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Brazilian Climate Epistemers' Multiple Epistemes: An Exploration of Shared Meaning, Diverse Identities and Geopolitics in Global Change Science

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The Global Environmental Assessment Project is a collaborative team study of global environmental assessment as a link between science and policy. The Team is based at Harvard University. The project has two principal objectives. The first is to develop a more realistic and synoptic model of the actual relationships among science, assessment, and management in social responses to global change, and to use that model to understand, critique, and improve current practice of assessment as a bridge between science and policy making. The second is to elucidate a strategy of adaptive assessment and policy for global environmental problems, along with the methods and institutions to implement such a strategy in the real world.

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Publication abstracts of the GEA Project can be found on the GEA web site at http://environment.harvard.edu/gea. Further information on the Global Environmental Assessment Project can be obtained from the Project Associate Director, Nancy Dickson, Belfer Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University, 79 John F.

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FOREWORD

This paper was written as part of the Global Environmental Assessment Project, a collaborative, interdisciplinary effort to explore how assessment activities can better link scientific understanding with effective action on issues arising in the context of global environmental change. The Project seeks to understand the special problems, challenges and opportunities that arise in efforts to develop common scientific assessments that are relevant and credible across multiple national circumstances and political cultures. It takes a long-term perspective focused on the interactions of science, assessment and management over periods of a decade or more, rather than concentrating on specific studies or negotiating sessions. Global environmental change is viewed broadly to include not only climate and other atmospheric issues, but also transboundary movements of organisms and chemical toxins. (To learn more about the GEA Project visit the web site at http://environment.harvard.edu/gea/.)

The Project seeks to achieve progress towards three goals: deepening the critical understanding of the relationships among research, assessment and management in the global environmental arena; enhancing the communication among scholars and practitioners of global environmental assessments; and illuminating the contemporary choices facing the designers of global environmental assessments. It pursues these goals through a three-pronged strategy of competitively awarded fellowships that bring advanced doctoral and post-doctoral students to Harvard; an interdisciplinary training and research program involving faculty and fellows; and annual meetings bringing together scholars and practitioners of assessment.

The core of the Project is its Research Fellows. Fellows spend the year working with one another and project faculty as a Research Group exploring histories, processes and effects of global environmental assessment. These papers look across a range of particular assessments to examine variation and changes in what has been assessed, explore assessment as a part of a broader pattern of communication, and focus on the dynamics of assessment. The contributions these papers provide has been fundamental to the development of the GEA venture. I look forward to seeing revised versions published in appropriate journals and books.

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ABSTRACT

Reflecting the importance placed on broad participation in scientific assessments concerning the global environment, reports by the Intergovernmental Panel on Climate Change (IPCC) emphasize the large number of participating scientists and the many different countries from which they come. The emphasis also reflects recognition among IPCC leaders that the scientific assessments aren't likely to be accepted by country leaders unless scientists from their respective countries participate in the creation of the assessments. This suggests an understanding of scientific knowledge as situated knowledge. This understanding contrasts dominant understandings of science as objective, value-free, and separate from politics, a neutral arbiter enabling actors to transcend political divisions and narrow conceptualizations of self-interest.

Based on preliminary ethnographic study of Brazilian scientists, science administrators and government officials engaged with international climate science and politics, this paper explores Brazilian actors' understanding of international science and policy processes related to human-induced climate change. The study highlights the reality of transnational social formations among these actors and their counterparts spread around the globe. It also suggests limitations of the inter-subjective model of science as neutral arbiter in political affairs. Interview data shows the ways in which Brazilian actors juggle multiple identities and points of views, all of which have a bearing on them as persons and interpreters of international science and the global environment. At times, their perspectives reflect the transnational nature of their personal and professional networks. At other times, their perspectives reflect the continued importance of history, geography and memories of colonialism, as they seek to make sense of their experiences in transnational networks and supranational arenas such as the IPCC.

A critical question underlying this study concerns the full range of consequences of efforts to "entrain" third world scientists into Northern-generated "international" scientific and environmental projects. The paper points to the need for further examination of such consequences at the levels of scientific and environmental problem-constructions and policy agendas.

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ACRONYM LIST

CDM	Clean Development Mechanism
CNPq	Conselho Nacional de Desenvolvimento Cientifico e Tecnologico (Brazil's national council of scientific and technological development)
CPTEC	The Brazilian center for weather forecasts and climate studies
ENGO	Environmental Non-Governmental Organization
(UN)FCCC	United Nations Framework Convention on Climate Change
GCM	General Circulation Model
GEF	Global Environmental Facility
IAI	Inter-American Institute
INPE	Brazil's national institute for space research
IPCC	Intergovernmental Panel on Climate Change
LBA	Large-Scale Biosphere-Atmosphere Experiment
LDC	Less Developed Country
MIT	Massachusetts Institute of Technology
NASA	The U.S. National Aeronautic and Space Agency
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation
OECD	Organisation for Economic Co-operation and Development
SBSTTA	Subsidiary Body on Scientific, Technical, and Technological Advice to the Conference of the Parties to the Convention on Biological Diversity
UNCED	United Nations Conference on Environment and Development
WRI	World Resources Institute

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INTRODUCTION

The globalism evoked by dominant environmental and scientific discourses involves a view of planetary beauty, fragility, and interdependence, accompanied by the need to transcend local, nationalistic frames of reference and concerns. Many have looked to science as a model for this transcendence, identifying it as "perhaps the most truly international culture in our divided world" (Brooks 1964), the most likely segment of a society capable of "transcending the 'idols of the tribe' in the service of human and environmental protection" (Evan 1981:23).[1] More recently, international relations theorists have promoted a similar understanding of the role of science and scientists in global environmental politics.

According to such theorists, science and global environmental problems are engendering a commonality of problem-definition and concern across national and geopolitical boundaries. Thus, Peter Haas (1992) defines epistemic communities in terms of shared consensual knowledge, building on earlier definitions of epistemic communities as professional communities for which concern with knowledge production takes precedence over other interests and activities (Holzner and Marx 1979). In Haas' formulation, an epistemic community is a network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue-area. It may consist of professionals from a variety of disciplines and backgrounds, but they have (1) a shared set of normative and principled beliefs that provide a value-based rationale for the social action of community members; (2) shared causal beliefs about the linkages between possible policy actions and desired outcomes; (3) shared notions of validity (i.e., intersubjective, internally defined criteria for weighing and validating knowledge in the domain of their expertise); and (4) a common policy enterprise – that is, a set of common practices associated with a set of problems to which their professional competence is directed, "presumably out of the conviction that human welfare will be enhanced as a consequence" (Haas 1992:3). Haas claims that efforts of epistemic communities have in numerous instances persuaded states to overcome a reluctance based on rational utilitarian considerations, the accepted models of rational choice that national governments typically have acted on.

In spite of the present socio-political importance of epistemic communities, relatively little attention has been paid to asymmetries in the functioning of expert networks and to influences of such asymmetries on the policy outcome (Biermann 2000:1; Jasanoff 1996b; Litfin 1994). Policy analysts' assumption of shared meaning within epistemic communities has not been subjected to much critical analysis based on empirical evidence, nor has the assumption that "It is in the long-term interests of all parties [in international politics] to encourage the development of transnational groups of experts that are formed on the basis of professional interest, geography, or shared concerns" (Lee 1995:14). The normative implication of this increasing role of epistemic communities has received relatively little critical attention from scholars, whose writings seem "almost complacent about entrusting power to such knowledge elites" (Jasanoff 1996a:174). Representations of the sort critiqued by Jasanoff are suspect in light of sociological and anthropological approaches to the study of science and the environment that have shown scientific knowledge to reflect and perpetuate particularities of perspective and inequities of power. Indications that norm-based consensus (in this case, a consensus about transboundary environmental phenomena) can, and perhaps increasingly does, have the power to override "narrow" interest calculations underscores the need for critical analysis of the dynamics and power dimensions of the generation of normative convergence in what Ulrich Beck has labeled our "risk society" (Beck 1992).

This study is a modest step in the direction of exploring these issues. It is based on research among climate scientists and politicians in Brazil and the United States, persons I here refer to as "climate epistemers." I use the term "epistemer" to refer to scientists and government officials engaged with international climate science and politics. I do this partly for the sake of linguistic simplicity. I do so also

because the distinction between scientists and policy-makers often is difficult, if not impossible, to discern, especially in science with geopolitical relevance (Elzinga 1993a:143). Brazilian officials most centrally involved with climate change science and politics in Brazil are generally Ph.D. scientists and also involved in the production of international science reports under the IPCC and other international scientific organizations. To the extent that the specific epistemers I refer to tend to be function primarily as scientists, science administrators, or policymakers, however, I will refer to them as such, for the sake of adding analytic precision.

One danger is that the term "epistemer" elides the very heterogeneity of epistemes this paper reveals to exist among participants in epistemic communities. Indeed, I would argue that to the extent that shared meaning is taken to mean the absence of cognitive heterogeneity and contestation, it is and will probably remain an impossibility, in science as in society. Heterogeneity will always remain. I therefore use the term "epistemer" in a more ironic way, similar to Michael Herzfeld's use of the term "Western" in his study of the symbolic roots of "Western Bureaucracy" (Herzfeld 1992). Herzfeld uses the term in an intentionally ironic way, aware that it enshrines a stereotype and lumps together diverse countries under a shared identity. Like the term "Western," the term "epistemers" belies the connotation of coherence. Nevertheless, as I show here, there also appears to be at least one level at which some cognitive convergence is taking place, albeit, importantly, with the persistence of heterogeneity. The glue that holds my "fieldsite" together is their interaction with an episteme of a sort, namely the climate regime and its associated concern about the global environment and about the production and evaluation of relevant scientific knowledge. In this sense, the episteme must be understood similarly to anthropological understandings of cultural groups as defined not so much by homogeneity as by a set of concepts, assumptions and beliefs with which all actors must interact if not necessarily embrace; culture is always contested, also among its members.

Climate epistemers are a nationally, ethnically and racially heterogeneous set of actors – mainly scientists and politicians – who concern themselves in the international scientific and policy-related forums focused on human-induced climate change. The core group of epistemers are those persons who physically participate in these forums, but the exact boundaries of this geographically dispersed group are not clearly definable since participants can include persons who closely follow what happens in climate-related international forums and who spend considerable energy seeking to shape public opinions on the issue of climate change and associated allocations of funds for scientific research or policy formation and implementation. The core set of epistemers are persons whose professional and, increasingly, social networks are wound up with other participants in the epistemic "community" (or "assemblage") that has formed around the climate issue. I argue that participation in international forums related to climate science does, in some respects, seem to entail and engender a commonality of problem-construction and norms among climate epistemers.[2] However, important interpretive and norm-based differences and inequities remain. These differences are reflected both at the substantive level (e.g., what is the nature of the carbon cycle and how does it implicate different national actors as contributors to global warming) and at the level of scientific cultures (e.g., who counts as an expert, what science is deemed reliable, what levels of cognitive authority are granted to different actors).[3] Many of these differences reflect the "North-South divide," a construct that will emerge in what follows even as it obscures differences and inequities within each of the blocks, as well as the commonalities between elements within the two blocks. Drawing on my research among climate epistemers in the United States and Brazil, I suggest that the notion of shared meaning within epistemic communities only works if one is willing to overlook profound differences in epistemers' articulations of norms, in their perceptions of international policy agendas, and, at least in some areas, even in their scientific understandings. Moreover, to the extent that a convergence of norms, causal understandings, and policy preferences is emerging among members of epistemic communities, the causes and the power dimensions and practical consequences of this convergence need to be understood in light of more complex understandings of the nature of power, in both politics and science.

THE POLITICS OF UNIVERSALIZING DISCOURSES

A hallmark of universalizing concepts is their tendency to hide contradictions, ambiguities, and complexities of socio-political reality. While recognizing that universalizing discourses also can work to progressive ends, world-system theorists identify presumed antinomies of unity and diversity, universalism and particularism, humanity and race, world and nation, person and man/woman as a "palliative and a deception" deliberately deployed in calculated dosages to make the functioning of a deeply divided and unequal system possible (Wallerstein 1990:39). Operating within a poststructuralist rather than a Marxist intellectual framework, Anna Tsing (Tsing 2000) acknowledges the broad appeal of universalizing discourses and the subsequent ease with which one – herself included – can fall into oversimplifying globalizing processes by highlighting primarily their virtues and promises. Regardless of intent, universalist discourses do of course, by definition, gloss over difference, and in the process of doing so, can serve the advancement of problematic political programs. Tsing identifies the sources of what she calls the "charisma" of globalizing discourses in three key features: (1) the futurism inherent in imaginings of the globe; (2) the fact that globalization processes have the potential to conflate and bring into dynamic interaction what was previously commonly separated (e.g., the scientific and the social, the corporate and populist, the excluded margins and the newly thriving centers, North and South, rich and poor etc.); (3) the common practice of associating rhetoric of linkage, circulation and flows of people, information and things with liberation and overcoming of past barriers.

The dangers of universalizing discourses in environmental arenas have been noted by many, not only in recent years. In the 1970s, for instance, environmental theorist Hans-Magnus Enzenberger pointed to the ideological functions of what he calls the "life-boat ethic," described as manipulative rhetoric of global brotherliness that avoids the need to analyze concrete inequalities, such as the distribution of power, costs and profits. In the present context, scholars also note how notions of ecological interdependence and of necessary preventive measures can tend to reflect local interests, albeit local interests often parading as global interests. This is the space of the "globalized local" identified by Vandana Shiva (Shiva 1993).

Celebratory discourses about the globalizing power of science resonate with corporate discourses of globalization (see for example (Coronil 2000:351)). Both sets of discourses offer images of globalization as liberations from present and past limitations and the promise of a unified humanity no longer divided by East and West, North and South, the rich and the poor. This discursive convergence reflects the general charisma of the global noted by Tsing. The convergence also reflects Etel Solingen's point that the reality that "openness to scientific interdependence goes hand in hand with heightened participation in the global economy;" the opposite to such openness is to be mercantilistic or nationalistic, limiting the flows of exchange of ideas and information (Solingen 1993:37-8). Solingen's work joins that of earlier scholars of science who identified the special affinities between the sociological principles of the republic of science and the classical economic theory of the market (Polanyi 1962). Moreover, insofar as science is perceived as authoritative, legitimate, and objective, it can guide and synchretize political action in ways that involve accommodation rather than blind involuntary coordination (Ezrahi 1990). In the era of global environmental regime-formation, the connections between science and political order are highlighted, as processes of trade and environment increasingly intertwine in global forums. Environmental agreements have to be understood in the context of mechanisms that seek to regulate and promote international trade, finance, technological transfers, communications, travel, weapons, development efforts, and human rights (Gupta 1998:298). Norm-violating behavior on the environmental front by corporations and national governments can invite damaging economic sanctions from other country leaders or from transnational networks of environmentalists.

This suggests the need to probe beyond the surface of globalizing discourses to identify more serious dimensions and the potential strategizing it conceals. To avoid falling victim to the charisma of the global, Anna Tsing suggests shaping analyses of globalization based on critiques of modernization which, unlike globalization, has lost some of its charisma (Tsing 2000:329). This entails three analytic turns: (1) the need to attend to the cultural specificity of commitments to globalization, rather than perceiving the force of globalization as transcending place and particularities of perspective; (2) attending to the social practices, material infrastructure, cultural negotiations, institutions, and power relations through which globalization projects work and, importantly, through which globalization projects are opposed, contested, and reformulated; and (3) retaining a critical distance with regards to the prescriptions for social change that accompany globalization projects. These three moves also help illuminate dimensions obscured by epistemic community scholars' emphasis on shared normative beliefs within epistemic communities and on the presumed self-evident nature of scientific evidence of global environmental degradation, its meanings, and the associated policy agenda. In the sections immediately below, I analyze (1) and (2) in an interlinked fashion. At the end of the paper, in line with Tsing's third analytical move, I call attention to certain potentially problematic consequences of efforts to entrainment third world scientists into international science and the climate regime and the associated (albeit circumscribed) normative convergence.

BRAZIL AND GLOBAL ENVIRONMENTAL REGIMES: LINKING PREEXISTENT AGENDAS TO CLIMATE CHANGE

What is the cultural specificity of Brazilian leaders' commitment to the climate regime? Although singular causal explanations would do little justice to the complexity of environmental politics in Brazil, Brazil's diplomatic position in relationship to international discussions about the global environment has clearly changed in step with the increasing reality of economic globalization and the associated international interdependences. Brazil's position reflects a partial and on-going transformation from an approach marked by resistance to international environmental regimes to one marked by relatively more openness and interest in the development of environmental science. Brazil led the opposition of less-developed countries (LDCs) to the first international environmental initiative, the 1972 United Nations Conference on the Human Environment held in Stockholm which legacy was to help identify and legitimate the biosphere as an object of national and international policy (Caldwell 1996:68, 101). Although consistently cautious due to the close link of the climate issue with deforestation in the Amazon – which Brazil's political leaders have defined as a sovereign issue not to be controlled at the international level – an important segment of these leaders changed course in the 1980s and 1990s, gradually showing more receptivity to international discussions and negotiation about global environmental problems. This was also reflected in the country's symbolic action of hosting the first Earth Summit in 1992 – the summit that gave rise to the Framework Convention on Climate Change.

Preexisting agendas

The transformation towards participation in this international environmental regime was partly a function of growing optimism in Brazil and other countries in the South that international attention to environmental issues need not undercut development goals but could serve national interests by securing financial support and technology for more environmentally sound development strategies (Lutes and Goldemburg forthcoming). National leaders in developing countries placed some faith in the prescription in the Framework Convention that developing countries be compensated for the "agreed full incremental costs" associated with limiting their greenhouse gases. The fact that the Clean Development Mechanism

(CDM) was accepted by the United Nations Framework Convention on Climate Change (FCCC) as an alternative to Joint Implementation (JI) was important in engendering this transformation, as was the fact that it was a Brazilian (i.e., less developed country) proposal. Unlike JI, CDM favored development priorities in host (developing) countries to the extent wished by Brazil and other developing countries by enabling new investment flows from richer nations to poorer nations such as Brazil and by speeding the transfer of technology and know-how (Cavard, Cornut and Menanteau 2001).

The main source of greenhouse gas emissions in Brazil is deforestation caused by the expansion of agriculture, mainly in the Amazon region. Deforestation aside, Brazil has a very good profile in terms of its emissions of greenhouse gases and could thus have a position of strength in the international negotiations. The share of non-fossil fuel, renewable energy in the national energy balance has been kept above sixty percent since the 1970s (La Rovere 2000). Brazil's comparatively clean energy matrix is partly due to the "Proálcool" program, which developed transportation fuel based on sugar cane. The program was developed in the 1970s and constituted an innovative solution not only to the oil crises of that decade but also to problems experienced within Brazil's important sugar-cane industry (Lutes and Goldemburg forthcoming). At the time of my fieldwork in Brazil in (April 1999), a few individuals within the Ministries of Environment and the Itamaraty (the ministry of foreign affairs) were working on identifying ways for Brazil to benefit from the Framework Convention. Based on discussions in Congress on how to increase production of fuel alcohol, for instance, a person within the Ministry of the Environment was devising a plan for increasing production of the alcohol by developing an international market for it in countries needing to reduce their greenhouse gas emissions.

Similar calculations of how to use the international climate change negotiations to advance Brazilian economic interests and preexistent agendas are apparent in recent engagements with the climate issue on the part of Brazilian environmental non-governmental organizations (ENGOs). Until 2000, Brazilian ENGOs generally didn't focus on international environmental issues such as climate change. Their concerns were national in focus. Greenpeace, which receives a large part of its mandate from abroad, was a notable exception, but as of April 1999, it limited its activities to lobbying rather than grassroots mobilization. Since 1999 and the FCCC adoption of the Brazilian proposal for a Clean Development Mechanism (CDM), several ENGOs working on forest issues in Brazil have started to link onto the climate issue and the climate convention. They saw a possibility of obtaining funds for forest protection through the CDM.[4]

Computer models as "technology of power"

Brazilian leaders involved with international climate negotiations – leaders in the ministries of foreign affairs, of science and technology, and the environment – are concerned to build national expertise in climate research in order to defend national interests. Liberal-democratic states need the authority of science to legitimize their actions (Ezrahi 1990; Mukerji 1989), and in the present globalizing world, nation-states look to a national base of expertise to mobilize scientific interpretations that favor perceived national interests. Rather than a transcendence of geopolitical divisions, this suggests an understanding of science as politics by other means. Brazilian leaders look to Brazilian scientists as producers of both practical-instrumental research and symbolic-instrumental research, two distinct – albeit over-lapping – functions of science described by scholar of science Aant Elzinga. The distinction between these two functions of research highlights differences in the way in which science relates to national interests. The first line of research – "practical-instrumental" research – aims at solving concrete problems through application of scientific knowledge. The other type of research, "symbolic-instrumental" research, serves political goals of a different nature, goals less concerned with the scientific component per se than with the latter's symbolic value as an emblem of scientific capacity; should the need arise for a specific type of

scientific expertise, a political unit secures influence in related but non-scientific arenas by having that expertise. The political unit is thus able to signal its interest and attachment to the problem area and a political will to play an active part in its development (Elzinga 1993a:1467). Computer modeling has important symbolic-instrumental functions.

Computer simulation is a central tool in the earth sciences whereby scientists seek to understand environmental problems, old and new. Computer modeling has become the central practice for evaluating truth-claims in areas of global change science where wholly empirical methods are infeasible (Edwards 1996; Lahsen submitted for review). Simulated projections using General Circulation Models (GCMs) also form the central scientific foundation of concerns about future deleterious consequences of human-induced climate change. The more complex GCMs include anthropogenic effects and couple oceanic, atmospheric, and some land-surface processes. Through numerical computations, GCMs simulate the complex interactions between the components of the earth system, mathematically representing the physical movement of gaseous or liquid masses, energy transfers, reflection, absorption, and other phenomena.

As also reflected in a U.S. National Academy of Sciences report, national climate modeling capability is widely perceived to be important to national security (National Research Council 1998). In the present climate regime, the GCM-based long-term climate models forced with greenhouse gases are an important "technology of power" (MacKenzie 1990). Similar to Donald MacKenzie's "gyroculture" that developed around ballistic missile technology in the making, the models and the community that produces them are both international and national. They are international in that the practitioners in different countries are well aware of each other's work and collaborate across national borders. They are national, in that both make up a "technology of power" too vital and too interlinked with national security concerns to leave powerful countries in comfortable dependence on external sources, especially if a country has pretensions of playing a major world role" (MacKenzie 1990:37). Without the means to produce a climate model of their own with which to project future global climate changes due to human activities, Brazilian officials rely on Brazilian scientists who have been trained in numerical modeling techniques abroad. They depend on the latter to certify the legitimacy of foreign group's climate projections. As a scientific epistemer put it in an interview with me, 'national political leaders know that we [Brazilian scientists participating in international scientific forums] would tell them if there's anything suspicious about the GCMs produced by foreign countries.' In this way, political leaders seek to limit their dependence on foreign science and scientists and to gauge their trustworthiness.

Brazilian leaders' dependence on foreign modeling groups' projections reflects the division in labor along geopolitical divisions between rich and less rich nations persists at the international level, due to limitations in national funding for big science. The majority of climate analysts are from developed countries with the means to support big science, and Kandlikar and Sagar note a widening gap between the capacity of less industrialized countries and developed countries in terms of their ability to perform climate research and analysis (Kandlikar and Sagar 1999:120). That division manifests itself particularly strongly in the domain of General Circulation Model (GCM) climate forecasts. Currently, only a dozen or so nations produce and use GCMs to consider the potential consequences of increasing greenhouse gases in the atmosphere. Brazilian epistemers work with such models through their international travel and networks, but Brazil does not have its own climate model. The resources required to run the increasingly complex climate models simulating the interactions between the atmosphere, oceans, and land-masses are so extensive and expensive that only relatively few national governments can carry them out, and Brazil is not among them.

Brazil's modeling capacity was particularly limited prior to 1991, in part because countries manufacturing supercomputers forbade exporting these technologies to Brazil when it was still pursuing the capability to develop nuclear bombs. In 1994, after Brazil relinquished that pursuit, the country obtained its first

supercomputer, located within the Center for Weather Forecasts and Climate Studies (CPTEC). Several other centers have since then installed or are in the process of installing supercomputers. Only two institutions – the National Institute for Space Research (INPE) and the University of São Paulo have developed GCMs for the use of modeling long-term climate change. Even in these institutions, such long-term modeling is given low priority, and none of these models are forced with anthropogenic greenhouse gases. Global carbon cycling is not given priority over short-term weather and seasonal forecasts, in spite of what a scientific epistemer called the desire among political decision makers ("people in Brasilia") to "compete with the United States and England on global carbon cycling."

Epistemers experience difficulties acquiring the necessary research equipment. Often, however, this is not due to a lack of funds but due to bureaucratic inefficiencies that hinder the process of obtaining necessary equipment in a timely manner. Similar difficulties have been described in the Indian context (Kandlikar and Sagar 1999:27). In terms of funds to travel to international meetings and to visit foreign scientific laboratories, epistemers escape national funding limitations through their participation in international science and assessment processes. The Brazilian equivalent of the National Science Foundation (CNPq) only supports travel to one foreign meeting every two years. However, epistemers obtain funding for foreign travel through projects and institutions such as the Large-Scale Biosphere-Atmosphere Experiment (LBA) in Amazonia and the IPCC. The travel is essential for the maintenance of their ties to the international scientific community, which in turn is essential for their ability to participate in cutting edge science.[5]

To produce proposals such as the CDM, Brazil depends on national expertise in the area of climate, a scarce resource in Brazil; according to Brazilian epistemers, only about ten Brazilian scientists really understand the global warming issue, follow it in the literature and know the physics. Developing countries also need technical expertise to obtain funds through international governance institutions involved with climate change and sustainability. For instance, Global Environmental Facility (GEF) provision of funds for projects to adapt to climate change are not given on the basis of simple need or poverty; they depend on how well a project is designed and presented to them, which requires making a case on the basis of "good technical skills" (Huq 2001).

In interviews with me, key Brazilian political leaders involved with the FCCC expressed desire for a national greenhouse gas-forced climate model in the future, but noted that material limitations prevent that in the foreseeable future ("We have a lack of everything; we can't dream too much"). To the extent that Brazilian leaders have needed to do their own modeling – which they needed to produce the CDM proposal, for instance – they have used a simplified version of a simple computer model developed by Tom Wigley, a climate scientist in the U.S. In doing so, they open themselves to criticism and rejection, since many Northern scientists already consider Wigley's model overly simple to be reliable. Cultural dynamics among climate scientists tend to favor comprehensiveness over simplicity in model building, on the (not always accurate) assumption that the former is more accurate and hence a better basis for policy and better science (Lahsen submitted for review; Shackley et al. 1998).

This hierarchy, and, certainly, the symbolic-instrumental value of GCM-modeling capability, has at least a few powerful Brazilian scientific and political leaders pushing for a Brazilian greenhouse gas-forced GCM model, even though the massive resources for this don't appear to be forthcoming at the present. Another obstacle is that, against the wishes of some of these leaders, some administrators of atmospheric science and individual atmospheric scientists in Brazil privilege the production of short-term weather and seasonal forecasts over modeling of anthropogenic climate change. The latter type of forecasts take up the capacity of Brazil's few powerful supercomputers allocated for atmospheric research.

Although climate epistemers reduce their dependence on national institutions and funding mechanisms through participation in international science projects and assessment processes (see below), Brazilian

political leaders dispose of a variety of means by which to develop and direct the country's scientific talent in the service of the national interest. At the time of my fieldwork (April 1999), the couple of Brazilian scientists who have assumed official responsibility for coordinating climate change-related science and policy-related activities were seeking to strengthen the national base of scientific expertise in the climate area. They suggested a variety of strategies for enrolling scientists in service of the state's scientific needs and political interests, including funding research and education possibilities in the area of climate change. Meetings can also be designed to initiate and maintain interaction with scientists and to stimulate their interest not only in global change science generally but also in nationally generated proposals for revision of policy framings and mechanisms under the FCCC. For instance, Gylvan Meira Filho, top administrator of Brazilian scientists and administrators in charge of coordinating climate change related science and policy-related activities chose to hold a meeting on the "Brazilian Proposal" at Brazil's national climate and weather forecasting center (CPTEC), in the hope that this would stimulate the interest of CPTEC scientists in climate science (Meira Filho 1999). At least at the time, Meira Filho was interested to change CPTEC's decision not to force its GCM climate model with anthropogenic gases, although, he said, "you can't force scientists" (Meira Filho 1999).

Nevertheless, various enticements as well as some measure of shared suspicions, cultural memory and national identity stimulate collaboration between the Brazilian government and Brazilian scientists. Indeed, the distinction between government officials and scientists is frequently blurred. As noted by Aant Elzinga, scientists in international science tend to play dual roles serving science but also politics, often rendering boundaries between researchers, politicians, and administrators difficult to discern (Elzinga 1993a).

NORMATIVE CONVERGENCE IN GEOPOLITICS AND SCIENCE

The above discussion of Brazilian political leaders' uses of science and of the international climate regime suggests Kandlikar and Sagar's (Kandlikar and Sagar 1999:119) observation in 1999 that "To date, climate negotiations have been less about protecting the global climate than about protecting national interests." The observation still rings true in 2001. However, it appears that a new normative order in international politics also underpins Brazilian leaders' decision to participate in the climate regime. Aside from pragmatic calculations of the sort described above, Brazilian commitment to the production of climate research and to the climate regime also reflects national aspirations having to do with prestige and perceptions of self-worth wound up with geopolitics. Brazilian leaders' decision to join rather than resist the international deliberations related to the global environmental is said to be partly due to a determination to steer Brazil's foreign policy away from what Brazilian leaders themselves came to consider an outdated and counter-productive "third-worldism" (and due to a desire to improve relations with the United States) (Hurrell 1992:417 cited in Lutes and Goldemburg forthcoming).

The same national pride was suggested in interviews I had with Brazilian politicians in which the latter expressed a desire to see Brazil strengthen its national expertise in the area of climate. An official in the ministry of foreign affairs noted that Brazil has higher scientific capacity than other developing countries and took issue with the fact that "Maybe people don't think that we can carry out [research] ourselves." The icon of Africa featured regularly in these and related expressions, suggesting a motivation to distinguish Brazil from other less developed nations. The following comments were made by different political epistemers: "If even in Brazil, we have very few people working on it, [and difficulty doing the greenhouse gas inventory,] you can imagine Mozambique, a small and very poor African country! They were completely lost. They don't know what to do;" "You get to meet important people [as a participant in the IPCC], and Paris is sort of a romantic place. And so after you've been there a few times, perhaps it's not as romantic anymore. But you know, to someone in Tanzania [Africa] who suddenly gets a chance

to do that, it's something." The statements are not unrelated to Brazil's aspirations to be a leader among Latin American countries. They also reflect the fact that Brazil is one of only a few countries in the Southern hemisphere that have been able to develop "resilient and fairly significant" scientific groups and institutions in the 20th century (the main example, much better analyzed, being India) (Schwartzman 1991:6).

However, this inclination to seek national pride and prestige through scientific capability is apparent even among political leaders of the world's very poorest nations. For instance, this inclination is apparent in a recent editorial in *Independent Bangladesh* by Saleemul Huq, a Bangladeshi climate epistemer[6] presently serving as director of the Climate Change Programme within the International Institute for Environment and Development in London (Huq 2001). Huq repeats UN President Kofi Annan's and the IPCC *Third Assessment Report*'s definition of human-induced climate change as "the number one environmental problem facing the planet earth" and notes with satisfaction that Bangladeshi scientists served as lead authors of several chapters and that

> Despite being a poor developing country and having weak scientific and technical institutions Bangladesh does have some of the leading scientists and experts on climate change in different institutions including BUET, BCAS, BUP, BIDS, BARC, IUCN, SPARRSO, EGIS, SWMC, etc. Indeed of the hundreds of experts involved in the IPCC/TAR, Bangladesh has probably had the most scientists as Lead Authors (after India) amongst the developing countries. This is an important recognition of their capability and expertise at an international level (IPCC members are chosen purely for their internationally recognised expertise and there is no quota for countries). These human resources need to be nurtured and developed further to enable Bangladesh to develop a proper strategy to deal with the problem at all its levels (including adapting to changes in the country as well as improving our negotiation capabilities internationally) (Huq 2001).

While the IPCC's *Third Assessment Report* has indeed sought to avoid the quota system that guided the design and inclusion of third world scientists in its second report, Huq's statement that IPCC scientists are chosen "purely for their internationally recognized expertise" fails to grapple with the very real problem of tokenism experienced by many third world scientists.

That aside, the point for the present purposes is that third world climate epistemers indeed do show sign of normative convergence, a finding also confirmed by my interviews with climate epistemers. I have identified something more than strategic linking of preexistent concerns to the climate issue among the core set of ten or so Brazilian climate epistemers – scientists, politicians, and at least one leader of an international ENGO in Brazil. To varying degrees and albeit not without some reservations about the extent to which climate change should be a top national priority, these epistemers expressed concern about human-induced climate change. They also expressed various levels of frustration at the difficulty of raising attention about the threat among Brazilian politicians and the public. They seemed to integrate perceptions of ecological interdependence and the need to transcend narrow, nationalistic frames of concern. Several of them expressed frustration with politicians in the Brazilian government who, in their view, remain stuck in mindsets characterized by zero-sum thinking and national economic interests: "all the talk is about economics: 'what can we get out of this?' As if getting money out of it was the priority," one of the Brazilian climate epistemers said about Brazilian political meetings convened to discuss climate change. Along the same lines, another climate epistemer criticized the fact that people outside of the scientific community often have the attitude that the developed countries got rich by polluting and conclude: 'so why can't we?!' She wished that the Brazilian public as a whole would get more educated about the issue and expressed that science courses in primary education don't include environmental issues to a sufficient degree.[7]

Thus, something more than strategic linking of preexistent concerns to the climate issue exists among Brazilian scientific climate epistemers, supporting the notion of cognitive convergence on the subject of the climate issue among epistemers on both sides of the North-South divide. To the extent that the climate issue is emerging from its marginal status in Brazil in terms of the priorities of the political and policy spheres, the general public, the scientific community, and even environmentalists, this is due in large part to the role of the international media[8] and climate epistemers. Confirming my own findings, Mark Lutes and José Goldemberg note that existing climate related programs in Brazil have been advanced because of the interests of individual scientists and research groups – and, in some instances, because those programs served other priorities, such as weather prediction, understanding inter-annual variability, biodiversity and resource management in the Amazon. Only rarely has scientific research in Brazil been the result of an exclusive response to a domestic institutional interest in climate change per se (Lutes and Goldemburg forthcoming). Brazilian governments and many scientists traditionally tend to focus on problems that are more local in nature. The same is likely to be the case in other less wealthy nations in the world. For instance, in their study of the perception and management of global environmental risks in Mexico, Diana Liverman and Karen O'Brien note that global risks were addressed only by politicians at the highest levels of government and under the profound influence from the international community and the United States. They suggest that scientific interest in the issue of climate change, some media attention, and "the commitments of some key individuals in government" centrally stimulated serious analysis and response to the global warming issue in Mexico. By contrast to these few climate epistemers, the majority of Mexican political and scientific communities where actors focused on "much more urgent" local problems such as local air and water pollution, deforestation and soil erosion (Liverman and O'Brien 2001). This resonates strongly with the situation in Brazil.

Epistemers with official policy-related functions in Brazil typically seek to orient other Brazilian scientific and political actors towards the global environmental problems with which they are involved. Scientific epistemers do so in their practices as scientists and teachers. Several scientific epistemers also raise public awareness of global environmental problems through the media where they feature regularly as national experts. One of them told me that he typically gives four to eight interviews each week to journalists working for newspapers, radio, and television, on subjects ranging from air pollution in São Paulo to biomass burning, climate change, and stratospheric ozone depletion. The strategy of another epistemer (an engineer by training who now serves in an official political capacity within the Ministry of Science and Technology) has been to involve "as many experts and ministers as possible" and "as much as possible." The fact of having been able to involve an unprecedented number of scientists and politicians around the FCCC meeting in Kyoto that resulted in the Kyoto Protocol led him to say that therefore "Kyoto was a success for us." "My approach is to raise awareness about climate change," he noted. Either through dual functions as scientists and politicians, or through their advisory roles to their national government, Brazilian epistemers serve to increase normative convergence among scientists, decision-makers, and the general public towards recognition of global environmental problems. This influence on the part of climate epistemers is not new: Immanuel Adler has identified the key role of the ideas and ideology of intellectuals – scientists, technologists and economists – and their institutions in establishing national goals, raising public awareness, and influencing policymakers in the 1960s and '70s. During those decades, these intellectuals were pressing Brazil towards pragmatic anti-dependence in science and technology and "egalitarian nationalism." Through their influence over political elites, institutions, and processes, this national and nationalistic elite created policy and institutional propensities for changing conditions in Brazil towards decreasing foreign dependency by creating a domestic computer industry and dominating the nuclear fuel cycle. Through these cases, Adler demonstrates the intellectual elites' power to influence the ruling elites to accept as given their antidependency ideology, thus affecting the course of change in Brazil (Adler 1987:1512). In the climate regime, the nationalist framework seems to be undergoing at least modification. At least a few prominent intellectuals in Adler's study are now climate epistemers, intimately interconnected in professional and personal relations with other epistemers and Northern green intellectuals and organizations.

Scientists can constitute an important link to national political power, as also suggested in the case of the 1975 Mediterranean Action Plan studied by Peter Haas; Compliance with that Plan was strongest in those countries in which experts – mostly ecologists and marine scientists – were able to consolidate power and influence among their national political leaders (Haas 1989). Among Brazilian climate epistemers there is a measure of the shared normative and principled beliefs identified by Haas, and these epistemers work to spread those beliefs and to increase national (and international) engagement with the issue.

THE POLITICAL ECONOMY OF CLIMATE RESEARCH

Brazilian climate epistemers' commitment to the climate regime also has material underpinnings. Although, at the national level, they are given access to a level of funding disproportionate to the overall national fiscal situation and allocation of funds for education and R&D, Brazilian scientific epistemers' ability to carry out cutting edge science and their professional status depend in important respects on their participation in international science.

Brazilian climate epistemers primarily concerned with the production of scientific knowledge (as opposed to serving mainly administrative and official governance functions) are, with few if any exceptions, trained in the United States. To rise to important positions as a scientist in Brazil and in international science, it is close to imperative to have been abroad and to have secured working relationships with powerful American and European scientific groups. Brazilian scientists can obtain access to international forums either by building strong ties with foreign scientists with power and status in international science or by securing ties to national leaders who can nominate them or send them as national representatives. International networks are especially key for those wanting to participate in international scientific projects, however. This is because North American and European agencies providing funding for international science projects tend to leave it up to individual scientists to choose their collaborators in the host countries, even as they may require U.S. scientists to have a Brazilian co-P.I. (Principal Investigator). The LBA is a case in point. The eighty million dollar experiment is designed to improve understanding of the role of the Amazon rainforest in the global carbon cycle and it has become the principal focus for most of the climate change related research in Brazil (Lutes and Goldemburg forthcoming). It receives some funding from the Brazilian government but the largest share of its budget is contributed by foreign institutions, especially the U.S. National Aeronautic and Space Agency (NASA). Through such projects, Brazilian climate epistemers maintain foreign ties and retain their scientific edge.[9]

The transnational nature of Brazilian climate epistemers' life worlds were brought home to me during my month of fieldwork in Brazil when on numerous occasions I found it difficult to steer the interviews from discussions about U.S. scientists and politicians to their counterparts in the Brazilian context. These discussions reflected a level of knowledge of central personalities in U.S. science and politics that surpassed that to be found among many mid- and lower-level U.S. scientists. This suggests the globalizing trend whereby segments of societies – and especially what some call "symbolic analysts" (Reich 1992), i.e., people involved in problem-solving, problem-identifying, and strategic-brokering activities, including research scientists and engineers – increasingly are connected to their counterparts throughout the world. Through actual interaction as they travel and through communications networks in this globalizing world, individuals and groups can come to have more in common with other persons that are far away, scattered throughout the world, than with a majority of their fellow national citizens.

In the case of climate epistemers, they may live on the periphery but their lifeworlds associate them with the center. At least for a few climate epistemers who have gained international reputations as excellent scientists, the geographic boundary between north and south weakens and, at times, virtually dissolves.

Simon Schwartzman writes that "To be 'south of the equator' means not to have participated fully in the Western intellectual and cultural tradition to which modern science and its related institutions, such as modern universities and entrepreneurial capitalism, belong" (Schwartzman 1991:67). But what is the measure of "full belonging"? Such descriptions of the periphery don't reflect the extent to which Brazilian epistemers are formed by their educations "in the center" (usually the United States), nor the extent to which their lifeworlds are constituted in and by international scientific and political forums and transnational networks of colleagues, with whom they also form friendships and visit with frequently, in some cases visiting and living in the "center" (usually the United States) for a month or more each year. In addition, Brazilian epistemers are connected with fellow epistemers through e-mail, telephones and fax machines.

While the scientific epistemers do experience some limitations in terms of funding and equipment available to them (described below), they are better off than many scientists who are natives of "the center" where they also live and work. Professional networks and accrued credentials are more important than factors tied to geographical location. This is not to suggest that scientists in the South as a whole do not suffer from serious material limitations, as also reflected in the relative low participation of LDC scientists in the IPCC. In the IPCC's 1995 *Second Assessment Report*, convening lead authors and contributors from developing countries constituted only about fourteen percent. The gap is particularly strong in the Working Group I, the group responsible for assessing the science: in this group, 93.6 percent came from Annex I (developed) countries, 6.4 percent from non-Annex I (developing) countries. This reflects the more limited scientific capacity of LDCs, and the associated smaller number of trained scientists working in LDCs. It also appears to reflect discriminating judgments on the part of IPCC leaders as to whom qualifies as an expert. It seems that Brazilian policy makers' judgments of who their relevant experts are do not necessarily converge with the judgments on the part of leaders of international science and assessment processes. This was suggested by the fact that a coordinator of global change research within the Brazilian Ministry of Science and Technology nominated twenty-eight Brazilian scientists to participate in the literature review of the IPCC's 1995 report, but only six from that list were chosen. Three Brazilian scientists not on the list were included by IPCC leaders, again suggesting the importance of foreign connections in terms of gaining access to international science and assessment processes.

While many Brazilian scientists suffer from profound limitations in access to the necessary means to be active and influential scientists, the small group of climate epistemers enjoy considerable access to financial resources. Aside from the international forums such as the IPCC, which provides the necessary financial support for their participation, Brazilian climate scientists obtain funding through the National Council of Scientific and Technological Development (CNPq) and, for scientists in the state of Sao Paulo, the FABESP. Several scientists and climate epistemers at the University of Sao Paulo relayed to me that they had never in their lives had a research proposal rejected. This is a reflection of the extent to which Brazilian leaders perceive a need for national expertise in global change. In the words of one Brazilian scientist and climate epistemer:

> There is strong interest in [science related to air pollution and global environmental problems] in this [in Brazil]. And in agencies – like FABESP, CNPq – the interest is *extremely* high. There is plenty of money for this field. You know, I *never* had one single grant rejected my whole life. And that is very different from American science. When I see – scientists in the United States often have their proposals rejected, and that never happened to me. In Brazil, if you have a good idea, if your research is relevant, and if you prove that you can do it, there is *100 percent* chance that you get the money. And that isn't just the case for me.

This abundance of research funds made available to Brazilian climate scientists does not reduce the importance of connections to the international scientific community. To avoid the threat of invisibility in

international science,[10] these epistemers need to maintain close ties with the international scientific community. The ability to speak English is of paramount importance, an ability that is strengthened through participation in the international scientific community. Through this participation, they also learn of important new scientific discoveries, methodologies, and projects of which they can be a part. Moreover, their international ties render Brazilian scientific epistemers valuable to Brazilian political leaders, for reasons described above.

BRAZILIAN COLLABORATION – SHARED HISTORICAL MEMORY, SHARED SUSPICIONS

Globalist projects commonly have both positive and negative consequences, and they may not remake the world as intended. Hence the importance of attending also to the struggles and contestations that surround globalization, to the "missed encounters, the clashes, misfires and confusions" that are as much part of the global linkages as the simple flow highlighted by so many optimistic descriptions of globalization produced both inside and outside of the social sciences (Tsing 2000:339). There is a tendency to assume that transcommunal and transnational ideas and activities form a single ideological system, an assumption challenged by an important subset of scholars, including anthropologists (Appadurai 1996; Marcus 1998; Rabinow 1999; Tsing 2000) and proponents of symbolic interactionism, a sociologically-grounded approach in science studies (Fujimura and Fortun 1996; Knorr Cetina 1999; Porter 1995; Star and Griesemer 1989). Even single scientific disciplines are typically more heterogeneous than commonly acknowledged (Galison 1997; Knorr Cetina 1999). Similarly, research among climate epistemers reveals that profound differences and chasms remain among them, despite a measure of the shared normative and principled beliefs identified by Haas. This suggests that the epistemic community of climate scientists is best conceived as a heterogeneous assemblage of a multiplicity of actors, agendas, practices, and processes that only occasionally converge in time and substance.

The limits of cognitive convergence were also recognized by the following U.S. science administrator who has been key in promoting the present focus on global environmental change, of which the creation of the Inter-American Institute (IAI) was a part. Based in Brazil and so far funded predominantly by Northern institutions (especially the U.S. National Science Foundation), the IAI provides funds for global change science projects to scientists in Latin America.

> At the least, we need to get in touch with the gulf that exists, and the suspicions that exist. And they are really startling – especially to scientists. Ever since 1989, we have been building an Inter-American Institute. President Bush called for it at a meeting in 1990. There are now 18 or so countries of the Americas that are members of the Inter-American Institute. And its purpose is global change research. The other day I heard something really interesting [*slight laugh*]. I don't even remember what precipitated it but somehow something came along and a person from one of the countries of the Americas – from Chile – after 9 years of [being involved with] this, said "There it is! There is the U.S. motive for IAI. I knew they were up to something, I knew there was a larger political motive. It took eight years, but now it has been revealed." It was actually a group of people from several countries, joined by Chile, who said that IAI was an American rip-off. Now, I was there from the word "go." I know the motives, I know every iota of thinking behind it. There is no conspiracy. There is no hidden purpose. There is no political agenda. [Laughs] It is basically altruistic as hell, but it was never ever perceived that way by the other players. These are friends of mine, people I have known for years, and I suddenly realized: oh my God, they have been sitting there in their respective countries, these pals of mine, wondering what devious thing I was up to.

An important portion of the cognitive differences that exist among epistemers are rooted in national identity, cultural memory, and other aspects of personal experience, all of which position actors differently in the field of geopolitics and international science. Thus, experiences of colonialism and perceptions of continuities between the colonial past and present conditions in international science perpetuates one line of division among epistemers. National sentiment is an important element. Brazil has been identified by some as "Latin America's most nationalist country," even during "sell-out periods" (Adler 1987:201). It is "one of those countries which, in spite of its liberal rhetoric and its rhetoric in favor of foreign capital, has systematically used its bargaining power, i.e., the bargaining power of its dominant classes, of its government technocracy, and of its national entrepreneurs, to resist. ... Even if the national technocrats consider themselves transatlantic, consider themselves liberals, in practice they have increased State intervention, have increased the strength of State enterprises augmenting Brazil's political control" (Maria da Conceicao Taveres, in Adler 1987: 201).

A nationalist ethos rooted in part in memories of colonialism and involving awareness of continued inequity – in the world, generally, and in science – limits the extent to which Brazilian epistemers accept dominant scientific and political interpretations of the global environment and the political implications of those interpretations. Brazilian actors' discourses portray the "international science" offered by transnational expert networks as biased by Northern framings and interests, and therefore not to be accepted at face value. Similar perceptions have been expressed in other third world contexts (Agarwal and Narain 1990). Brazilian epistemers – scientists and policymakers alike – have witnessed how important framings associated with the Framework Convention were set into place by Northern actors without input from developing countries, yet with important consequences for the latter (these framings and their implications for notions of responsibility and third world nations have been described by many analysts. See for instance, Agarwal and Narain 1990, Biermann 2000, Kandlikar and Sagar 1999, Miller 1998, and Yearley 1996, among others).[11]

Suspicions of the sort described immediately above have forged an on-going collaboration between Brazilian policy makers and scientists working on climate related issues. Brazilian scientists and politicians were initially stirred into action by a report by a prestigious U.S. environmental non-governmental organization, the World Resources Institute (WRI). The World Resources Institute's 1991 calculation of country-by-country emissions of greenhouse gases exaggerated the responsibility of key developing countries, listing three developing countries among the world's top six net emitting nations. The report ignored the issue of historic responsibility and calculated responsibility in terms of national emissions levels rather than per capita emissions, which are much lower in the third world than the developed North. The report also estimated CO_2 emissions from deforestation and, even more, from methane, which has a fraction of the atmospheric lifetime compared to CO_2, which the report didn't take into account. As a result, the report presented developing countries as culprits equal to Northern nations and listed Brazil among the top four biggest polluters of the atmosphere. Divorced from any discussion of its limitations, the index by the WRI quickly became standard material for those discussing the negotiations, e.g., the OECD (Roddick 1997).

This situation stimulated close collaboration between Brazilian scientists and politicians on the emissions-related science, a collaboration I was told has continued since. The close collaboration among scientists has yielded findings related to the carbon cycle that conflict with findings presented in IPCC forums and reports. In the aftermath of the WRI report, the collaboration resulted in research findings by Brazilian scientists associated with Brazil's national center for space studies (INPE) that challenged the WRI and IPCC representations of Brazil as a top emitter of carbon dioxide. These findings were subsequently brought to the attention of the IPCC, which integrated them into its conclusions and made INPE's director – Gylvan Meira Filho – co-chair of the IPCC Working Group I. (No longer director of INPE, Gylvan Meira now serves as director of the Brazilian Space Institute, which subsumes INPE).

Brazilian scientists and politicians typically frame the issue of responsibility in terms of historic contribution to the problem and in terms of per capita emissions rather than national totals that disregard population size. The discourses of Brazilian scientific and political climate epistemers alike reflect some measure of distrust of international scientific institutions such as the IPCC, which they describe as dominated by Northern framings of the problems and therefore biased against the interpretations and interests of the South. Scientists without official political roles in the domestic context express the view that the IPCC is biased. For instance, the (MIT-trained) director of Brazil's climate and weather forecasting research center believed that if a scientific argument would benefit only poor nations then it probably wouldn't be influential within the IPCC. "Say, if it could be proven that only tropical forests remove atmospheric carbon dioxide while Boreal forests are a source of CO_2, then I think the U.S. would cut funding for carbon cycle studies of that source," he said. Moreover, scientists and engineers now occupying key national political and administrative positions related to climate science and policy have chosen not to pass their findings through the IPCC peer review process before taking them to the Framework Convention because they distrust the peer review. This choice was explained as follows by the person responsible for coordinating Brazilian research related to climate change and greenhouse gases – someone with extensive experience with the IPCC, both as a national representative and policymaker and as someone with pertinent technical expertise:

> INTERVIEWEE: I don't like the IPCC. I think it is too biased. Now, I'd like to have a lot of new discussion about responsibility and attribution. As it is, all this game is dirty. The science is biased; it reflects their point of view [his voice gets shrill, reflecting strong feelings about the issue]. In all the working groups, if you have ninety percent of the people coming from the developing countries, it is bound to reflect their perspective. I'm not saying that they have prior bad intentions.
>
> Both the IPCC and the FCCC are biased by governments. [...] It's very clear when it comes to the convention. There are no misunderstandings there, no trying to convince people through the wrong methods, no trying to give certainty to several points of view that are completely biased. The IPCC, they make believe that their point of view is objective.
>
> LAHSEN: So you perceive them as using science disguised as being objective when it is really not, [and that they do it to obtain] political results?
>
> INTERVIEWEE: As a basis for political discussion at the convention. Yes. And using this to help arguments supporting their point of view. That is why we present our proposals directly to the convention. Because it cannot go through the literature, because they will not allow us. If we go through peer review, the peer reviews will be part of IPCC and they all reject our proposal saying that we are doing junky literature, and so on. They will not approve our piece, they won't allow our papers to get published in any scientific magazine. Because you have to go through a peer review process and they will say that this is junky science. That what we are doing is junky science because we are Indians and we don't know what we are talking about. That kind of thing. [with raised voice again]
>
> LAHSEN: Which studies in particular?
>
> INTERVIEWEE: Oh, like the Brazilian proposal [CDM], all the modeling we are doing. They will point out what is wrong, and actually it is not wrong. We say in our proposal what our simplifications are. But they say that we are wrong, that we can't use this or use that, that we have wrong assumptions. And that is not the case. You have to go into the details and look at what is the difference if you incorporate these details that they say we forget. So this is a big political circus. And we have no time to take part in these discussion because if you direct too much time in that direction then we can't do our business in Brazil. We [who are in charge of coordinating and producing Brazilian environmental science and policy] are very few. So we have to forget about this.

It is beyond the scope of this paper to probe these claims in depth. Let it be said, however, that although peer-reviewing Northern scientists likely would uphold the rejections by pointing to scientific criteria, studies are needed that scrutinize this and other instances of conflicts similarly involving divergent scientific interpretation. Analyses are needed that probe the extent to which third world epistemers are disempowered by the cultural value hierarchies that pervade international science. Studies of peer review processes have shown the ways in which prejudice can disadvantage scientists who are women (Wennerås and Wold 1997) or who reside in the third world (Gibbs 1995). Moreover, third world scientists with limited means to the most advanced technology are likely to be disadvantaged by a value hierarchy that places greater value on complex models than on simpler models and techniques. The existence of this value hierarchy has been identified and its scientific merit critiqued (Lahsen submitted for review; Shackley, et al. 1998), yet it continues to function as a cultural force, with important implications for Brazilian and other third world scientists, even epistemers who are materially less disadvantaged compared to other third world scientists. The above epistemer's carbon cycle-related modeling was carried out using what he himself referred to as a "rather radical simplification" of a model (developed by Tom Wigley) which many U.S. scientists, especially climate modelers, already consider too simplified to be reliable to qualify as good science or policy tools. Yet, the more complex models have limitations of their own. According to Shackley et al., the merits of simple models as well as complex models depend on the problems they are used to explore. However, as Aant Elzinga has also shown in the case of science in Antarctica (Elzinga 1993a; Elzinga 1993b), scientific expertise in the climate regime can serve to secure the interpretations of the powerful. Material and other restraints limit Brazilian politicians' and administrators' ability to provide alternative scientific interpretations and problem-constructions.

In spite of these collaborations, and as already suggested above, the relationship between political leaders and scientists is not devoid of tensions. In a globalizing world, individualization processes tend to grow stronger (Beck 1992) and scientists are subjected to contradictory forces (Schoijet and Worthington 1993). Tensions between government officials and climate epistemers around the subject of the global environment surface regularly, and, in interviews with me, more than one Brazilian policy makers suggested that participation in international scientific projects such as the LBA intensifies Brazilian scientists' criticism of Brazilian political leaders' policies bearing on deforestation. Brazilian environmental scientists tend to be highly critical of government inaction on that issue, which aligns them with foreign scientists and environmental activists (as relayed by someone in Brasilia's government, "normally [both foreign and Brazilian] scientists are very biased in terms of policy; they use [science] to blame Brazil for misusing the Amazon forest").

A related schism between Brazilian scientists and politicians, particularly military officials, also showed itself in the context of the LBA experiment, which studies the Amazon region. The latter suspected that the experiment might serve foreign interests. Particularly suspicious to them was the fact that the project involved flying a converted NASA spy plane over the Amazon. Brazilian epistemers participating in the LBA project expressed both some understanding of these security concerns but, as a whole, tended to dismiss them as relatively unimportant. Communication between scientists and persons in government concerned about the LBA was limited; the details of the latter's concerns were unclear, as these concerns were expressed primarily through bureaucratic venues, through delays in the issuance of the necessary visas and licenses to the foreign scientists and their projects. The scientists sought to alleviate the concerns about the surveillance – which also raised controversy among the public – through communication via the media. Members of the public and the media expressed suspicion that the U.S. was scouting Brazil's natural resources (gold in particular). They also expressed the common suspicion, based on experience, that the foreign scientists were conducting these projects without giving anything in return; that they would simply take their data and leave, possibly even using the data to blame Brazil for the deforestation and the resulting effects for the global environment. In this context of contestation, the scientists sought safe ground by focusing the attention of the media and their own attention on the science itself, the merits and objectives of the project.

While the above suggests Brazilian scientific epistemers' role in legitimating international science and, through it, perhaps, an international ethos less marked by geopolitical division and historical suspicion, scientists also sometimes resist the international forums and agendas to serve more local agendas. This was already suggested above in the discussion of how the institutions with supercomputers nevertheless resist pressures from politicians/science administrators to allocate these valuable and limited computer resources to climate modeling forced with greenhouse gases. It appears that certain material conditions, particularly scientists' need to do consulting, reduces the incentive to respond exclusively to international scientific agendas and to national science administrators' desire to steer them in the direction of international science and climate research. The Brazilian government exerts greater power over scientists in government laboratories than in the universities (in the former it sometimes happens that research has to be signed (approved) by the government before it can be made public). However, in both institutions, the government's ability to direct scientific research has been limited in recent years by the proliferation of consulting practices among scientists. While not officially sanctioned, the government has looked the other way, aware of the economic hardship suffered by scientific epistemers on federal and state payrolls because real wages have declined significantly during the 1990s due to the economic crisis. One university-based climate epistemer – who also identified himself as "a farmer," as owner of a farm for profit – said that since 1995, forty percent of his salary comes from consulting for industry (officially, scientists can only supplement their salary by ten percent through consulting). This same scientist also resisted urgings to do more research on long-term anthropogenic climate change, choosing to devote a large part of his work towards producing better short-term (weather and seasonal variability) forecasts on which lives depend in Brazil due to the prevalence of floods and droughts. He himself noted the urgent needs for these forecasts and struggled to balance those needs with international scientific projects and concerns related to human-induced climate change.

One can only speculate the extent to which this decision was related to his sources of funds, but it does suggest the possibility that – to the extent that scientists consult for nationally based industries – their consulting services might stimulate some Brazilian scientists to work on more local and immediate problems over longer-term, less certain problems such as human-induced climate change.[12] Some university departments do not allow consulting, however. By contrast to the epistemer discussed immediately above, a climate epistemer in such a department – someone who is highly regarded in international science and who is enlisted in so many LBA-associated projects that he has had to decline some of them – claimed that he experiences no conflict whatsoever between the international scientific agenda and his own priorities. This is perhaps a function of the nature of his particular line of research, which bridges local pollution problems and global environmental problems. However, it suggests the need to explore the ways in which differential access to different institutions and resources shapes the problems scientists choose to address through their work.

The above discussion also suggests the extent to which Brazilian politicians must work to produce Brazilian scientific subjects who can serve the national ("local") interest. It illustrates the (not always successful) strategizing on the part of national political leaders required to secure a national base of expertise in a globalizing world. As noted by Arjun Appadurai, much that has been considered local knowledge is actually "knowledge of how to produce and reproduce locality under conditions of anxiety and entropy, social wear and flux, ecological uncertainty and cosmic volatility" (Appadurai 1996:181). National identity formation has an important imaginary component and often result from deliberate social engineering (Anderson 1991). The same applies to community formation generally, and hence to the formation of identities and affiliations below and beyond the national level. As discussed below, one can see efforts at entraining scientists and politicians into the climate regime as a means of producing new subjectivities – new subjects who in turn form an important link to national arenas (for foreign global change leaders strategizing beyond their own national borders) and to international arenas (for LDC political leaders strategizing for national interests). Identities and knowledge are not stable, and local

knowledge is neither natural nor necessarily tied to local territory. Nations – and communities generally – are created in part through the inculcation of a spirit of nationhood, a spirit that is nurtured by a variety of means, including offering opportunities to some. Provision of financial support for functionaries – a key tool in nation-building (Anderson 1991) – is a means by which national as well as foreign (Northern) leaders of global change science seek to produce reliable scientific subjects in the less developed countries; as openly recognized in Northern policy literature, capacity training is a means of influencing the problems scientists perceive and choose to address.

KNOWING WHEN MEANING IS INDEED SHARED – THE PROBLEM OF SPIRALS OF SILENCE

Peter Haas identifies epistemic communities with shared meaning. However, my research among Brazilian epistemers suggested that human and material limitations undercut their ability to *openly* contest scientific conclusions and policy agendas with which they differ and which they view as biased. After eight years of collaboration with third world scientists around the Inter-American Institute, the U.S. global change leader quoted still hadn't become fully aware of the suspicions that pervaded among his colleagues and friends concerning the IAI. This suggests that contrary to dominant assumptions among Northern scientists and leaders, contestation can exist beneath a surface appearance of accepted "facts" and shared meaning, contestation which doesn't necessarily express itself in peer-reviewed scientific literature. This also underscores the difficulty of knowing the extent to which scientific conclusions and policy preferences are in fact shared among epistemers.

Attempts to identify disagreement among epistemers is also rendered difficult by the political importance of scientific consensus in the climate regime. Leaders in global change (mostly "Northerners") recognize that national leaders around the world are unlikely to accept the assessment reports and associated policy measures if scientific experts from their own respective countries are not part of the assessment process. The authority of the IPCC is a function of the consensus it represents. The reports and IPCC leaders and defenders thus point to the large number of scientists from countries around the world to establish its authority and the credibility of its conclusions. Given incomplete scientific understanding of human-induced climate change and years of controversy among scientists due to conflicting views of its reality and potential consequences, convergence of international scientific opinion is generally used as a measure of the reality and nature of the threat, and as support for policy action (see for instance (Soroos 1997:207)).

The IPCC reports are rightly understood to reflect prevailing scientific opinion. But emphasis on consensus hides important differences that remain, as well as the dynamics that support some interpretations over others. The extent to which the reports – and the production and accrediting of scientific knowledge generally – are interlinked with social dynamics and problems of power is less often recognized. For instance, subtle and not so subtle cultural dynamics among climate scientists generally and within the IPCC can tend to discourage open disagreement with the official consensus conclusions (Lahsen 1998a). These dynamics contribute to the IPCC tendency to understate caveats and to focus on worst case scenarios, a tendency also identified in a June 2001 U.S. National Academy Report (Seelye and Revkin 2001). The same drive to present a strong consensus has led to complaints on the part of individual scientists who feel that their scientific authority was abused because their differences with dominant IPCC conclusions weren't reflected in the consensus reports.

IPCC reports result from complex social processes and represent only a "suboptimal essential consensus" (Fuller 1988). Suboptimal essential consensus leaves uncertain the extent to which participants participated and agreed, as well as the contributing factors that led them to agree or at least not voice

concern. This type of consensus is shaped by the most vocal and powerful scientists. A consensus functions optimally "when each member of the group knows the justificatory standards and current beliefs of all the other members, especially as changes come about as the result of social interaction" (Fuller 1988:214). When this is the case, a consensus is called an "essential consensus." However, even in the best designed essential consensus, perfect information of this kind is unlikely to be readily available, if only because not everyone is constantly, explicitly, and while heard by everyone, stating his or her beliefs. This is the case with the IPCC. A consensus which is less than essential is called "suboptimal," and a suboptimally functioning essential consensus produces what has been termed "the spiral of silence."[13] This happens when those who either disagree with a standing belief or who have no strong views on the issue simply remain silent. If the public forum is presumed to be a democratic one and thus equally accessible to all, then there is a strong temptation to take the more highly visible (or audible) positions as the ones most representative of group opinion.

Aside from limitations in material resources and scientific expertise, it is important in this context to recognize the potential role of prejudice and intimidation in building a surface appearance of agreement. The epistemic community literature assumes agreement on scientific and normative matters where important differences exist under the surface. But international forums such as the IPCC are not forums where scientists necessarily feel free to voice their differences with prevailing understanding of science and preferred social order. In other forums, Brazilian scientists express perceptions of prejudice, experiences that evoke Brazilians' cultural experiences of colonialism:

> When the Portuguese came to Brazil, in the 1500s, they gave mirrors to the Indians. They obliged them to cut the trees and took the wood back to sell in Portugal. And they gave mirrors in payment for cutting down the trees. They worked for the whole year cutting trees and then the Portuguese loaded up all the timber and gave them a few mirrors and that was it! And some metal axes to cut the trees that were more efficient. It's something like that [with the IPCC]! They always look to the third world like that. We are Indians, we don't how to talk, we are not... we don't know what we are doing. 'Poor guys, forget about them.' That's how people look at us.

This same epistemer noted that my being Danish and thus from a developed country gave me a level of credibility not enjoyed by himself ("[Y]ou are from the developed countries. So in this sense you have more credibility than the Indians. If I talk, I have no credibility!"). This line of discourse may at times serve as a strategy by which to mobilize "political correctness" in favor of LDC actors. However, to reduce it to that would do injustice to the pervasive perception among Brazilian epistemers of prejudice and tokenism in international science.

Other Brazilian climate epistemers expressed similar experiences. Speaking about science generally, a Brazilian climate scientist and epistemer who is highly respected internationally noted:

> EPISTEMER: This issue of what I call colonialism in science, it exists. It is *very* strong. And nobody talks about it. On either side. Who profits and who suffers.
>
> LAHSEN: And what are examples of it?
>
> EPISTEMER: Oh, thousands. It is very common. I'll tell you an example from Max Planck. For any scientist to work in Brazil, you have to have a Brazilian counterpart, you need to have some local support and things like that. And people here do that just in exchange for very [minor things in exchange] – sometimes, old and useless equipment. So you donate an [instrument] to somebody in Bahia [a poor region of Brazil], for example. This is a concrete example I know. And this person in Bahia does whatever necessary and works as a slave for the people who donated the [instrument], which was a spare in their laboratory. Or, [the example of] a scientist from Manaos who gets a gift from NASA, and he likes the prestige to tell his colleagues or friends that he works with scientists

from NASA, even if everything he does is to carry their equipment in the field. [Says slowly and with emphasis on each word:] This really happens.

Perceptions of inequity and prejudice were also reflected in the experiences Brazilian climate epistemers' shared with me in interviews, experiences of being included as tokens rather than equal participants in forums such as the IPCC.

> I think that there is a very big North American bias. I think these international programs are extremely elitist, you know, English-speaking scientists getting together. But now, there is this awareness that you have to include the developing world. You can't make a global network of observations if you don't have Brazil chipping in money, Africa chipping in money, or whatever; you have to have these countries participate. But I feel that the participation is at a minimum. You're a token scientist. If you speak English, great, but...

This scientist said that she often has the impression that her input as a participant in international forums isn't taken seriously, and repeatedly mentioned the feeling of being a token rather than a true participant.

Considerations having to do with prestige and intimidation can reduce the range of opinions expressed in forums characterized by suboptimal consensus formation. In the words of one epistemer, participation in the IPCC and other similar international forums is "a great honor," to American scientists but also particularly for many scientists in developing countries whose sense of self-worth can become wrapped up with continued inclusion in those forums. He added:

> [The IPCC] has become a prestigious club, you know. You get free tickets to international meetings, and per diems...You get to meet important people, and Paris is sort of a romantic place. And so after you've been there a few times, perhaps it's not as romantic anymore. But you know, to someone in Tanzania [Africa] who suddenly gets a chance to do that, it's something. I became part of that process, but I always looked at it with great skepticism because by then I [had other important official positions within Brazil]

As noted by scholars in STS, scientists evaluate the risks and rewards of making claims, choosing from a range of ways to describe the matter at hand on that basis. They evaluate the "credibility economy" into which their claims will enter (Shapin 1995). When economic and political realities work strenuously against the public credibility of claims about something (Shapin mentions, as an example, the dangers of drinking coffee), actors are less likely to make countervailing claims. This doesn't make them nor the processes with which they are engaged any less scientific; in such areas, deliberations about the credibility of different test regimes can be "perfectly scientific" yet "political through and through" (Shapin 1995:2645). This same point was made by the Brazilian epistemer quoted immediately above. She said about international scientific projects and processes such as the IPCC with which she has been involved that "You might have science talk, but it's totally political." In such a context, scientists choose their claims with circumspection.

ALTERNATIVE MODELS

To the extent that the epistemic communities remain identified as professional communities for whom epistemic criteria – concern with knowledge production – has primacy over other interests or orientations, full recognition of the diversity of contemporary machineries of knowing may require giving up the notion of epistemic community altogether. As suggested by Jasanoff and Wynne, the term epistemic community leads one to "intuitively" associate it with boundedness, internal cohesion and common purpose (Jasanoff and Wynne 1998). Yet these concepts apply poorly to the transnational epistemic

community that has formed around climate change, and it probably applies poorly to most, if not all, social formations commonly referred to as epistemic communities. Alternative concepts that better account for the heterogeneous nature of the epistemic community that has formed around climate change include those of "transculturation" in the "contact zone" (Pratt 1992) and "assemblage" (Rabinow 1999; Watson-Verran and Turnbull 1995). At the least, epistemic community literature needs to integrate greater recognition of the persistence of internal heterogeneity and inequity, and the practical effects of power inequities.

Mary Louise Pratt's notions of "transculturation" and "contact zones" aid efforts to conceptualize the cultural dynamics of increasingly shared environmental problem-construction within epistemic communities. In *Imperial Eyes: Travel Writing and Transculturation* (Pratt 1992), Pratt writes about travel writing, European expansion, and the dynamics of meaning-making on the imperial frontier. The travel writing and enlightenment natural history catalyzed each other to produce a Euro-centered form of global or, as she calls it, "planetary" consciousness. Pratt goes beyond the binary logic of colonizer and colonized by using the concept of transculturation to provide insight into ways in which colonies select and appropriate metropolitan modes of representation, and in which metropolitan culture in turn is produced by the colonies.

Pratt uses the concept of "contact zones" to develop her theory of transculturation. The contact zone, she writes, is the space of colonial encounters, the space in which peoples geographically and historically separated come into contact with each other and establish ongoing relations, usually involving conditions of coercion, radical inequality, and intractable conflict. She borrows the term "contact" from linguistics, where the term "contact language" refers to improvised languages that develop among speakers of different native languages who need to communicate with each other consistently, usually in context of trade (Pratt 1992:6). Contact zone is an attempt to invoke the spatial and temporal co-presence of subjects previously separated by geographic and historical disjunctures, and whose trajectories now intersect. A "contact" perspective emphasizes how subjects are constituted in and by their relations to each other. It treats the relations among colonizers and colonized, or travelers and "travelees," not in terms of separateness but in terms of co-presence, interaction, interlocking understandings and practices, often within radically asymmetrical relations of power" (1992:7). Peter Galison's notion of "trading zone" seems closely related. These zones of interaction are where heterogeneous groups of actors exchange and barter information. They are where the meanings of terms and the usefulness and significance of machines and techniques are negotiated, as different scientific groups come to the trading zone with different conceptions and languages. Galison recognizes that the production of science involves a complex and messy set of relations and interactions among diverse and varied groups of people with competing and sometimes non-intersecting agendas (Galison 1997).

In the context of the present analysis of epistemic communities, the concept of transculturation serves to raise the question of how dominant (Shiva's "globalized local") representations of environmental issues are received and appropriated by forces working to increase democracy and environmental sustainability (for examples of how certain framings of sustainability reflect the interests of dominant powers, see Goldman this issue and (Gupta 1998). Anthropologists have used the term "transculturation" to describe how subordinated or marginal groups select and invent from materials transmitted to them by a dominant or metropolitan culture. While subjugated people cannot readily control what emanates from the dominant culture, to the extent that they retain critical distance from interpretive frameworks and socio-political agendas emanating from elsewhere, they can determine to varying extents what they absorb into their own, and what they use it for.

To better account for the heterogeneous nature of the social formations that make up science, Helen Watson-Verran and David Turnbull (Watson-Verran and Turnbull 1995) have proposed the notion of "assemblage," based on the work of Deleuze and Guattari (Deleuze and Guattari 1987:90). Assemblages

"constitute connections and contrive equivalences between locales in knowledge systems" and integrates notions of power as inherently at play in meaning making (Watson-Verran and Turnbull 1995:117). The concept combines the notion of an episteme with a sense of the ad hoc contingency of a collage in its capacity to include a wide variety of incompatible components.[14] This study of Brazilian climate epistemers suggests that the concept of assemblage also applies to the social formations that have formed around the climate issue, formations that include not only scientists but also politicians and administrators.

In short, the concepts of "assemblage," "transculturation" and "contact zones" can foreground the continuance of diversity within social formations forming around particular issues, knowledges, and practices. Moreover, compared to dominant understandings of epistemic communities in political science (Haas 1992) and policy literature (Lee 1995), these concepts more adequately capture the reality of knowledge elites' complex, contradictory and shifting subjectivities between identifications rooted in national, subnational and transnational social formations.

OVERLOOKED DIMENSIONS OF ENTRAINMENT

Power dimensions of entrainment

Forging cognitive convergence in science and around global environmental problems seems a worthy undertaking. Indeed, efforts at capacity training are often needed and generally appreciated among LDC scientists and administrators. Not only do third world scientists largely depend on such training and on the associated inclusion in international networks for their ability to participate in, and contribute to, cutting edge science; for these scientists, and for many of their political leaders and science administrators, capacity training supported by rich nations also represent welcome change from past patterns of exploitation of LDC scientists and natural environments without giving much, if anything, in return.

Global environmental indicators also suggest the need for some level of cognitive convergence. In the words of Stuart Hall, the "enormous impact" of global ecological interdependence calls for the development of "some form of an ecological consciousness which has to have, as its subject, something larger than the freeborn Englishman" (Hall 1991:25) – in other words, a consciousness that must transcend narrowly nationalistic frames of reference and concerns. The above discussion suggests that capacity training and global environmental treaties are means by which to forge such vitally important consciousness. The discussion that follows should therefore not be understood as an argument against capacity training nor against internationalism in general; transnational coalitions have the potential to be empowering and positively transformative. Rather, the discussion is meant as a cautionary tale about commonly ignored power dimensions and potential negative consequences of normative convergence facilitated by the formation of epistemic communities.

Among scientists and policymakers, the dominant tendency is to understand normative convergence as a reflection of the inter-subjective nature of science. According to this view, the facts speak for themselves. This understanding is also supported by some social science concepts, including Haas' notion of epistemic communities, for which inter-subjectivity is a constitutive element. The same understanding is reflected in the following excerpt from an interview I had with a U.S. leader in global change science.

> Given the suspicions that exist in the world – and which I have gotten in touch with better now, but obviously still don't fully understand – imagine you're a South African, and you're at a [FCCC-related] negotiation. And there are some scientists standing up there and they are saying: ...'by the way, we've discovered through these measurements that South Africa is a major carbon source.'

> Now, if you're the leader of South Africa, are you happy that you are going to be responding to a monitoring program in which you have not a single investigator? No! It is unacceptable! It will not work. Now, if someone stands over there and says 'I am from such and such a project group, and we've done global monitoring, and it shows this for America and this for Europe and this for South Africa. And the guy from South Africa knows that he had two investigators that were integral to that study and one of them is at MIT getting a degree right now, suddenly those data have meaning. And *it is literally the difference between assuming a conspiracy and assuming that the information is objective* [emphasis added].

This U.S. science administrator takes for granted that given the right credentials (credentials certified by an education at MIT) and the opportunity to participate in the production of the science informing global change policy at the international level, the objectivity of the science is established. In this hypothetical example, informed by the science administrator's own experience with international scientific forums closely linked to attempts at international policy formation, the South African scientists function as witnesses who certify the inter-subjective nature of scientific truth. The emphasis on representation and participation seems to be little more than a mechanism by which to reassure distrusting political leaders that everything is just and true.[15]

To the extent it is recognized in "Northern" global change science policy that an MIT education and participation in international science has an effect on scientists' normative frameworks and on their practical orientations, this is usually interpreted in the vein of the idealistic view of science as a benefactor of humankind. The "cultivation" (Global Environmental Assessment Project 1997:126) and "nurture" of research communities in the developing world, particularly the "entrainment" of third world scientists into international science and into environmental science, has become standard practice in Northern science institutions. With some critical self-reflection (discussed further below), one science administrator described the practice as follows:

> When you get organized, you organize a big [international scientific] program. If you are careful, and most are, you entrain some scientists from Ecuador, Kenya, etc. And you are proud of yourself for having been international, using a formal mechanism for being international, so that when you go into the field, there is a Kenyan and some people from Ecuador, etc.

Such entrainment is propelled by multiple motivations, some altruistic – e.g., a desire to improve scientists' working conditions in the third world – others more pragmatic and self-serving in nature, e.g., the need to obtain financial support from multiple countries for big science projects, and the need to create LDC scientists who can certify international scientific knowledge for their respective national leaders. It is generally taken as self-evident that such nurture of transnational communities of experts with shared concerns is in the long-term interest of humanity as a whole (see for instance (Lee 1995:14)). Efforts at capacity training are generally understood by those designing it in well-intentioned but uncritical terms. A central reason is an impoverished understanding of the role of science in society, an inclination to conceive of science as little more than "a set of facts, skills, hypotheses, theories, and other information that can be communicated without reference to the social contexts of production, validation, or use" (Miller 1998:11). To the extent that the inculcation of a scientific ethos and social networks are recognized as important to these programs, it is as mere conduits of scientific facts: Little attention is paid to the more fundamental role of social networks in science in creating communities with shared norms and expectations (Miller 1998:11).

When entrained into the professional community, epistemers are inevitably influenced by dominant ways of framing issues related to science and environment; entrance into an epistemic community has a "disciplining effect" (Litfin 1994: 46). The following Brazilian climate epistemer had a vague perception of this effect, expressed in her suspicion that her scientific and environmental views have been profoundly

shaped by her U.S. education and ties. The interview segment suggests the ways in which socialization into the international scientific community – and into the community of climate epistemers in particular – involves internalization of values and norms that can function as a form of power and distances scientists from interests and concerns specific to the national unit – interests and concerns which this scientist nevertheless seeks to share and defend:

> You know, you can't escape the international invasion of science; [...] its definition of future research agendas is bound to trickle down. And if you want to do state of the art stuff, you want to get involved with that – but it changes things. I am a biased subject because my education has been only in the U.S. So no matter how nationalist I am, I don't know ... do you understand what I mean? There are a lot of interests that I try to defend in Brazil. But maybe my education doesn't allow me to see that [i.e., the Brazilian] side as well as I should.

Asked whether she really believes this to be the case, she responded emphatically that she was certain that this is the case. She said that national reactions to a new president of the central bank in Brazil had prompted her to think about it. That president was educated in a U.S. Ivy League school and had worked for many years for George Sooros, the famous and powerful New-York based international (America) investor. This epistemer had heard some fellow Brazilians say that Brazil thus had "given them over to the International Monetary Fund; that they just put this guy there who caters to the Americans," and she noted:

> And I was thinking about that – that we, scientists, are the same. We [Brazilian scientists educated in the U.S.] get a vision of science in the U.S. and we don't know how to do it [i.e., science] any differently. Maybe my criteria are just American and I try to apply them to a Brazilian reality; there are these things, like the-way-you-do science paradigm and what you choose to focus on.

She then noted ("It just occurred to me") that maybe if I talked to Brazilian scientists who weren't educated in Brazil, I would find them to have "a different view of how things should be conducted, or about global warming or the IPCC." After some thought, she concluded that Brazilian scientists who haven't been educated abroad and who aren't part of international science tend to study problems that are more local in nature.

Training third world scientists can alienate them from the national context when and if they return to their home country after an education abroad (such return is encouraged by Brazilian educational funding structures: before going abroad to obtain a degree abroad paid for by the Brazilian government, scientists are made to sign an agreement by which they promise to pay the government the cost of their education should they decide not to return to Brazil upon obtaining their degrees). Upon their return, Brazilian climate epistemers often find themselves alienated from their local/national scientific communities because few scientists here are trained and interested in the same issues and techniques that they have learned abroad. The few Brazilian scientists with training in numerical modeling expressed perhaps the strongest feelings of isolation, finding themselves surrounded by few with whom they could discuss their research and research interests. The difficulty of obtaining resources to attend international scientific meetings abroad only compounds the feeling of isolation; financial support necessary to travel to international meetings is difficult to obtain. Even in the state of Sao Paulo, which has its own scientific foundation (FABESP) and a level of research funds unsurpassed elsewhere in Brazil, scientists are typically only granted the funds to attend one international meeting every two years. Participation in the IPCC and other international science and assessment processes is one way to circumvent this limitation on their ability to remain networked with foreign scientists – a network which, despite new communications technologies, continues to depend on regular face-to-face interaction.

The "attention-drain" away from local problems is especially problematic when capacity training only enrolls already educated LDC scientists. Capacity training efforts therefore ought to involve efforts to

bring new bodies and new talent to science in the relevant LDC countries rather than simply enroll existing scientists into the international agenda. Doing so may in turn necessitate closer scrutiny of educational structures. Brazilian climate epistemers complain at the lack of interest in environmental science among Brazilian students.

> EPISTEMER: The interests of people and new students entering science... it is not [in science]. It is [influenced by] other forces. For example, it is very easy to see this, here, that the three most difficult careers in the University of Sao Paolo are this: the first is medicine. That's very traditional. It takes about 90-100 candidates per vacancy. The second is tourism, and the third is journalism. It's not engineering, it's not science. In physics, here, it's practically one-to-one, [meaning that] everyone who applied to the institute of physics at USP was accepted. But in tourism it is 100 to one. In communication, it was 100 to one or something like that. You can get this data from the home page of the University of SP. So that is very interesting and it shows that people aren't interested in science generally.
>
> LAHSEN: So you must have a problem building this capacity, with LBA or whatever.
>
> EPISTEMER: Yes, of course, it is very difficult.
>
> LAHSEN: That was also what I was hearing from [another climate epistemer]: 'there are too many problems for too few people,' [he said]. And from him I was getting the sense that there's not a lot of people coming to the field. That there is really a competition for the attention of the few scientists that there are.
>
> EPISTEMER: Yes. That's right.

It is generally assumed that capacity training benefits developing countries. As the above-quoted U.S. science administrator put it:

> when you get organized, you organize a big program. If you are careful, and most are, you entrain some scientists from Ecuador, Kenya, etc. And you are proud of yourself for having been international, using a formal mechanism for being international, so that when you go into the field, there is a Kenyan and some people from Ecuador, etc. Now, after 25 years of doing it that way, we realize that it is not enough. That the entrainment of the investigators doesn't by itself accomplish a great deal for that country.

Upon review of twenty-five years of such "global programs" in weather and, more recently, climate, he concluded that

> a Third World country has very little to gain by participating. For instance, in the 1970s, the subject was extended weather; how you'd get past a 3 day forecast to a 10-12 day forecast. That was a whole decade of global studies. And there were 50 or 60 countries involved, and by definition, then, most of them were Third World countries. When it was all over, the countries that benefited from it all were the countries that already had a lot. And the Third World countries barely gained from their participation. Their infrastructure didn't get any stronger, their weather forecasts didn't get any better – but those in the U.S. did, the Europeans' did.

Socio-political dimensions of scientific knowledge

The possibility that epistemers' scientific and environmental understanding may be shaped by particularities rooted in the North is seldom recognized in Northern science and policy arenas. Yet STS literature illustrates the ways in which knowledge and practices of experts embed particularities of

perspective, including tacit assumptions about the organization of society or politics that reflect and reinforce particular social orders. Yaron Ezrahi (Ezrahi 1990) describes the role of science and technology as cultural resources in the construction of liberal-democratic societies. Rather than conceiving of science and political action in terms of rationality and irrationality, Ezrahi joins other STS scholars in conceiving of science as a cultural enterprise – an enterprise involving a "cluster of symbols, languages, orientations, institutions, and practices" which effect particular ways of seeing, describing, and judging experience (1990:9). Ezrahi identifies the function of science in liberal democracies as a tool by which political decisions can be legitimized through depoliticization and depersonalization – political decisions that otherwise might cause tension to the extent that they circumscribe the very individual freedom with which democracies are identified. Operating on a similar understanding of the ways in which science and political order are co-produced, other scholars as well have shown the ways in which social and cognitive processes connect in the production of knowledge, in the process reinforcing particular socio-political orders (Shapin and Schaffer 1985; Shapin 1994; Jasanoff 1996a; Miller 1998). Instead of portraying science and technology as mere tools to be employed for practical purposes, science and technology studies have shown the ways in which science and technology serve to *reinforce and* reconfigure social worlds, including power relations. Thus a rising middle class in 19th century Scotland deployed phrenology – a science relating cranial anatomy to intelligence – to challenge Scottish class hierarchy (Shapin 1979). In other work, Shapin and others show the extent to which the very practice of producing science and technology involves "heterogeneous engineering" (MacKenzie 1990:28). For scientific pronouncements to be accepted as truth, scientists must build networks of trust. Often in alliance with a heterogeneous group of other actors, scientists engage in engineering of the social as well as the physical world in their efforts to produce what comes to be accepted as truths (MacKenzie 1990:28; Shapin 1994; Shapin and Schaffer 1985). Some level of shared normativity is both a necessary precondition and an effect of the production and dissemination of scientific facts (Shapin 1994). Translated to the IPCC context, this means that Northern countries whose scientific framings dominate in science and in the IPCC have an interest in creating normative homogeneity within the international scientific community.

The above science studies, among others, have described the ways in which technology embeds particular, and, even, conflicting, ways of understanding.[16] Science scholars have also noted the link between visualization and cognition – the importance of presenting scientific findings with convincing visual display in order to convince others of their truth (Latour 1985; Latour 1987; Latour 1990; Latour and Woolgar 1986). Visual representations such as graphs, indexes, and statistics, are central means of what Bruno Latour calls "enrollment" and "translation." They serve to "harden" and "black box" uncertain scientific findings by rendering invisible scientific data's inherent interpretive flexibility, thus encouraging particular interpretations of the evidence presented.

Applied to the climate arena, GCM-based climate projections are particularly powerful tools by which to obscure from view the heterogeneous and contradictory scientific evidence concerning human-induced climate change. They are thus also particularly effective at reducing perceptions of conspiracy by convincing model users and those using model outputs that the information is reliable and objective. Indeed, numerical modeling is commonly referred to as "objective methods," contrasted by so-called "subjective methods" such as synoptic techniques. The term hides the considerable role of intuition and subjective judgment in climate modeling as well. It is beyond the scope of this article to discuss in detail the power of climate models to stimulate shared understanding of human-induced climate change, but this power is a function of the "seductive" power of simulation technology over the imaginations of both producers and consumers of the model output; the fact that model groups now produce large models by integrate sub-models produced by others, reducing familiarity with the models' flaws, assumptions and general configurations; the impossibility of verifying climate projections; and a tendency among modelers to highlight their models' virtues rather than their flaws (Lahsen submitted for review). The entrainment of LDC scientists and decision makers in the practice of producing and using these models and their

output is therefore also likely to influence their interpretations of the global environment in the direction of believing in the reality of damaging human-induced climate change. To the extent that climate epistemers have established working ties and relations of trust with fellow epistemers in the third world, the latter are likely to subject the models and their output to relatively less scrutiny (or, short of the technical expertise to do so, receive them with relatively less suspicion) than they might in the absence of such trust and cognitive convergence. As documented by Stephen Shapin, settings characterized by familiarity and interdependence strengthens a tendency to take claims at face value (Shapin 1994).

The science studies understanding of science presents a fundamental challenge to the epistemic community literature and to efforts to build technical capacity in developing countries and to include scientists from these regions in international expert communities (Jasanoff 1996a; Miller 1998:11). If science can be deployed and adapted for political ends, this begs critical analysis of the ends – intended or unintended – served by capacity training. It begs critical understanding of the role of "entrained" LDC scientists in maintaining and changing social and political structures. Such critical understanding is particularly important at a time where systems of governmentality are transcending the framework of nation-states (Gupta 1998). This transcendence is facilitated by international science and assessment processes, and by the proliferation of global agreements related to the global environment. Indeed, one can see the preoccupation with risks – including global environmental risks – as allowing a new level of socio-environmental interventionism. The new level of governance over the relation between people and things achieved in "postdisciplinary society," as described by Robert Castel (1991) in the context of new management techniques in psychiatry, can also be discerned in the climate regime, owing to the same technologies identified by Castel, i.e., computerization, administrative rationalization, and methods of risk management. In the climate regime, intervention is increasingly predicated on theorizing and on computer models' statistical correlations involving limited data and limited knowledge. As in Castel's psychiatry, the primary aim is no longer to address actual environmental damage but to

> anticipate all the possible forms of irruption of danger. 'Prevention' in effect promotes suspicion to the dignified scientific rank of a calculus of probabilities. To be suspected [*e.g., as an environmental threat,* ed.], it is no longer necessary to manifest symptoms of dangerousness or abnormality, it is enough to display whatever characteristics the specialists responsible for the definition of preventive policy have constituted as risk factors.

The abstracting generalization inherent in the shift from dangerousness to risk entails a "potentially infinite multiplication of the possibilities of intervention. For what situation is there of which one can be certain that it harbours no risk, no uncontrollable or unpredictable chance feature?" (Castel 1991:289).[17] The danger, as Castel also notes in the context of management in psychiatry, is that the futile myth of absolute eradication of risk inherent in such rationalizing projects construct "a mass of new risks." Self-reflexively aware of my own intervention here, and heeding Anna Tsing's prescription for a critical distance to prescriptions for social change that accompany globalization projects, I suggest below some generally unacknowledged consequences of entraining LDC scientists in international science and epistemers generally in the climate regime.

Practical consequences of entrainment

Globalist projects may not remake the world as intended. This recognition was dawning on a U.S. leader of global change science in a 1998 interview with me. This administrator acknowledged that after twenty-five years of attending to the entrainment of third world scientists, using formal mechanisms in the shape of scientific proposals and calls for proposals to do so, "we realize that it is not enough, that the entrainment of the investigators doesn't by itself accomplish a great deal for that country. [...] When we do a science program [in U.S. federal institutions such as NASA, NOAA, and the NSF], I guarantee you

that the conduct of the science and the papers that are written leave the residual infrastructure stronger than we had before we did the science. That is not true in the Third World."

What happened, and what can be learned from this? First of all, this suggests the need for critical evaluation of what and whom are truly served by capacity training projects. Related questions concern the fit between the climate agenda and other socio-political and environmental agendas in the LDC countries in from which scientists are enrolled into international scientific and assessment-related forums. The basic message of this analysis is the need to consider how entrainment shapes LDC scientists' scientific practice and social worlds, and how this in turn affects conceptualizations of the global environment and of what constitutes pressing problems.

Science administrators making decisions that affect the design of international science, including capacity training, tend to simply assume that their agenda merits attention over all others. Typically little thought is given to what projects and practices LDC scientists are taken away from through the entrainment. A conversation with me led a U.S. leader in global change research to reveal this assumption as he began to reflect critically on the power dimension of entrainment efforts:

> What this conversation reveals is that any process that you can call entrainment is the process that is going to be the key to scientific equity. Because entrainment means their joining your momentum. And that is the problem you just pointed to; they become interested in your movement then, become part of your movement rather than part of their own. And I hadn't thought about that. That's a potent effect, and I had never reflected on the place it has in this. I don't know exactly how we are going to deal with this issue of scientific equity. I think it will become an important movement in the coming decade.

LDC scientists do not emerge out of a vacuum. As suggested by the epistemer quoted above, compared with scientists educated abroad, scientists trained in Brazil tend to work on problems that are more local in nature. Her claim lends some support to Eduardo Gudynas' provocative claim that "The establishment of 'global' environmental problems has a radical exclusive characteristic: all regional and local Latin American problems are now of secondary importance compared to the global ones" (Gudynas 1993:174). Advancing a similar critique in his discussion of international reports about the global environment, Shiv Visvanathan presents the latter as "new charters of conquest" that "capture the new styles of control and surveillance" and "freeze imaginations" of alternatives to "the logic of the world that they seek to create and impose" (Visvanathan 1991:377-8). Such claims must be taken very seriously, as must the potential role of the entrainment of LDC scientists in this potential state of affairs. For instance, although many initially meant for global change to include a broad environmental agenda, it has increasingly been reduced to a narrow focus on co2. Thus, rather than subsume action on behalf of issues such as biodiversity protection and local air pollution, the climate agenda might reduce attention to the latter. In the words of Brazil's former Minister of the Environment (also an epistemer), the climate issue is "killing other issues" such as local air pollution. This is not to suggest any foregone conclusions in either direction but to stress the need to investigate the fit between policy agendas conjured up to serve one social context, on the one hand, and, on the other, alternative agendas that exist in places into which the former is absorbed.

A normative question presents itself: Should climate change be conceptualized as the number one problem for countries such as Brazil and Bangladesh? Certainly, these countries have many other more immediately pressing problems, both social and environmental. It can therefore also seem problematic if national leaders of the world's poorest countries prioritize the development of a national scientific expertise in an extremely resource intensive area of science, due to an aversion to dependence on foreign science and technology sources or due to the necessity of having scientific capacity in order to write "convincing" proposals to the Global Environmental Facility and other such forums intended to provide

LDCs resources to help them reduce their greenhouse gas emissions, or, even worse, because a sense of national self-worth is wound up with S&T capability.

It is a prevalent assumption that the climate change agenda serves a transition towards sustainability. Despite the above suggestions to the contrary, that may be so. However, the assumption needs to be tested against empirical evidence rather than taken on faith. This may reduce the danger that rich and dominant nations in the world project their own needs and goals onto poorer countries, thus defining "global" environmental agendas in parochial and self-serving way. For instance, in the words of late congressman George E. Brown

> there is great danger here for industrial nations to misinterpret the needs of other nations in terms of their own parochial goals. There is a risk that the meaning of sustainable development will be distorted so that each nation sustains its current standard of living. Obviously, poor nations are not interested in sustaining poverty (Brown Jr. 1994:34).

In the world's most competitive national economies, the sustainability and climate change agendas are often supported by the argument that all other considerations aside, there is money to be earned through the new emphasis on green technology. Indeed, Northern advocates of an internationalist environmental ethos frequently support their position by pointing also to the national economic advantage offered by strength in the area of green technology production. This ecological modernist concept (Hajer 1995) is captured by the title of a book on the subject: *Green Gold* (Moore and Miller 1994).

None of the above is meant to suggest that international environmental agendas do not carry great benefits (whether potential or already realized), nor that the development of cleaner technology isn't a good thing. Quite to the contrary; such shared agenda and technology are extremely important. Rather, it is to argue for deeper thinking and more empirical investigation by which to critically examine powerful yet often misled and misleading conceptions related to the nature and functions of science and environmental agendas at a time where both serve to transform the relations between populations and things.

CONCLUSIONS

I have suggested that framings of climate-related knowledge reflect particularities of perspective; that inequities shape abilities to frame environmental knowledge and to produce science that secures the highest prestige in the international arena; and that the inequities inform contestation of dominant framings of science, environment, and world affairs generally. Finally, but without final conclusions, I have posed a question mark around the relationship between the climate agenda and a broader, democratically defined agenda for sustainability.

Along with other empirically-grounded studies of community interaction, this study suggest that social formations formed by climate epistemers are best understood through the concepts of transculturation and heterogeneous assemblages. Brazilian scientists and politicians included in international climate science and assessments cannot be adequately understood neither as representatives of "local knowledge," nor as interchangeable with any other member of the transnational "epistemic community.

Particularities of both national and international contexts affect epistemers' subjectivities, their behavior and cognitive framings. Climate epistemers are deeply influenced by transnational cultural enclaves dominated by Northern perspectives. This is arguably reflected in Brazilian climate epistemers' commitment to the problem of climate change, their faith in its reality as a problem standing in contrast to

most other segments of their fellow nationals. Yet in important respects they identify as Brazilians and manifest distrust of international regimes in science and politics which they see as biased in favor of Northern interpretations and interests. This shared distrust facilitates collaboration between Brazilian politicians and scientists to produce alternative scientific framings of the global environment to those that dominate in international arenas. Expressions of distrust also evoke a nationally shared history of colonialism. Brazilian scientific epistemers are in important respects aligned with their nation-state and its perceived interests. They also serve to certify international science for the state, thus ensuring trust among political leaders in international scientific projects and assessments – a trust that probably serves the scientists' interests, to the extent that they are interested in supporting and participating in these projects and assessments. But Brazilian epistemers, scientists as well as politicians, cannot be presumed to necessarily represent a Brazilian or "Southern" perspective either; thoroughly hybridized through their foreign educations and transnational life-world, they are not reliably local subjects. The reality is much more complicated than such essentialized identifications suggest, constituted as each individual *is of* multiple, shifting subject positions, each a participant in multiple national and transnational social networks and globalization processes. If subject positions are unstable, so are larger social formations, including Haas' epistemic communities.

In all of this, interests are negotiated, shaped by social interactions and perceived realities. No doubt, interest perceptions would also be influenced by further analysis of the actual consequences of present international agendas associated with climate change and sustainability for alternative social and environmental agendas at the local and transnational levels. Both globalizing and localizing processes and the associated social formations must be understood in terms of the Hegelian dialectic, as simultaneously carriers of positive and negative effects. Ignoring this is hardly beneficial for anyone in the long run. In the long run, representations of scientific communities as homogenous and of science as intersubjective may, ironically, be counterproductive. As also supported by my research among Brazilian epistemers, Stephen Yearley notes that not only does science not always succeed in resolving international environmental issues by means of "intersubjective understanding," but the very use of the "(supposedly) universalistic" discourse of science to diagnose the globe's problems often exacerbates rather than alleviates existing suspicions of the North's interpretation of global interests (Yearley 1996:103).

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ENDNOTES

[1] See also earlier work by scholars of science and technology, such as Storer (1974), Restivo and Vanderpool (1974). These scholars used the concept of "third culture" to refer to the cultural outgrowth in science of processes of globalization. Writing in the early 1970s, Restive and Vanderpool suggest that a third-culture of science is emerging which affirms the vision of science as a microcosm of, and stimulus for, a world community (Restive and Vanderpool 1974: 471).

[2] The causal mechanisms involved should not be presumed; it could be that persons are already concerned before entering these international forums and that that is indeed a reason for their choice to participate. However, evidence presented in this article does suggest that this normative convergence is at least in part a result of this participation, as science and policy forums influence what is looked upon and how to best understand what is being looked at and discussed.

[3] By contrast to dominant understandings of science but in line with other science studies, these levels – the substantive and the cultural – are intimately intertwined, not separate.

[4] Source: Roberto Kishiname, Executive Director of Greenpeace Brazil, personal conversation.

[5] Even with a foreign education and the necessary credentials, Brazilian scientists whose international networks aren't robust suffer exclusion from international science projects and institutions. One scientist in that situation with whom I spoke was seeking a postdoctoral position in the United States to seek to reestablish networks with U.S. scientists. As a graduate student in the U.S., she had made the mistake of choosing advisors whose primary loyalties were to other Brazilian scientists, scientists who in turn didn't include her in the international science projects through which they obtained grants and carried out science.

[6] Huq has a Ph.D. in botany from Imperial College, London. On his web site, he is described as "a leading environmental planner at national and international level having worked for numerous international agencies on global environmental issues," and as having advised Bangladeshi government planners on climate change programs.

[7] She did say that this is changing, however, that younger Brazilians do learn about climate change and ozone depletion and such things now in their text books, beginning in the fifth grade or so (that is, around the age of eleven). So she attaches hope to the younger generations.

[8] Several epistemers whom I interviewed in Brazil noted the role of the media in promoting concern about climate change and, even, Northern framings of the science and its policy implications. One of them said "If you read the newspapers, magazines. You see that it reflects [Northern] interests," and another claimed that in 1999, nearly all stories in the Brazilian media on global environmental problems were generated through international newswires.

[9] Through such projects, epistemers obtain access to funds and cutting-edge technology. The LBA is a case in point. For instance, through that project, Brazilian epistemers at the University of Sao Paulo have access to sophisticated equipment with which to measure the greenhouse gas emissions from various types of foliage.

[10] The dynamics that contribute to such invisibility are described in Gibbs 1995, an article that reveals the extent to which the international scientific community is bereft with inequities and prejudices. Third world scientists experience disadvantages in a variety of ways for a variety of reasons, some financial, others social in nature. For instance, imperfect ability to communicate in English, combined with the fact of having a mailing address in a developing country, tend to undermine third world scientists in peer review processes. The language problem is suggested in the interview segment immediately below, and its consequences for scientists' careers were reflected in the comment by the editor of *Science* in 1995: when asked about his editorial practices, this editor responded that articles with imperfect English submitted for publication weren't likely to be published because, he said, if they make mistakes in English one would suspect that they are similarly sloppy in their science (Gibbs 1995). I sometimes encountered prejudices along similar lines in my fieldwork among U.S. scientists critical of IPCC policies intended to increase the visibility of third world scientists. Sometimes, this practice engenders feelings of resentment against what is perceived as a violation of the merit system. It is also resented when "Northern" scientists

feel that their work-load as lead authors and the like is greater because a co-lead author from a third world country doesn't carry his or her weight.

[11] For instance, the IPCC's decision to include land-use driven changes in carbon stored in above-ground biomass as an anthropogenic source but to exclude similar changes in below ground biomass (soil carbon) as natural source - was made without input from LDCs and unfavorable to them. The same was the case with the decision to include methane from rice agriculture and cattle and not from deer and other ruminants which exist in the North (the rationale being that the latter are "wildlife," despite the fact that they are managed populations) and with the lack of distinction between subsistence and luxury emissions and the prevalent method of calculating emissions in terms of national emissions rather than per capita emissions.

[12] Not all scientific departments allow consulting. For instance, the physics department at USP does not, and rather than being enforced by the state – which has been willing to look the other way – it appears that physicist colleagues jealous of geophysicists' ability to carry out socially relevant science, enforce the prohibition. It would be worthwhile to study the influence of these differing situations and consulting practices on different scientists' choices in research foci.

[13] The term was applied by social psychologist Elisabeth Noelle-Neuman, based on the work of Alexis De Toqueville (Fuller 1988:214).

[14] The same recognition of heterogeneity that underpins the concept of assemblage can also be accommodated by Maarten Hajer's "discourse coalitions" (Hajer 1995). The notion of assemblage seems preferable, however, because it highlights heterogeneity rather than convergence, and because it focuses on actual social formations rather than on discourses.

[15] Here, perhaps, lies another part of the explanation for Northern scientists' frequent impatience with bureaucratic mechanisms intended to increase participation of third world scientists in the IPCC and elsewhere: the mechanisms are deemed unnecessary because the process is just and true without such interventions.

[16] See for instance Pamela Mack's (1990) study of NASA's Landsat Earth Resources satellite system. The system was developed in the context of different agencies definitions of what the system was supposed to do conflicted, and the results of these differing perceptions and conflicts became embedded in the technology itself.

[17] For related reasons, Akhil Gupta also contends that global environmentalism is "part of a qualitative transformation of the world economy whose ramifications go far beyond mere *intensification* of existing trends. It foreshadows the creation of a set of institutions and practices that make up, in Foucaultian terms, a new technology of government" (Gupta 1998: 293). He notes that global environmental problems such as climate change (and ozone depletion and biodiversity) have strengthened a series of concepts that have so far provided the means to map the relation of "local" peoples such as peasants to "larger" institutions and structures such as the world economy" (292-3).

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