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Big science, small impacts—in the South? The influence of global environmental assessments on expert communities in India

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Abstract

To help decision-makers cope with the uncertainty of global environmental change, transnational networks of experts have offered numerous assessments of the state of knowledge, often advertised as consensus of "international science". Substantial social science research has already analysed the effects of such global environmental assessments on industrialized countries; this study explores their influence in India as a pivotal developing country. It appears that although global environmental assessments did not remain without any influence in India, their effect is still small. These limitations could be addressed, it is argued, by increasing the usefulness and legitimacy of global environmental assessments in the South through stronger consideration of the socio-economic context of developing countries and other Southern concerns and interests, by raising the participation of Southern experts, by enhancing research capacities in and communication links to the South, and by ensuring that global environmental assessments are organized as self-adaptive processes, such as IPCC, and not as one-shot effort, such as the Global Biodiversity Assessment. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Many global environmental problems have sparked off formidable increases in scientific research, as well as in international scientific cooperation for assessing the accumulated knowledge and for synthesizing it in a form accessible and useful to decision-makers. About 2500 scientists, for example, have been working with the UN-sponsored Intergovernmental Panel on Climate Change for its three-volume report *Climate Change 1995* (IPCC, 1996a–c). The *Global Biodiversity Assessment* (GBA, 1995) involved participation of roughly 1500 experts in its field, and hundreds of experts took part in the compilation of the assessments on the state of the stratospheric ozone layer, such as the reports of the Co-ordinating Committee on the Ozone Layer, the "Blue Books" of 1986 and the reports of assessment panels under the UN Environment Programme, which acts as secretariat of the ozone treaties (Benedick, 1998; Jung, 1999; Litfin, 1994; Social Learning Group, 2001b,c).

Despite all these efforts, the question arises: do such assessments really matter in the course of policy-making, and if so, for whom do they matter? This question is not new—substantial research has already been directed to the influences of global environmental assessments in industrialized countries, in particular in the areas of climate change and regional air pollution (e.g., Cash, 1998; Farrell and Keating, 1998; Fisher-Vanden, 1997; Global Environmental Assessment Project, 1997; Keating and Farrell, 1998; Moser, 1998; Social Learning Group, 2001a). Here, it could be shown that global environmental assessments clearly make a difference in national environmental politics. This research has also indicated that the influence of global assessments varies significantly between Western industrialized countries and the countries in transition to a market economy in Eastern Europe (Botcheva, 1998; VanDeveer, 1998).

Less research, however, has been done on the influence of global environmental assessments in the South. This will thus be the focus of this study: How does information flow from global to local, from global environmental assessments compiled by transnational scientific networks to national decision-making in the

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South? Do global environmental assessments influence scientific assessment and policy-making in the South, or do developing countries evaluate the state of the world's environment and the respective policy options independently from global efforts?[1] Which assessments are perceived as legitimate, trustworthy and useful in the scientific and political system of developing countries? Which reports do experts and decision-makers in developing countries use as basis for decision-making, and why? And how could these variables be influenced, if deemed necessary, by altering the way in which the international scientific community conducts global environmental assessments (Jäger, 1998)?

In examining these questions, I will concentrate on one developing country, India, an essential player in global environmental negotiations. I will draw on primary sources and a series of in-depth interviews with representatives of the Indian scientific community, governmental bureaucracy, environmentalist organizations and industry, all conducted in India from January through March 1999 (see Appendix), as well as on Indian scientific and popular publications and other secondary sources.[2] Since the analysis addresses fairly sensitive issues, including legitimacy of United Nations and foreign scientific research as well as reasonableness and effectiveness of governmental policy and the influence of project funding, it was agreed that as a rule, the identity of interviewees will be disclosed only in the reference section without ascribing single judgments and information to individuals.

The article is structured as follows: I will first look at the general perception of global environmental assessments within the Indian expert communities, will then examine how useful the assessments are to these experts, followed by an analysis of their responses. In the concluding section, I will outline feasible avenues for improving the influence of global environmental assessments, with a view to equitable and yet effective global environmental policies.

2. Perception of global environmental assessments within the Indian expert community

The relatively small global change research capabilities in the South are likely to be the most crucial difference between industrialized and developing countries bearing on the influence of global environmental assessments. Financial, technological and human resources in developing countries are often too scarce to pursue cutting-edge research on global environmental issues, or are used in other areas deemed as more important. By and large, most research and assessments on climate change and ozone depletion are thus done in the North, and it is this research upon which global environmental assessments chiefly rely. While decision-makers in industrialized countries can claim, through their own assessment capabilities and the strong participation of their own experts, a sense of ownership over the information produced in global assessments, for many actors in developing countries this information appears more or less as a product received from abroad.

India stands out to some extent due to its significant research capabilities. But even here, given the relatively low prominence of global environmental issues in the Indian domestic debate, most Indian environmental scientists prefer to work on national and local pollution problems that are considered more urgent. Those Indian experts who participate in international assessments on global warming or biodiversity often view these efforts as "a waste of time", the more so since political action is seen as the industrialized countries' responsibility anyway (own interviews; Gupta, 1995; Kandlikar and Sagar, 1999; Rajan, 1997).[3]

Added to this comes a perception by some experts of a general lack of interest within the Indian governmental bureaucracy to make use of, and to support, independent scientific expertise, such as published scientific assessments, since this could undermine the power of the bureaucracy itself.[4] Another characteristic of the Indian scientific community is that many researchers work at public institutes (Mahajan, 1999). This might limit the willingness of experts to publish their knowledge in the form of scientific environmental assessments that could be viewed unfavourably by the governmental bureaucracy responsible for the funding of the institutes. Non-governmental organizations, on the other hand, often lack the capabilities to conduct their own scientific assessments.

Despite these restrictions, Indian experts are aware of the major international assessments, and one would find

[1] An equally important question is the degree to which experts from developing countries who are active in global environmental assessments are able to influence the structuring of these assessments. I have addressed this question in Biermann (2000).

[2] In particular, Jasanoff (1993) provides a detailed account of India's environmental policy, with special reference to the climate issue; Kandlikar and Sagar (1999) analyse numerous aspects of how climate research is being conducted in India, and Jakobsen (1998) examines the emergence of India's climate policy from 1992 to 1997. Rajan (1997) describes in detail how India's foreign environmental policy evolved before 1993, offering an extensive and in part fascinating narrative based to a remarkable extent on "confidential sources", that is, internal documentation and letter-exchange within the Indian diplomatic service and ministerial bureaucracies.

[3] This is different when those issues are assessed that are of pivotal relevance for developing countries, such as transfer of technology which stood in the centre of IPCC (2000).

[4] I owe this observation to one of the anonymous reviewers of this article.

the relevant reports available on bookshelves in offices and laboratories. Yet it seems that on balance, most Indian researchers remain fairly critical of international assessments, though their degree of criticism differs. For some, it is essentially "only science", and for experts at some private policy think tanks, reports such as IPCC (1996a–c), GBA (1995) and the ozone assessments even appear to be the prime source of reference. A biodiversity researcher at the Tata Energy Research Institute, for example, when confronted with a new issue, would first refer to GBA to gain broad understanding of the problem. A volume on *Climate Change. Post-Kyoto Perspectives from the South*, edited by this institute (Tata Energy Research Institute, 1998a), draws predominantly on IPCC, along with some journal articles of Northern authors who are themselves highly visible IPCC authors (e.g., the article on "The science and economics of climate change" by Gupta and Kumar, 1998).

However, there is also a significant number of experts who are wary of prejudices in the framing of assessments. Some watch IPCC, for example, with "great suspicion" and argue that IPCC is a "political-scientific" institution with little transparency and inherent Northern intellectual supremacy (own interviews). Unsurprisingly, certain frames that might be considered as running counter to Southern interests, such as the World Resources Institute's greenhouse gas ranking of 1990[5] or the "value of life" debate within IPCC,[6] are viewed with considerable disapproval, if not outrage, by many experts in the South.

The Indian perception of global environmental assessments is influenced, too, by the degree to which researchers from developing countries took part ("you want to find Southern names on the list"). Yet there is little confidence in the prospect of single Southern experts altering an assessment's agenda, because "the entire conceptualization has been done in the North, and Southern experts are often mere observers" (own interviews). Some doubt, therefore, that increasing participation of Southern experts in the current IPCC third assessment cycle will result in proportional increases in Southern influence. This is explained by financial dominance of industrialized countries, by quantitative preponderance of Northern experts, along with a relative lack of knowledgeable, "eloquent and energetic" Southern experts capable of structuring and determining the scientific agenda from a minority position. Many Indian experts, especially on the social and economic aspects of climate change, thus simply feel "outnumbered by the North", since "when we write one paper, they write ten" (own interviews).

This perception extends to the international literature which global environmental assessments purport to review and to synthesize. Some Indian scientists argue that peer reviewers in the North "operate on an entirely different wave-length", and it seems that Southern authors sometimes try to anticipate this "wave-length divergence" when submitting articles for a predominantly Northern audience (own interviews). Some Indian researchers also prefer publishing their research in Indian scientific journals. These are cheaper to contribute to than foreign periodicals and cheaper to buy, which warrants prompt and wide distribution of scientific findings within the Indian community.

A somewhat critical perception of global environmental assessments extends even to natural scientists. Though cooperation with Northern institutes is important and Northern climate models and data are accepted and used in India (if computing resources permit), some admit that in general, "one has to keep an eye on the numbers" (own interviews). Northern researchers are not suspected of deliberate biases, but it is generally anticipated that data from the North would be misleading if merely extrapolated to the South.[7]

Taken together, the information offered by global environmental assessments is widely known and in use among research institutions surveyed for this study. The assessments are seen as handy tools for quick reference and generalist knowledge, which is particularly required in the donor-driven, project-based community of private research institutes in India. But international

[5] The US-based World Resources Institute (1990, p. 15ff; and Chapter 24) assessed in 1990 the global warming impact of single nations in 1987 (see also Hammond et al., 1991). India was ranked fifth, scoring higher than West Germany, Great Britain or France. The Indian Minister of Environment and Forests felt increasingly pressurized by foreign environmental organizations and governments that used the World Resources Institute's assessment as a bargaining chip during the UNCED preparations, arguing that developing countries too were to blame for the climate problem. The private Centre for Science and Environment, New Delhi, took the initiative and re-assessed the Northern assessment (own interviews; Jakobsen, 1998, p. 21), and published shortly thereafter a widely-circulated study in which the World Resources Institute was accused of statistical bag-player-cheat and, in the opening paragraph, of "environmental colonialism" (Agarwal and Narain, 1991, p. 1). See on this debate also Jasanoff (1993), McCully (1991), Parikh et al. (1991, p. 43–44), and Subak (1991).

[6] Based on economic evaluation methods, some IPCC contributors had suggested different monetary values for the human life to allow for assessing the "damage costs" of global warming; it was suggested valuing loss of one life in OECD countries with 1.5 million US dollars and in developing countries with 150,000 US dollar. These values were accepted by the writing team responsible for drafting Chapter 6 of Working Group III's 1995 Report and subsequently presented to the plenary. Developing countries prevented the report in its original form from being accepted (see, e.g., Agrawala, 1998, p. 626).

[7] This is seen, for example, as a prime reason for the dispute on methane emissions (discussed below), when global emissions had first been forecast based on measurements of Northern rice paddies only—though Indian scientists accept that at that time, this had been a defensible first guess which has now been corrected by the Indian methane research that advanced the debate by showing that Indian methane emissions were much lower than in the North (own interviews).

assessments are also taken with a grain of salt. When confronted with international environmental assessments, most researchers expect actual or potential Northern bias, without forgoing advantages of the scientific information compiled in the report.

3. Usefulness of global environmental assessments for Indian experts

How useful are global environmental assessments for experts in India? Though it is difficult to generate a clear picture that accommodates researchers from public research institutions and private, donor-driven think tanks, it seems that there are at least three main restrictions on the usefulness of global environmental assessments for the Indian expert community.

3.1. Lack of concern for the particular situation of developing countries

First, many Indian experts feel that global environmental assessments and the international research community do not take sufficient account of the situation and problems of developing countries, which limits the usefulness of the information. An often-cited case in point is the handling of sea-level rise by melting ice shelves and glaciers in the IPCC (1996a) assessment, in which sea-level rise had been separated from other climate change impacts by devoting an entire chapter to this question. Without doubt, this particular climate change impact is vitally important for many developing countries, too. Yet more crucial for roughly half of humanity is, for instance, the monsoon cycle. In Southern and Eastern Asia, most agrarian activity depends on the monsoon, and for lack of financial and technological resources no leeway exists to adjust farming practices should monsoon cycles change. For Indian experts, monsoon variability, therefore, stands in the centre of their concern and research, and to them, a separate IPCC chapter on the monsoon appears justified at least. Some even argue that the IPCC, had it been more concerned with Southern interests, would have had to present "an entire volume on the monsoon" (own interviews). Only recently has IPCC placed more emphasis on these issues.

Pivotal for Indian researchers is also the vulnerability of their countries to global warming and possible strategies for abatement, again issues which are seen as having been poorly covered by IPCC until the third assessment cycle,[8] and for which foreign foundations and governments are seldom inclined to provide funds. Despite two decades of intensive world-wide climate research, information on climate change impacts and on feasibility of adaptation options is still scarce for developing countries,[9] or it is based on extrapolation from experiences in the North that must be viewed with caution, given substantial economic, social, technological and climatic differences between industrialized and developing countries (own interviews; Agrawala, 1998; Kandlikar and Sagar, 1999; Pachauri, 1998, p. 147; Ramakrishnan, 1998; Sharma and Kumar, 1998, p. 28).

3.2. Lack of concern for the socio-economic context of developing countries

Secondly, the usefulness of the information offered by global environmental assessments is restricted when they do not fully account for the socio-economic context of developing countries. GBA, in particular, is viewed as framed too strongly in the flora-and-fauna-protection paradigm, without paying sufficient attention to the situation of local people living in the centres of biodiversity in India, because "you cannot think about biodiversity without thinking about people" (own interviews). It could be hypothesized that a Southern framing of a global biodiversity assessment would begin with the human person and analyse the biophysical world from this starting point—since, as argued by Ramakrishnan (1996, p. 124), "[l]inking ecological and social processes is crucial for appreciating the relationship between biodiversity and ecosystem function and to utilize this relationship for human welfare through sustainable management of resources".

Further socio-economic concerns of developing countries are, to name a few, technology transfer (though meanwhile addressed by IPCC)[10] and the technological independence of the South; intellectual property rights and Northern "biopiracy" (in the case of India, e.g. Northern patents on basmati rice and neem tree products); as well as the safety of genetically modified organisms transferred into developing countries (Gupta, 2000a, b). Almost all experts in India claim that GBA and IPCC have neglected these issues (own interviews). Especially GBA seems rather useless in this respect for experts who have to deal with

[8] For recent developments, see, e.g., IPCC, 1998b, 1997, paragraph 2.

[9] Some new research and assessments in this respect are underway, such as the GEF-funded project Assessments of Impacts of and Adaptations to Climate Change in Multiple Regions and Sectors (AIACC).

[10] IPCC has recently published a special report on technology transfer, which was initiated by the political body on scientific and technological advice (SBSTA) under the climate convention and identifies and evaluates different options to accelerate the development and diffusion of technology for both limiting greenhouse gas emissions and adapting to climate change. Work on this report begun in June 1997; the report was completed in 2000 (IPCC, 2000). Likewise, the third assessment report will contain, in working group III (mitigation), a chapter on "barriers, opportunities and market potential of technologies and practices" (IPCC, 1998a).

questions such as the legal status of farmers and indigenous communities vis-à-vis their traditional knowledge and their local seed varieties.

GBA is also seen as oblivious of social, economic and environmental harm that the biotechnological revolution could cause in developing countries. Biotechnology promises a second Green Revolution with huge increases in production, but for many experts in India it also raises the spectre of the problems of the first Green Revolution, including costly investments in capital-intensive, high-tech applications and, as a result, growing dependence of Southern farmers from Northern corporations, from local wholesale traders to frail agricultural monocultures (Shiva, 1997, p. 54).

In this range of different perceptions, GBA does not help much for Southern user communities. In its chapter on biotechnology, which was drafted by ten Northern lead authors, GBA simply dismisses Southern traditional practices as disadvantageous (GBA, 1995, p. 689) without discussing the economic and social aspects emphasized by critics (e.g., Shiva, 1993, p. 10). "Indirect impacts" of biotechnology are briefly mentioned but hardly discussed, and merely with an interest in adverse impacts on *biodiversity* and not on *humans*. In the three sentences in which GBA discusses "disadvantaged groups" (GBA, 1995, p. 707), these are foremost viewed as threat of accelerated loss of biodiversity since the disadvantaged groups could feel compelled "to degrade their environment further". Indian experts who are working in this area and struggling with problems of international and national benefit sharing or possible adverse impacts of biotechnology in the South, will find only little help in consulting GBA.

3.3. Lack of concern for questions of international equity

A third limitation of the usefulness of global environmental assessments is their often sizable neglect of equity considerations, which Indian experts view as extremely important. Article 3, paragraph 1, of the 1992 UN Framework Convention on Climate Change mentions the need for "equity" as a principle of all climate policy, and the 1992 Convention on Biological Diversity provides for the "equitable sharing of benefits" that may arise out of the utilization of genetic resources. Yet what equity eventually means is a question that leaves much room for debate.

Considerations of equity in global warming policy, for example the debate on fair entitlements to emissions, have been largely ignored in the first and second IPCC assessment cycles, even in the socio-economic sections. IPCC (1996c) did include a chapter on equity, yet there was not much linkage of this chapter to the overall assessment design. In the third assessment cycle, a task group has been set up to assess methodological aspects of "cross-cutting issues", including equity, within working group III (IPCC, 1997).[11] Another example of the third assessment cycle is the chapter "Adaptation to Climate Change in the Context of Sustainable Development and Equity" in the Working Group II report. Even though these developments led to a broader consideration of equity issues within the socio-economic analysis of IPCC, it is noteworthy that a major conflict within the third assessment cycle centred on just this cross-cutting nature of equity.[12]

Nor has equity received much attention in GBA. Equitable sharing of benefits derived from utilizing genetic resources has not been addressed in the GBA biotechnology chapter (authored by an exclusively Northern writing team), even though "fair and equitable sharing" of these benefits is one of the three objectives of the biodiversity convention, which GBA wishes to support (Mugabe et al., 1996, 1997; Henne, 1997). The assessment offers only few lines on "moral/ethical debates" on biotechnology, suggesting among others that the claim of developing countries and the convention's objective were not ethical in a "conventional sense", and that ethical debates would "lead to delays and restrictions on the use of genetic resources" (GBA, 1995, p. 707).

Taken together, for the expert community in India, the usefulness of global environmental assessments appears restricted for three main reasons: first, particular Southern concerns, such as monsoon variability or the specific vulnerability of developing countries, are viewed as insufficiently covered by the assessments (except for recent reports such as IPCC, 1998b); second, the socio-economic context of developing countries is regarded as not fully reflected; third, Southern concerns of equity in global environmental policy are seen as

[11] The first chapter of working group III's report will address "development, sustainability and equity in climate change mitigation" and "alternative development pathways"; the equity theme also pervades most other chapters (IPCC, 1998a).

[12] In February 1999, six economists from industrialized countries openly impugned a "cross-cutting chapter" on equity, sustainability and development written by a World Bank scientist from Sri Lanka, demanding that this chapter should not be included into the third assessment report. It would be playing fool to the extensive peer-review system of IPCC if it were impossible to reject papers submitted to such peer review, but still, when a Southern scientist submits a chapter on equity which is rejected by six Northern economists, few observers would not feel inclined to regard this as a clash within IPCC between Northern and Southern perspectives on global warming, on economics and maybe on the general role of science. The incidence is without precedence in earlier assessment cycles, and it is fair to assume that the recent increase of Southern participation in IPCC has at least created an "assessment environment" which enabled a Southern scientist to propagate a fairly controversial paper and which compelled Northern economists, maybe somehow threatened in their own perception of what are appropriate standards of "economic science", to react by seeking open conflict—what is seen as somewhat of an "over-reaction" by some observers from India (own interviews).

having been treated at best as an annex theme, not as something that deserves centre stage in the deliberations.

4. Responses by India's expert community to global environmental assessments

How does Southern science respond to reports compiled by global environmental assessments? Do global environmental assessments make a difference to the domestic expert appraisal of global environmental change and the experts' response in their own scientific work?

In the case of biodiversity, GBA could not provide much new information to Indian experts since this field has a long tradition in India. India's Botanical Survey (since 1890), Zoological Survey (since 1916), and Forest Survey (since 1981) all conduct regular expeditions and publish assessments of India's biodiversity, having surveyed by now about 65 per cent of the country (Ministry of External Affairs, 1997, p. 63; MoEF, 1998, pp. 14–35, 1999). There is thus not much role GBA can play in the assessment of biodiversity, and those questions which are new and crucial for Indian experts, such as benefit sharing or intellectual property rights, are not covered by GBA. Any influence of GBA on Indian science is thus difficult to trace.

This differs from global environmental assessments in the field of climate change and ozone depletion. Although the influence of assessments on the overall scientific community is small due to the general marginalization of these issues, assuming the counterfactual—how would Indian science have proceeded without the global environmental assessments—there are at least four distinct reactions of Indian science. These responses differ from reactions by Northern experts because Indian science is determined by factors particular to developing countries, notably a relative lack of financial and technological resources and a shared perception that the economic development interests of India must be protected vis-à-vis a predominant Northern science and Northern political and economic power.

4.1. Capacity building

First, participation of Indian scientists in global environmental assessments has resulted in some capacity-building, by increasing the information available to Indian scientists, by helping establish contacts among Northern and Indian scientists, and at times by the provision of financial and technological support, such as computer work stations. For example, many researchers, in particular from government-funded research institutions in India, lack the means to travel abroad and participate in international conferences and meetings unless international or foreign donors reimburse the costs.

The IPCC Trust Fund supports participation of developing countries in IPCC meetings by devoting half of its budget to reimbursing travel expenses of Southern delegates, albeit only to IPCC meetings and not to general professional gatherings. By now, at least one developing country participant for each IPCC writing team meeting will be financially supported (own interviews; Agrawala, 1998, p. 630). This capacity building is small but still makes a difference: without the global environmental assessments, communication between Southern and Northern scientists would be even less.

4.2. "*Counter assessments*"

Secondly, Indian scientists responded to Northern science and global environmental assessments sometimes with "counter assessments" meant to verify or refute data believed as having negative political consequences for India. Most widely known is the report *Global Warming in an Unequal World. A Case of Environmental Colonialism* of the New Delhi-based Centre for Science and Environment (Agarwal and Narain, 1991), which directly responded to an assessment by researchers from the United States.[13]

Another example, is the Indian research on methane, a major greenhouse gas. Developing countries account for a larger share of global methane emissions compared to global carbon dioxide emissions because a substantial amount of methane is emitted by agrarian activities, notably animal husbandry and rice farming. India, for example, possesses, with 2.2 per cent of the land surface and 16 per cent of world population, about 18 per cent of the world stock of goats, 19 per cent of cattle and every second water buffalo on earth. In 1990, the US Environmental Protection Agency (1990) published a study which suggested that India alone would account for more than one third of global methane emissions from rice paddies; a result that would, if not contested, certainly have influenced climate negotiations.

On publication of this Northern assessment, Indian public research institutions launched their so far most focused domestic global environmental assessment, the "Indian Methane Campaign". More than 50 researchers from 16 Indian institutions joined the "Campaign". Its result indicated that Indian methane emissions from rice paddies were roughly ten times less than the US Environmental Protection Agency had suggested, and that global methane emissions were accordingly lower too. This reactive assessment process in India has broadened into analysing and assessing all greenhouse gases to provide the national communications to the conference of the parties required under article 12 of the

[13] See footnote 5.

climate convention. In a sense, the Northern debate has thus helped to increase communication and cooperation among Indian scientists on climate-related issues (own interviews; Kandlikar and Sagar, 1999).

4.3. Changes in research agendas

Thirdly, global environmental assessments have influenced Indian research activities by pointing out particular problems for India or by raising concern about certain issues. This effect of shaping research agendas seems to be stronger in developing countries compared to the OECD, since in the South, lack of resources places stricter constraints on researchers. In particular, scientists at public research institutions in India concentrate their work on issues they perceive as particularly relevant for the "national interest" and as not sufficiently covered by global environmental assessments. While most IPCC research addresses general climate modelling and mitigation options, Indian scientists have directed most of their scarce resources to assessing adverse effects of climate change on India. The Working Group on Environment for the Ninth Five-Year Plan (1997), for example, expressly included in their terms of reference the assessment of adverse impacts of climate change on India (Chatterjee, 1999; Meachinkara, 1998).

To answer such research questions, Indian researchers need to rely on Northern science since computing systems available in India do not allow for modelling regional climate change and ecological vulnerability sufficiently. Hence direct contacts and exchange programmes with Northern institutes are used to apply Northern models to forecast regional climate changes in India as well as in other Asian countries (own interviews).

This Indian climate impact research evolved partly out of traditional work on monsoon patterns, through which Indian scientists had developed some confidence in predicting the monsoon cycle. Partly instigated by the international climate debate and the global environmental assessments in this field, Indian monsoon experts have become increasingly concerned that global warming could affect these regional weather patterns, thus threatening food security on the sub-continent. Consequently, a new line of research on climate change has been established in the system of public research institutions working on monsoon and regional climate variability. This is both an indigenous development within the Indian meteorologists' community and a response to global environmental assessments, especially the IPCC.

Other issues which feature high on the Northern agenda, notably sea-level rise, are covered less by Indian research, although a major government-driven assessment project has recently analysed the effects of a rise in sea-levels in India by 1 m (own interviews; see also Lal, 1995).

4.4. Impacts on donor-driven research

Fourthly, work especially at private research institutes is indirectly influenced by global environmental assessments to the extent that the institute's work is fully or partly funded by foreign foundations, foreign governments or international organizations. International organizations—such as the Global Environment Facility, the UN Development Programme, the World Bank and the UN Environment Programme—or foreign foundations are often closely linked to global environmental assessments, and IPCC or GBA play some role in policy-development within these international bodies. In this context, it appears that the inflow of Northern money for environmental policy research and assessment increased significantly after 1992. As for the Tata Energy Research Institute, for example, foreign project-funding increased from less than three million Indian rupees (1987) to roughly hundred million rupees in 1997/1998, a tenfold increase when adjusted to the US dollar exchange value. Although in 1987, the institute's domestic funding exceeded foreign contributions, by now project funding from abroad is twice as much as funds received from within India (Tata Energy Research Institute, 1998b, p. 102).

Since the initiative for projects is usually taken by Indian counterparts, the *direct* influence of foreign funding on the details of the Indian research agenda appears limited and is often not seen as such, in particular when donors' interests and the institute's agenda converge. On the other hand, issues that are not financed cannot be analysed for lack of resources, since private organizations "have to earn money", and "any assessment must be financially viable" (own interviews). It is also viewed with concern that Northern funds chiefly address the *mitigation* of climate change in India and other developing countries with low per capita emissions, but rarely the assessment of *vulnerability* and of feasible *adaptation* strategies in the South. The "Asia Least-cost Greenhouse Gas Abatement Strategy" (ALGAS) project, for example, which is executed by the Tata Energy Research Institute and the National Physical Laboratories and funded by the UN Development Programme, the Global Environment Facility and the Asian Development Bank, assesses exclusively the least-cost mitigation options in India and other Asian countries but not feasible strategies or technologies for adaptation (own interviews; MoEF, 1998, p. 97).

Foreign funding is also a major driving force behind current research within India on market-based mechanisms in climate policy (own interviews). One expert observed that it was "remarkable how much research is actually focused on activities implemented jointly (AIJ),

least-cost mitigation and tradable permits in a country where the government has been strongly opposing such instruments in international negotiations" (Jakobsen, 1998, p. 39). In a sense, many Southern researchers feel their hierarchy of assessment needs and interests being distorted by the need to raise money from Northern governments and foundations (own interviews).

5. Conclusions: How could more effective assessments be designed?

What can decision-makers wishing to design effective global environmental assessments learn from the Indian case study? Clearly, such assessments will hardly suffice to change the public perception of global environmental issues in India. The root causes of the low prominence of, say, climate change in India is not lack of information but that people have other, more short-term problems to care about in public discourse: not only economic development and poverty but also a number of more immediate and serious local environmental problems, such as soil degradation or air pollution. Climate change and ozone depletion will thus remain elitist issues with which mainly senior governmental bureaucrats and some hundred experts within public research institutions and private institutes will be concerned.

However, some improvement in the design of assessments seems possible. I suggest five "lessons" for assessment design that may be drawn to improve the usefulness, credibility and legitimacy and general awareness of global environmental assessments in developing countries, and thus to increase the benefits of scientific research for the South.

5.1. Improve usefulness and legitimacy

First, the effectiveness of global environmental assessments might be improved if they better took into account Southern concerns and viewpoints. In the most radical formulation it could be argued that other problems needed to be addressed and assessed. Agarwal and Narain (1991, p. 24) noted, for example, "if issues like climate change have to be put on the agenda, then it is equally important to put environmental problems like desertification, land and water degradation [...] on the global agenda. The global environmental agenda, as it is being framed by the West, must be questioned. The agenda in itself has become politics." If urgency of international environmental action were to be measured by indicators such as "maximal number of human lives protected with least effort", pollution and degradation of freshwater resources would be the most important issue to which research and funds should be directed. Degradation of the world's soils, too, is an environmental issue affecting the life of more than a thousand million people, but less targeted by global research efforts than climate change (see, e.g., German Advisory Council on Global Change, 1995, 1999).

Taking Southern concerns into account would also entail a reorientation from mere "scientific" analysis to a stronger examination of the socio-economic issues that are cause and consequence of global environmental change. Candidates for debate are consumption patterns in the North (and how to influence them), equity issues, the specific vulnerability of developing countries and how this could be addressed. All these issues have already been addressed, for example by IPCC, and have been strengthened in the third IPCC assessment cycle. It is likely that this development will increase IPCC's credibility, legitimacy and usefulness at least within India (though simultaneously it may *decrease* credibility within OECD countries).

5.2. Increase Southern participation

Lack of credibility, legitimacy and usefulness in developing countries is linked to the domination of assessment processes by experts from industrialized countries who are capable of structuring the assessment process and of influencing the outcome according to their own priorities. The present experience with global environmental assessments and the debate within India shows that strong Southern participation is crucial to prevent the assessments from neglecting the interests of developing countries. For example, it were chiefly the representatives from the South within the IPCC plenary who hindered the body from adopting economic calculations which valued Northern lives ten times higher than Southern lives.[14]

How could Southern participation then be strengthened and made more effective? IPCC has already taken, after the 1990 report of the Special Committee on the Participation of Developing Countries,[15] a number of actions to remove obstacles that impair developing country participation. For example, to increase the communication of scientific knowledge and IPCC findings in particular, major documents are being translated in all six UN languages, and IPCC takes much more account of geographical representation as well as of the views of environmentalist and business

[14] See footnote 6.

[15] In view of the committee, developing countries lacked, first, enough experts experienced in the field of climate research. Moreover, information about the climate problem was deemed insufficient in developing countries. Yet to bridge the information gap, existing channels of information to the South were seen as too ineffective, which was explained by the institutional environment in developing countries, such as lack of coordination. Finally, the financial resources in developing countries did not suffice to allow for wider participation of their experts (Rajan, 1997, p. 108; Agrawala, 1998, p. 629).

organizations represented by experts (own interviews; IPCC, 1997). Current IPCC rules of procedure require each working group to be chaired by one Northern and one Southern scientist, and each chapter of assessment reports must have at least one lead author from a developing country (own interviews; Agrawala, 1998, p. 630). Participation of Southern scientists in IPCC's third assessment cycle appears much more visible than in previous rounds. In a sense, IPCC's governance structure has a quota system that resembles political bodies such as the meetings of parties to the Montreal protocol, the executive committee of the ozone fund or the Global Environment Facility, which are all governed by North–South parity procedures.[16]

Lack of funds remains a problem, however. Government-funded research institutions in India normally do not have money to send their scientists to professional conferences abroad. This has been attenuated for direct participation in IPCC working groups, but still, the general communication between Indian and foreign scientists is scarce compared to transatlantic or intra-European cooperation. Moreover, travelling and communicating alone is not sufficient to enable developing country experts to write or review chapters for international assessments, since working time in itself is a scarce and costly resource. In particular private institutes are sometimes unable to permit their staff to devote their time to work on international assessments if this is not accompanied by project funds. Even though the travel costs of Southern experts are reimbursed, at least one highly qualified Indian atmospheric scientist had to refuse an invitation to participate in the third IPCC assessment cycle purely for financial reasons, while researchers from other private institutes anticipate no such financial constraints (own interviews).

The difficult financial situation in India thus privileges participation of those researchers who have sufficient financial support to widely communicate on a regular basis with Northern scientific communities. Added to this is the general lack of interest in global environmental issues within the government, which submitted too late, for example, the list of Indian experts suitable for participation in the third assessment cycle (though IPCC seems fairly permissive in accepting belated nominations). Some Indian researchers felt only poorly informed about the recruitment process for IPCC's third assessment cycle and complained of a lack of transparency on the side of the government, of the better connected Indian institutes, and of IPCC itself (own interviews).

Taken together, these factors prevented some qualified Indian scientists from being invited to, or from making the effort to participate in, global environmental assessments. This creates, in turn, a predominance of those Indian scientists who are internationally well connected and funded, who can avail themselves of time and money sufficient to draft and review lengthy IPCC or GBA chapters, and who are particularly open to international networking. It is this that made it possible that one private institute alone managed to contribute six experts to the current third IPCC cycle, which has caused some displeasure among Indian experts not from this institute (own interviews). Though these researchers are certainly qualified for their tasks as IPCC contributors, they do not fully represent the entire spectrum of Indian science, and cooperation with experts from public research institutions is limited or non-existent (own interviews).

5.3. Ensure process

Furthermore, the influence of global environmental assessments increases if they are designed as an iterative process instead of a single event. This is one explanatory factor for the relatively stronger influence of IPCC compared to GBA in India. Organizing assessments as long-term processes also ensures that the special concerns of developing country experts and governments could be better taken into account, in particular if the assessment need has first been felt and articulated by Northern actors and the initial framing has been done within the North. If GBA, for example, would have been more than a mere one-stop endeavour, it would have been possible, in successive "assessment rounds", to re-focus the assessment and to include more information on the human dimensions of biodiversity, the sharing of benefits of biotechnology or the question of intellectual property rights on genetic resources.

5.4. Increase communication to Southern actors

The benefit of global environmental assessments to developing countries could also be increased if the managers of these expert networks, as well as individual scientists active in them, took greater effort to communicate their findings to a worldwide audience. Experts in

[16] For IPCC's third assessment cycle, it has been decided that there will be three Chair and Vice Chairs from industrialized countries (including one from a country with an economy in transition) and three from developing countries, with similar quotas applying to the working groups (IPCC, 1997, paragraph 14). The IPCC thus has in effect the same parity governing structure as the Global Environment Facility or the Montreal Protocol and its Fund. In the Global Environment Facility, the governing council consists of 16 developing countries, two countries with economies in transition and 14 OECD countries, and it decides by a vote representing both a sixty per cent majority of participants (favouring the South) and a sixty per cent majority of total contributions (favouring the North) (Global Environment Facility, 1994, paragraph 16). Both the meeting of parties to the Montreal Protocol and the executive committee of the ozone fund decide by two-thirds majority vote that must include the majority both of developing and industrialized countries (Biermann, 1997).

India claim that at present, most assessment managers and individual scientists are more concerned with communicating their findings to powerful Northern governments than to the relevant actors in the South, such as the Indian media, the Indian community of environmentalists, or the country's judicial system. As was pointed out by one Indian expert, "IPCC will ensure that its findings are known to The Times of London and to the New York Times, but not to the Times of India".[17]

5.5. Enhance research capacity

The need to improve the usefulness and legitimacy of global environmental assessments in countries like India and to increase participation of their experts eventually requires enhancing the endogenous research capacity in the South (see also Agrawala, 1998, p. 632; Kandlikar and Sagar, 1999). Two ways of doing this are conceivable: one would be increasing the funds of IPCC or of a future GBA to enable these bodies not only to reimburse travel costs of developing country participants but also to organize Southern contributions as commissioned papers, i.e. to pay for them. This would help to achieve a more balanced participation of Southern scientists and would assist in building up more endogenous capacities within the Southern research institutes. If Indian scientists, for example, could base their assessments and statements to their government less on Northern data but rather on global circulation models that have been developed and are used within India itself, this might influence the perception of these data in the Indian decision-making system (own interviews). A second possibility would be to provide more research capacities directly, for example through the Global Environment Facility or the UN Environment Programme, with similar effects.

But however important it is to increase the awareness of global environmental science in developing countries, only marginally will it affect the solution to most problems of anthropogenic global environmental change. At least for the next few decades, it is up to the industrialized countries to act, because—as noted by Parikh (1994, p.2943) for the problem of global warming—"[i]f all countries had the living standards similar to those in India and China, there would not have been [greenhouse gas] concentrations accumulated as of today". The consumption of the Indian middle class is indeed on the increase, as often noted by Northern observers, but the average income and "environmental consumption" of the richest ten per cent of all Indians is yet significantly below the income and consumption of the poorest 20 per cent of citizens in the richest industrialized countries (Parikh et al., 1994, 1991). However desirable it is that global environmental assessments are influential in India and offer crucial information to decision-makers and the public in India, their most crucial effect still needs to be in the North.

[17] The quote is from an anonymous reviewer from *Global Environmental Change*.

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Appendix—Interviews

If not stated otherwise, all interviews were conducted by the author in New Delhi or Mumbai from January to March, 1999.

Anil Agarwal, Director, Centre for Science and Environment, New Delhi.

Professor V. Asthana, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi.

Professor Tarun Bose, Jadavpur University, Calcutta.

Dr. Kalipada Chatterjee, Manager, Global Environmental Systems Group, Development Alternatives, New Delhi.

Dr. Hemant Datye, Fellow, Indira Gandhi Institute of Development Research, Mumbai.

Uma Garud, Additional Secretary, Federation of Indian Chambers of Commerce and Industry, New Delhi.

Nirmala Karunan, Greenpeace International, New Delhi.

Professor Rahmatullah Khan, (then) Rector and Jawaharlal Nehru Chair in Environmental Law, School of International Studies, Jawaharlal Nehru University, New Delhi.

Richard J.T. Klein, Senior Fellow, Potsdam Institute for Climate Impact Research, Germany; lead author, Intergovernmental Panel on Climate Change. Interview by the author in Potsdam, February 2001.

Dr. Murari Lal, Chief Scientific Officer, Centre for Atmospheric Sciences, Indian Institute of Technology, New Delhi; Convening Lead Author, Intergovernmental Panel on Climate Change.

Professor V.S. Mani, School of International Studies, Jawaharlal Nehru University, New Delhi; Secretary-General, Indian Society of International Law.

Abraham P. Meachinkara, Ministry of Environment and Forests, Government of India.

Sunita Narain, Deputy Director, Centre for Science and Environment, New Delhi.

P.H. Parekh, Advocate Supreme Court of India, President of Supreme Court Advocates on Record Association; Chairman of Consumer Education and Research Centre, Ahmedabad; Secretary-General of the International Institute of Human Rights, New Delhi.

Professor Jyoti K. Parikh, Acting Director, Indira Gandhi Institute of Development Research, Mumbai.

Professor Kirit S. Parikh, Founder Director, Indira Gandhi Institute of Development Research, Mumbai.

Dr. Rajendra K. Pachauri, Director, Tata Energy Research Institute, New Delhi; Vice Chair Intergovernmental Panel on Climate Change.

The Honourable Shri Suresh Prabhakar Prabhu, (then) Union Cabinet Minister of Environment and Forests, Government of India, New Delhi.

Dr. Lakshmi Raghupathy, Joint Director, Ministry of Environment and Forests, Government of India.

Professor P.S. Ramakrishnan, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi.

Shikhar Ranjan, International Legal Studies Division, School of International Studies, Jawaharlal Nehru University, New Delhi, and Affiliate, Greenpeace International, New Delhi.

Dr. K. Vinayak Rao, Research Affiliate, School of International Studies, Jawaharlal Nehru University, New Delhi, former Senior Policy Analyst with Centre for Science and Environment and Fellow at Tata Energy Research Institute, both New Delhi.

Pia Sethi, Research Associate, Tata Energy Research Institute, New Delhi.

Dr. T.P. Singh, Fellow, Tata Energy Research Institute, New Delhi.

Sharmila B. Srikanth, Area Convenor, Tata Energy Research Institute, New Delhi.

Dr. Robert T. Watson, Chair of the Intergovernmental Panel on Climate Change. Interview with GEA Project Participants, Harvard University, December 1998.

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