to focus on the distinctions between *both* ecosystems and socioeconomic systems (see discussions in later sections), I confine the discussion in this chapter to the two categories of North and South.

related disciplines such as biology, ecology, and ecotoxicology carried out in sub-tropical and tropical regions is very small compared to research in non-tropical latitudes (Bourdeau et al. 1989; Lacher and Goldstein, 1997). In addition, the North and its temperate and arctic ecosystems are sometimes cited as the "normal" or "standard" type in ecological sciences (Pomeroy and Service, 1986).

The knowledge divide comprises multiple gaps – in basic environmental and social data, monitoring of change, assessments, and more comprehensive research on human and social systems.

The Data Gap

The data gap is fundamental, since data availability is critical for monitoring, assessment, and further research. As stressed by Hales and Prescott-Allen in this volume, even in industrialized countries, data are often too limited or too disparate to be usable.[2] In developing countries, however, "even the most basic statistics are often lacking" (UN Economic and Social Council, 2001) and "[m]onitoring and data collection infrastructure of most developing countries is severely handicapped or non-existent" (UN System-Wide Earthwatch, 2000).

The data gap is manifest for both local and global issues. Information on mercury poisoning among populations in the Amazon, for example, is largely absent, and yet pollution levels of mercury from gold mining operations are significant (Lacher and Goldstein, 1997). Knowledge in the South about the effects of the use of agricultural pesticides on human health and ecosystems is also eextremely limited (Karlsson, 2000).

In the area of global environmental change, the North carries out almost all basic research and analysis, and the relevance of the results for developing countries is not usually assessed (Gutman, 1994). Yet, it is those countries that are most likely to be negatively affected by global

2 The scope of this gap is spelled out in the Environmental Sustainability Index (WEF, 2002). As Esty (2002) argues, the importance of sound data as the foundation for environmental decision-making – at the global, regional, national, local, and corporate scales – cannot be overstated.

warming (Redclift and Sage, 1998).[3] One of the exceptions to this pattern is India, which has a community of climate researchers. Their research focus, however, has been almost exclusively on the impact of climate change on coastal zones and agriculture, and hardly any of the results have been published (Kandlikar and Sagar, 1999).

The limited contribution to the body of scientific knowledge on global environmental issues from developing country scientists is not only a reflection of the unequal research capacity, but is also a result of different research priorities. Environmental issues of more acute local importance, rather than on a global scale, are engaging scientists in developing countries (Biermann, 2001; Gupta, 2000; Commission on Developing Countries and Global Change, 1992).

The knowledge divide between North and South regarding environmental issues could, from a historical perspective, be seen as just a phase of the scientific development process. It could be regarded as simply a knowledge gap that remains to be filled through more research. However, when science, both natural and social, is entering the policy process as the basis for environmental governance at the global, regional, and national levels, the knowledge divide becomes more than a purely scientific issue. It may have political consequences.

CONSEQUENCES OF THE DIVIDE FOR GLOBAL ENVIRONMENTAL GOVERNANCE

The international policy debate is in no small part shaped by the arguments emerging from scientific research and analysis (Kandlikar and Sagar, 1999: 133). Policymakers put strong faith in science, particularly in natural science, to discover environmental threats, interpret the

3 The IPCC finds that most of the less-developed regions are particularly vulnerable to climate change, both because a larger share of their economies is in climate-sensitive sectors and because they lack the resources to adapt. For example, small island states and low-lying coastal areas are especially vulnerable to a rise in sea level and to storms and have a limited capacity to respond to such events (IPCC, 2001: 16).

consequences, and even suggest policy options. At the global governance level, this is illustrated by the fact that "scientists represent the only members of civil society to be consistently asked to advise government representatives" (UNEP, 2000: 13).

There are a number of scientific advisory processes at the global level through which scientists are invited to give advice on environmental issues. Scientific expertise is sought in intergovernmental bodies like the Intergovernmental Panel on Climate Change (IPCC), in *ad hoc* expert groups to various conventions, in bodies that develop technical standards and global assessments on the state of environmental knowledge, or in capacity building and multilateral aid projects.

These scientific advisory processes contribute in three principal ways to intergovernmental deliberations (UNEP, 2000):

- Catalyzing action by using science to set the terms of the debate;
- Ensuring a significant scientific component in negotiations;
- Establishing authoritative scientific standards for policy deliberations, decisions, and implementation.

Science is of significant importance to global deliberations. Relevant questions in relation to the North-South knowledge divide then become:

- What knowledge do decisionmakers in global institutions consider?
- If the desired knowledge is available, how it is used?
- What type of influence does it have on the content and character of global environmental governance?

Issues of the South Remain Off the Global Agenda

Many argue that environmental issues addressed by governance at the global level tend to be those on the priority agenda of Northern countries (Agarwal, Narain, and Sharma, 1999; Gutman, 1994). These are usually issues of a "global character," often including climate change, ozone depletion, and biodiversity. While the effects of climate change are likely to be most adverse and severe primarily for developing countries, these countries are the ones faced with more pressing immediate

concerns. Redclift and Sage (1998), for example, claim that for many in the South, the global environmental agenda is "essentially a Northern agenda, of little relevance to them." The issues on which attention is focused are often far from the experience of environmental degradation of poor people in hamlets, villages, towns, and mega-cities in large parts of the world, where "the 'environment' consists of problems associated with health, shelter, and food availability" (Redclift and Sage, 1998: 501). These environmental issues, which the South prioritizes, are less visible on the global agenda.

The comparative invisibility of environmental issues prioritized by the South can be linked to the North-South power gradient within the current international system, where the more powerful countries set the agenda. Nevertheless, it can also be argued that Northern dominance in setting the agenda is often supported by the invocation of science.

It is difficult for the South to put up science-based arguments for alternative issues to prioritize. As Gutman (1994: 390) argues, the South "is unable to express its environmental priorities or assess the costs and benefits of the international environmental agenda put forward by the North." Agarwal et al. comment on the power of scientific discourse in setting the agenda, and how that handicaps the South:

> The focus on science can easily divert attention from problems that have a focus in other issues like poverty. A science-based environmental agenda is more likely to be an agenda determined by the science-rich North, which can neglect the environmental concerns of the poor nations. (Agarwal, Narain, and Sharma, 1999: 5)[4]

Issues of the South – Invisible Even When on the Agenda

While the discussion above is concerned with the issues that make it to the global governance agenda, there are issues that are already on

4 Agarwal et al. here make use of the common definition of scientists as natural scientists, in this case environmental scientists. I would argue that scientists in other disciplines, such as sociology, economics, and development studies, do focus on other issues like poverty as subjects of study.

the agenda but whose relevance for countries in the South remains invisible due to lack of scientific data.

The Sanitary and Phytosanitary Agreement

The WTO agreement on Sanitary and Phytosanitary measures (SPS Agreement) illustrates this point.[5] With increasing trade and stricter standards established in importing countries, the issue of pesticide residues in agricultural products has gained in importance. The Agreement mandates that standards for the levels of pesticide residues in traded agricultural products — the Maximum Residue Limits set by the Codex Alimentarius — should be accepted by all parties to the Uruguay Agreements. These standards have thus become, indirectly, legally binding for the member countries of the WTO.

Developing countries, however, have problems in generating residue trial data because the industry, which provides these data, only does so for crops of major economic importance (Codex Alimentarius Commission, 1997). The absence of Maximum Residue Limits for pesticides on crops that developing countries export can be a serious hindrance to trade.

Industrialized countries have well-developed and enforced national legislation, as well as the capacity to produce residue trial data. Developing countries, on the other hand, often lack this capacity. Therefore, the globally agreed upon rules are least useful for those countries which in theory would benefit most from such coordinated regulations.

Toxic Substances

Another case in point can be found in the provisions of the multilateral environmental agreements that address toxic substances posing health or environmental risks. The process of adding substances to the agreements requires a large amount of data showing the level and type of risk. Notably, the Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (the Rotterdam Convention) of 1998 includes as one of

5 For a detailed description of the Sanitary and Phytosanitary Agreement and its implications for developing countries, see Karlsson (2000).

the essential criteria for adding further hazardous pesticide formulations to the Convention the "reliability of the evidence that the use of the formulation" causes health problems (United Nations, 1998).

In this and other cases, developing countries face the risk of having their priority substances of concern not addressed due to lack of hard evidence of the health effects. There is little research in these countries on risks from chemicals. The types of specific chemical risks they face — which often come from the particular socioeconomic, institutional, and cultural circumstances in which the substances are used in developing countries — may therefore not appear on the priority lists of Northern countries. For instance, pesticides that may be used under strict safety conditions and without significant risks in developed countries, may pose significant health risks in developing countries when used by uneducated farmers without protective gear.

Inappropriately "Globalized" Knowledge

Another consequence of the knowledge divide occurs when "globalized" knowledge is not appropriate for situations and problems in the South. At the global level, scientific knowledge is often collected, analyzed, and summarized into assessments of particular environmental problems. These efforts create a scientific foundation for decisionmaking at the global level.

When most of the information assembled at the global level, or incorporated into global models, is generated in non-tropical latitudes and in developed countries, the assessments may be less valid for environmental problems in the South for the following reasons:

- There are unique ecosystems and species of both ecological and economic importance in the South that are only marginally present in some developed countries (e.g., rain forests, mangroves, and coral reefs), and may not be sufficiently accounted for in global assessments.

- There is a range of managed systems (agricultural, silvicultural, and aquacultural) equally unique to the tropics and sub-tropics.

- Northern analysts may have unfounded assumptions, among other things, about patterns of human behavior – for example, that agricultural workers will wear protective clothing at all times while spraying pesticides.

- The type of diet, body weight, and general health conditions assumed in the determination of tolerable levels of toxic substances in the human body may be different. A level of contamination by a substance in a food crop that is a marginal part of the diet can be relatively higher than in a food crop that serves as the staple food. People already weakened from other diseases or malnutrition may also be more sensitive to toxic substances than the average healthy person in a developed country.

The lack of good data, as well as the knowledge and science divide, contribute to the relative invisibility of Southern issues on the global governance agenda. In the area of climate change, for example, assessments have sometimes been inaccurate. The Indian Methane Campaign was launched in 1991 in response to climate change studies done abroad, including a study by the U.S. Environmental Protection Agency (EPA, 1990), which attributed large emissions of methane to Indian sources. The campaign made its own assessment of Indian methane emissions and denounced the EPA's findings (Kandlikar and Sagar, 1999: 123).

Biermann (2001) cites the Indian scientists' criticism of the IPCC regarding the lack of a separate chapter in their report on the monsoon, which is a central concern for research on climate change from their perspective. Furthermore, the modeling of the cost of carbon emission mitigation carried out for developing countries by scientists in the North is not satisfactory because "it is generally characterized by a lack of sensitivity to the differences between developed and developing countries" (Kandlikar and Sagar, 1999: 130).

Although it might be expected that data from the North would be misleading if merely extrapolated to the South, the extrapolation is done time and again. Of course, tendencies to disregard local variability on both global and local environmental issues can be interpreted as a pragmatic approach when there is a lack of local data. Whatever the reason, however, biases and inappropriateness for the conditions in developing countries are strongly noted in the South, particularly by scientists who are often excluded from the global scene. The knowledge divide can thus impair global deliberations, when they are based on an unsatisfactory understanding of the geographically distinct causes and effects of the global problems.

Inadequate Participation of Developing Countries in Global Governance

Another major consequence of the North-South knowledge divide pertains to the inadequate participation of developing countries in the provision of knowledge for global policy and action. The lack of national scientific capacity weakens the position of developing countries in multilateral negotiations and their participation in the conventions. Even in institutions designed to be "global," such as the IPCC, there is an enormous disparity in North-South participation.[6] Not only do developing country officials lack scientific input from their own researchers, but they also experience significant difficulty in coping with the masses of scientific and economic documents coming from the West.

The lack of developing country science raises the question of a Northern bias in global assessments. It appears that the Northern bias may be more pronounced as one moves further from basic science (Kandlikar and Sagar, 1999). Moreover, global environmental assessments often fail to explicitly address value considerations, such as equity (Biermann, 2001), which is of particular relevance to developing countries.

In the environmental domain, both the strong dependence on science (natural science in particular), and the tendency to disguise value judgments by "scientizing"[7] the debate, increase the need to focus on the lack of participation of developing countries in scientific advisory processes. It is easy to fall into complacency by assuming that one need not pay so much attention to geographical representativeness because science is "objective" and, therefore, whoever is not involved in the decisionmaking would have arrived at the same conclusions (Yearley, 1996: 118). Many researchers have pointed to the limits to complete objectivity in research and to the cultural dependence and implicit value judgments in natural science (Jasanoff, 1996).

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6 In the 1996 IPCC Working Group I there were 158 authors from the United States, 61 from the United Kingdom, 3 from India, and 7 from China. The relative participation looked similar in Working Group II. Working Group III had 30 participants from the United States, 5 from the United Kingdom, 7 from India, and 2 from China (Kandlikar and Sagar, 1999).

7 Jasanoff (1996: 173) defines the act of "scientizing" an issue as "at once to assert that there are systematic, discoverable methods for coping with it and to suggest that these approaches can be worked out independently of national or sectarian interests."

With the value connotations associated with science, and particularly its application in policy, it is clear that the present participation of the South in deliberations on global environmental governance, both scientific and political, is inadequate. It is a question of equity and fairness to present more balanced knowledge-based voices from developing countries in these arenas.

BRIDGING THE KNOWLEDGE DIVIDE: CHANGING THE GENERATION OF KNOWLEDGE

Acknowledging the existence of a knowledge divide between the North and the South and its consequences prompts the question of what can be done to address the situation. Over the long term, bridging the North-South knowledge divide will require measures aimed at reducing the divide itself. Increasing the generation of scientific knowledge in the South and of the South will be critical in this respect. Four strategies could be pursued: (1) strengthening the data and science foundations of the South; (2) strengthening the scientific community in the South; (3) encouraging more research on the South among Northern scientists; and (4) expanding the groups capable of generating scientific knowledge.

Strengthening Southern Data and Science

The most straightforward way to bridge the knowledge divide is to commit resources to strengthening the data and science foundations on which global environmental governance efforts depend. The value of baseline data comparable across countries is clear (Esty, 2002). Such metrics allow for trends to be tracked, problems spotted, policies evaluated, and "best practices" identified. Enormous potential gains could be achieved across many environmental problem areas simply by moving laggards toward the performance of those at the leading edge. Because of the belief that poverty and environmental degradation are causally linked (World Commission on Environment and Development, 1987), it would be essential to improve data on sustainable development and socioeconomic indicators as well as data on environmental factors.

POSSIBLE GLOBAL ENVIRONMENTAL GOVERNANCE MEASURES

- **A global environmental data initiative to track a set of key socio-economic and ecological and environmental public health indicators in all countries of the world on a methodologically consistent and comparable basis;**
- **Beyond building a global environmental database, a true commitment to closing the North-South knowledge gap, which would entail capacity building in the South. The developing world needs more scientists, economists, and researchers of all sorts;**
- **Building up this capacity, requires (as discussed below) sustained commitments to education for several decades.**

Strengthening the Scientific Community in the South

Part of the responsibility for strengthening the scientific community *in* the South lies in the hands of developing countries themselves who need to prioritize investment in science. But their efforts alone will not suffice. The role for bi- and multilateral aid agencies and Northern and international research programs in building this capacity is critical.

A number of actors are already involved in such capacity building, from national space agencies to UN organizations, from the international academic community to individual researchers (Fuchs, Virji, and Fleming, 1998; EUMETSTAT, 1997; UN Economic and Social Council, 1997). It is even increasingly the case that international scientific advisory processes have as a goal the facilitation of national level capacity building (UNEP, 2000).

However, much capacity building is currently aimed at financing more Ph.D. degrees for developing country citizens, providing funds for large scale cooperation projects on global environmental change research, and granting travel money to bring scientists from the South to scientific conferences and expert meetings. These efforts do not suffice to provide developing country scientists with a basic research infrastructure.

Research funding is predominantly nationally based. Up until now, there has been no explicit mandate in global environmental governance (such as in the UN Environment Programme and the Global Environment Facility) to fund basic research based on the competitive merits of research proposals. Most of the resources go to assessments of previous research rather than the generation of new knowledge.

POSSIBLE GLOBAL ENVIRONMENTAL GOVERNANCE MEASURES

Establishment of small "micro research grants" for individual research projects in countries with limited research capacity.[8] Existing expert bodies under multilateral environmental agreements or other UN bodies could administer these grants. These agencies would have the best overview of the specific research gaps hampering their work.

Similar to the success in the field of micro credit, where very little money goes a long way for development in poor communities, rather humble research grants for salaries and equipment might lead to substantial research results in many developing countries. When combined with assistance to make the results internationally available, such measures could make significant contributions to reducing the knowledge divide.

Increasing the Number of Northern Scientists Working on the South

The second approach to increasing knowledge of environmental and human systems in the South is to strengthen the scientific community of the North *for* the South, by increasing the number of Northern scientists who conduct field studies in the South. When they carry out their work in close partnership with local scientists, they benefit in their own research from local knowledge and experience while also contributing to the capacity of their Southern partners. This approach may necessitate capacity building for the Northern research community on local ecological and socioeconomic contexts in the South.[9]

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8 I am grateful to Dr. Arthur L. Dahl for this suggestion and for contributing valuable input to discussions on global governance measures in general.

9 Dasgupta (1998: 22) argues for such an approach among economists who study environmental issues.

Northern scientists could learn to better incorporate the priorities and realities of the South, both within research and policy processes.

POSSIBLE GLOBAL ENVIRONMENTAL GOVERNANCE MEASURES

- **Establishing of clear communication channels between UN bodies, such as convention secretariats, and Northern funding agencies, such as research councils and private foundations. Priority research areas could thus be suggested;**
- **Convening UN expert meetings in the South, even if the majority of experts are from the North, combined with field trips with local experts.**

Expanding the Number of Groups that Generate New Scientific Knowledge

The third approach to reducing the knowledge gap is to expand the groups that participate in the generation of scientific knowledge. The limited numbers of scientists in the South, and the extremely limited resources available for monitoring and research activities, warrant more innovative approaches. For example, if high school students across these countries, as part of their education, gathered basic data on environmental and social parameters under the guidance of researchers and with the support of the educational infrastructure, the cadre of observers and the amount of data collected would increase dramatically. There are already a number of successful examples where this has been tried.

School children, non-governmental organizations, major groups, and amateur volunteers have helped to collect data and fill data gaps, and the UN Secretary-General has encouraged the Commission on Sustainable Development to develop this further (UN Economic and Social Council, 2001).

Including these new groups in science production is not only a pragmatic approach to collecting data; it would also contribute to an aspect of human development that all should be entitled to:

> The intellectual tools and approaches of science should be made accessible in all countries, and to all levels of the population, in order to allow all persons to be active participants in finding solutions to environmental problems and defining appropriate forms of sustainable development. (UN Economic and Social Council, 1997)

A complementary approach would be to make the newest global data (satellite images, for example) available for natural resource management decisions at the local level.

POSSIBLE GLOBAL ENVIRONMENTAL GOVERNANCE MEASURES

- **Strengthening support for projects that incorporate training for various civil society groups and the private sector, enabling them to participate in data collection;**
- **Promoting the development of simple monitoring and research methods that could be used by local groups;**
- **Establishing various central cores of stable funding for long-term monitoring projects on specific environmental degradation problems;**
- **Encouraging the international scientific community to make its results public and available in usable forms for local populations and decisionmakers.**

Making the tools of the scientific enterprise available to larger sections of the population of the world would not only bridge the knowledge divide, but is likely to increase the level of trust between various stakeholders in decisionmaking processes, from the global to the local level.

BRIDGING THE KNOWLEDGE DIVIDE: CHANGING DECISIONMAKING

Another approach to bridging the knowledge divide would be to take the divide at face value and to focus on how it is addressed in governance, trying to change the way decisionmakers deal with knowledge and uncertainty. Getting global institutions to change their decisionmaking processes to reduce the negative consequences of the existing knowledge divide could entail three strategies: (1) facing uncertainty with more care and rigor; (2) making better use of available knowledge; and (3) considering alternative knowledge in the policymaking process.

Dealing with Uncertainty

Facing uncertainty with more care will entail greater acknowledgement of the limits of knowledge, clearer focus on underlying assumptions, and, at times, a precautionary approach.

Those engaged in global environmental policymaking must take more care to construct their analyses on solid foundations. Special attention must be given to getting data from the South. Modeling must be done in ways that reflect the experiences and realities of the developing world. Where extrapolations or assumptions are used, the basis for these starting points should be made explicit. Ranges of values and the use of multiple scenarios can also help to ensure that uncertainties are addressed in ways that generate a more neutral analytic foundation for global environmental action.

Utilizing Existing Scientific Knowledge in the South

A second approach that global institutions could adopt is to make better use of the scientific knowledge about the South that is available. It will take effort to find these data. Travel may be necessary to physically collect them, as this knowledge is unlikely to be catalogued and found through the databases of libraries accessible over the internet. It may require spending more time to locate scientists from the South – or scientists from the North whose specialty is environmental impacts in the South – and more resources to bring them to meetings in scientific advisory processes at the global level. It will certainly require some investment in verifying and quality-

controlling the data found. Simultaneous translation at meetings may also be necessary, as language frequently is an obstacle to contributions from Southern scientists.

A lot of science from the South never reaches the international science arena. Many, especially younger, researchers in the South publish in local journals, particularly in the fields of agriculture, silviculture, and aquaculture (IDRC, 1991). In many cases, the language barrier prevents scientists from publishing in international journals and they are confined to the domestic or regional science community. Funds for the translation of some of this body of knowledge would help to close the knowledge gap.

Considerable information and analyses are also generated by agencies, domestic and foreign, governmental and non-governmental, which work directly on environmental management and sustainable development in the South. Much of the research and writing in the development community, such as internal project reports, usually remains in the gray literature and never reaches the scientific journals (Kammen and Dove, 1997). This literature could be made more accessible and incorporated into global-level discussions.

POSSIBLE GLOBAL ENVIRONMENTAL GOVERNANCE MEASURES

- **Systematic efforts to bring forth "hidden" scientific knowledge to scientific advisory processes at the global level;**
- **Broadening the disciplines represented in global decision processes, i.e., including the social sciences, to expand the base of data and information (UNEP, 2000);**
- **New commitments of resources for assisting scientists from the South in making their research results internationally available – both through publications and through participation in international meetings.**

Incorporating Other Sources and Types of Knowledge

The third approach to changing decisionmaking requires a somewhat different mindset within global institutions, in order to broaden the categories of knowledge that are considered. It would ask decision-

makers to acknowledge that highly validated science cannot do everything and that there may be value in examining the wealth of experience captured in local and traditional knowledge, especially of indigenous people.

The knowledge divide looks different if one includes local knowledge. For example, local people may have considerable knowledge of species interconnections, natural variations in biogeophysical factors in the local context, and an integrated understanding of how their own actions influence the natural resources they depend on, even if they cannot express this knowledge in the language of modern science.[10] There is a considerable amount of local knowledge in these categories that could be of value to decisionmaking. One scientific advisory body that has started to discuss how to approach traditional knowledge is the Committee on Science and Technology of the Convention to Combat Desertification (UNEP, 1998). Non-governmental organizations (NGOs) are also a potential channel through which such local experiences could reach the global level.

POSSIBLE GLOBAL ENVIRONMENTAL GOVERNANCE MEASURES

- **Systematic dialogue between government-appointed experts in scientific advisory bodies and NGOs to explore ways of sifting out the valuable local experiences of communities that do not normally participate in policymaking processes. Such an exchange could in turn encourage the participation of scientists from multiple disciplines and the formulation of further research priorities;[11]**
- **Scientific validation of alternative types of knowledge. To this end, scientists should be encouraged to collect and "test" local knowledge. Traditional knowledge should be "systematized" and put to the tests of normal scientific validation and peer-review;**
- **Dissemination of alternative types of knowledge and information to policymakers through the normal scientific channels.**

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10 In many cases, this knowledge is in the process of being lost because people migrate to urban areas, are forced off their land, etc.

11 I am grateful to Professor Anders Hjort of Ornäs for contributing this suggestion.

CONCLUSION

> The world is divided into two civilisations that interact strongly, albeit in a one-sided way. One civilisation is based on the growth of scientific knowledge, the other demonstrates a more or less passive acceptance of results generated by the first. (Salomon, 1995: 9)

While Salomon makes this statement in the context of a general discussion of the role of science and technology for development, this chapter argues that the gist of his conclusion is also applicable to environmental governance at the global level, despite a significant and growing scientific enterprise in many developing countries. The natural-science-dominated discourse on global environmental issues, the reluctance to take action under uncertainty, and the limited scientific capacity of the South put developing countries at a disadvantage in the global environmental governance arena.

The "globalization" of knowledge based largely on findings in Northern societies and ecosystems presents additional obstacles for developing countries in global deliberations. Possible approaches to addressing the knowledge divide and its negative consequences on global environmental governance, discussed in this chapter, can be summarized as follows:

MEASURES TO BRIDGE THE KNOWLEDGE DIVIDE

Changing the Generation of of Knowledge	Changing Decisionmaking
• Launch an initiative to collect baseline environmental data across all countries of the world; • Strengthen the scientific community in the South; • Strengthen the scientific community in the North researching in the South; • Expand the groups participating participating in the generation of new knowledge.	• Face uncertainty more carefully and rigorously; • Use available knowledge about the South better; • Identify, test, and, where appropriate, incorporate alternative sources of knowledge.

The knowledge divide and its consequences cannot be considered a problem of the South alone, but rather a collective problem for the international community, since the North and the South are ultimately part of the same physical and social whole. Any serious approach to addressing the knowledge divide should consider not only the goal of making global environmental governance more equitable and more broadly knowledge-based, but also the deeper underlying issue of what it means for people to be involved in the generation of knowledge about their own realities.

REFERENCES

Agarwal, Anil, Sunita Narain, and Anju Sharma, eds. 1999. *Green Politics*. New Delhi: Centre for Science and Environment.

Biermann, Frank. 2001. "Big Science, Small Impacts – In the South? The Influence of Global Environmental Assessments on Expert Communities in India." *Global Environmental Change* 11 (4): 297-309.

Bourdeau, Philippe, J. A. Haines, W. Klein, and C. R. K. Murti, eds. 1989. *Ecotoxicology and Climate, With Special Reference to Hot and Cold Climates*. Vol. 38. Chicester, United Kingdom: John Wiley and Sons, Ltd.

Codex Alimentarius Commission. 1997. *Problems Relative to Pesticide Residues in Food in Developing Countries*. Rome: Food and Agriculture Organization and World Health Organization.

Commission on Developing Countries and Global Change. 1992. *For Earth's Sake: A Report from the Commission on Developing Countries and Global Change*. Ottawa, Canada: International Development Research Center.

Dasgupta, P. 1998. "Shifting Responsibilities for Knowledge to Advance a Sustainable South." In *Organizing Knowledge for Environmentally and Socially Sustainable Development*, edited by T. H. Ismail Serageldin, Joan Martin-Brown, Gustavo Lopez Ospina, Jeann Damlamian and Tariq Husain. Washington, D.C.: World Bank.

EPA. 1990. *Methane Emissions and Opportunities for Control*. Washington, D.C.: United States Environmental Protection Agency.

Esty, Daniel C. 2002. "Why Measurement Matters." In *Environmental Performance Measurement: The Global Report 2001-2002*, edited by Daniel C. Esty and Peter R. Cornelius. New York: Oxford University Press.

EUMETSTAT. 1997. *Annual Report on Developing Country Activities*. Toulouse, France: Committee on Earth Observation Satellites.

Fuchs, Roland, Hassan Virji, and Cory Fleming. 1998. *START Implementation Plan 1997-2002*. Stockholm: International Geosphere-Biosphere Programme. Available from http://www.start.org/Publications/Documents/START_Implementation_Plan.pdf

Gupta, Joyeeta. 2000. "North-South Aspects of the Climate Change Issue: Towards a Negotiating Theory and Strategy for Developing Countries." *International Journal of Sustainable Development* 3 (2): 115-135.

Gutman, Pablo. 1994. "Developing Countries and International Environmental Negotiations: The Risks of Poorly Informed Choices." *Society and Natural Resources* 7: 389-397.

Hassan, Mohamed H. A. 2001. "Can Science Save Africa?" *Science* 292 (5522).

IDRC. 1991. "The Global Research Agenda: A South-North Perspective." *Interdisciplinary Science Reviews* 16 (4): 337-344.

IPCC. 2001. *Climate Change 2001: Impacts, Adaptation and Vulnerability*. Geneva, Switzerland: Intergovernmental Panel on Climate Change. Available from http://www.ipcc.ch/pub/tar/wg2/

Jasanoff, Sheila. 1996. "Science and Norms in Global Environmental Regimes." In *Earthly Goods, Environmental Change and Social Justice*, edited by Fen Osler Hampson, and Judith Reppy. Ithaca, NY: Cornell University Press.

Kammen, Daniel M., and Michael R. Dove. 1997. "The Virtues of Mundane Science." *Environment* 39 (6): 10-41.

Kandlikar, Milind, and Ambuj Sagar. 1999. "Climate Change Research and Analysis in India: An Integrated Assessment of a South-North Divide." *Global Environmental Change* 9 (2): 119-138.

Karlsson, Sylvia. 2000. *Multilayered Governance: Pesticides in the South – Environmental Concerns in a Globalised World*. Linköping, Sweden: Department of Water and Environmental Studies, Linköping University.

Lacher, Thomas E., and Michael I. Goldstein. 1997. "Tropical Ecotoxicology: Status and Needs." *Environmental Toxicology and Chemistry* 16 (1): 100-111.

Pomeroy, D. E., and M. W. Service. 1986. *Tropical Ecology*. New York: Longman Scientific & Technical.

Redclift, Michael, and Colin Sage. 1998. "Global Environmental Change and Global Inequality." *International Sociology* 13 (4): 499-516.

Sagasti, Francisco, and Gonzalo Alcalde. 1999. *Development Cooperation in a Fractured Global Order: An Arduous Transition*. Ottawa, Canada: International Development Research Center.

Salomon, Jean-Jacques. 1995. "The 'Uncertain Quest': Mobilising Science and Technology for Development." *Science and Public Policy* 22 (1): 9-18.

Serageldin, T. H. Ismail. 1998. "The Social-Natural Science Gap in Educating for Sustainable Development." In *Organizing Knowledge for Environmentally Sustainable Development*, edited by T. H. Ismail Serageldin, Joan Martin-Brown, Gustavo Lopez Ospina, Jeann Damlamian and Tariq Husain. Washington, D.C.: World Bank.

Shrum, Wesley, and Yehouda Shenhav. 1995. "Science and Technology in Less Developed Countries." In *Handbook of Science and Technology Studies*, edited by Sheila Jasanoff et al. Newbury Park, United Kingdom: Sage Publishers.

UNEP. 1998. *Report on International Scientific Advisory Processes on the Environment and Sustainable Development*. Nairobi, Kenya: United Nations Environment Programme. Available from http://earthwatch.unep.net/about/docs/sciadv.htm

_____. 2000. *The Second Report on International Scientific Advisory Processes on the Environment and Sustainable Development*. Nairobi, Kenya: United Nations Environment Programme. Available from http://earthwatch.unep.net/about/docs/sciadv2.htm

UN. 1998. *Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade*. New York: United Nations. Available from http://www.fao.org/ag/agp/agpp/pesticid/pic/Download/fin_e.pdf

UN Economic and Social Council. 1997. *Commission on Sustainable Development, Fifth Session, 7-25 April 1997. Overall Progress Achieved Since the United Nations Conference on Environment and Development. Report of the Secretary-General, Addendum, Science for Sustainable Development*. New York: United Nations. Available from http://www.un.org/documents/ecosoc/ cn17/1997/ecn171997-2add25.htm

_____. 2001. *Commission on Sustainable Development, Ninth Session. Information for Decision-Making and Participation (Chapter 40, Agenda 21), Report of the Secretary-General*. New York: United Nations.

UN System-Wide Earthwatch. 2000. *International Expert Meeting on Information for Decision-Making and Participation*. Geneva, Switzerland: United Nations Environment Programme. Available from www.unep.ch/earthw/ottawabk.htm

WEF. 2002. *Environmental Performance Measurement: The Global Report 2001-2002*. Geneva, Switzerland: World Economic Forum.

World Bank. 1999. *World Development Report 1998/99, Knowledge for Development*. New York: Oxford University Press. Available from http://www.worldbank.org/wdr/wdr98/contents.htm

World Commission on Environment and Development. 1987. *Our Common Future*. New York: United Nations.

Yearley, Steven. 1996. *Sociology, Environmentalism, Globalization*. London: Sage Publications.

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