New Civic Epistemologies of Quantification: Making Sense of Indicators of Local and Global Sustainability

Clark A. Miller
University of Wisconsin–Madison

Processes of globalization and decentralization are changing the relationship among statistical knowledge production, nation, and state. This article explores these changes through a comparison of five projects to design and implement indicators of sustainable development to replace conventional measures of economic welfare and social demographics—community sustainability indicators, Metropatterns, greening the gross domestic product, the Living Planet Index, and standardized accounting rules for inventorying greenhouse gas emissions. Drawing on a coproductionist idiom, the article argues that these projects constitute experiments in modifying the civic epistemologies of democratic societies, transforming not only knowledge production but also political identities, relationships, and institutions.

Keywords: *quantification; sustainability; indicators; globalization; decentralization*

The last decades of the twentieth century brought two major, sometimes contradictory trends in the organization of public affairs: *globalization*, as people increasingly framed issues in global terms and built new, planetary-scale social and economic relationships; and *decentralization*, as national governments devolved responsibilities to local and regional governments as well as to nongovernmental, quasi-governmental, and private organizations (see, e.g., World Bank 1997; more generally, see Matthews 1997; Kettl 2000). These two trends raise complex, challenging questions about the role of knowledge in democratic decision making. Since the late nineteenth century, science advice and science policy have been primarily of concern to national governments, who have developed a virtual monopoly over support

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for scientific research, commissioning and setting standards for risk assessments, gathering expert advice relevant to the formulation and implementation of public policy, and collecting statistical data. Yet, as decentralization and globalization have taken hold, new arrangements linking knowledge to power have begun to acquire salience. Among scientists, concern has grown over how to effectively communicate scientific information to policy makers in this new era, and there is increasing attention being paid to communicating with public, media, nongovernmental organization (NGO), and corporate audiences (Lubchenco 1998; Yearley 1991). New expert advisory arrangements have begun to emerge to bring scientific input to local legislators and global governing bodies, although many remain ad hoc in character (Guston and Branscomb 1996; Miller 2001a, 2001b). At the same time, there is a growing recognition that notions of expertise may need to be broadened beyond science, one notable consequence of which is that holders of "local knowledge" have become a powerful constituency in international institutions and treaty making (Long Martello and Jasanoff 2004).

Nowhere is the changing politics of science more potentially significant than in statistical quantification. The linguistic tie between *state* and *statistics* betokens a much deeper connection between the administrative state and statistical representations of its subjects. Indeed, statistics is arguably the language of the modern state, the tool through which those who debate public policies know and represent society and the economy, assess policy choices, and, increasingly, evaluate government performance (Porter 2000; Hacking 1990, 1992b; Nowotny 1991; Rueschemeyer and Skocpol 1995). During the colonial era, statistical surveillance offered a powerful tool for the state to define and control subject populations (Cohn 1996; Anderson 1983). In democratic societies, quantification has been deployed as a tool for depersonalizing politics and reducing the appearance of administrative discretion, both for outside control of bureaucratic agencies and for defending administrative decisions against external critics (Porter 1995; Jasanoff 1991; Ezrahi 1990). Historically, state agencies have produced statistical data in addition to being their biggest consumer. Numerous agencies today collect statistical knowledge on demographics, economics and labor, crime, natural resources, and other topics too numerous to count.

This article offers a preliminary investigation into changes in the production and consumption of statistical knowledge associated with recent political transformations, with a particular emphasis on the changing *civic epistemologies* of American democracy (and, to a lesser extent, international organizations).[1] The article explores the changing deployment of quantitative statistics in American environmental politics through a case study of the creation and use of indicators of sustainable development (ISD). ISD offer a

good site for inquiry into the contemporary politics of quantification. They represent a new, post-command-and-control phase of environmentalism, one of the late twentieth century's signature social movements and a key site of conflict in efforts to decentralize and globalize public policy. Increasingly, they permeate all levels of government. Local communities, national governments, and the United Nations alike see ISD as an essential evolution in the incorporation of environmental information into good government. ISD have become, I argue, a key site of innovation in which people are working out new conceptual models of nature and society and new relationships among experts, citizens, and public officials for defining and measuring human well-being. More than merely technical changes in measurement protocols, ISD are important new experiments in governance.

Put simply, I argue that ISD are important features of new, emerging civic epistemologies in local, regional, and global settings. They are technologies through which people are coproducing new ways of knowing and ordering the world at these scales.[2] In the first and second sections, I review the literature on the relationship between the production of quantitative knowledge and the state—largely in the form of statistics—and show how it has been entwined in the civic epistemologies of twentieth-century American environmentalism. During the conservation movement and the subsequent environmental movement, the production of quantitative knowledge about nature focused on the environment of the nation as a whole and on federal environmental policy. As I describe in the third section, however, in five brief examples of ISD projects, processes of globalization and decentralization in environmental affairs are tightly coupled to new experiments in the role of quantification as a component of civic epistemology in local and global politics. I conclude with an analysis of these observations for science and technology studies (STS) theories of the politics of quantification and its place in democratic governance.

Quantification, the State, and Civic Epistemology

To explore the changing relationship between quantification and the state, it is useful to begin by defining the concept of civic epistemology. In his classic study of science and democracy, Yaron Ezrahi (1990, 9) observed the following:

> As a cultural enterprise, science, like religion or art, is a distinct cluster of forms of authority, discourse, and action which, while differentiated from politics, can be deployed and adapted as elements of particular political worlds.

> But the socio-cultural "repertoire" of any political world—the range of norms, institutions, or behaviors upon which it can draw—is determined in each case by the available cultural materials, that is, socially established traditions, beliefs, and practices.

This article defines civic epistemology as the specific elements or socio-cultural repertoire in any political world that make up its arrangements for producing, validating, and using knowledge in the formulation, implementation, and analysis of public policy. More generally, it can be understood in terms of the practices, methods, and institutional processes by which the community identifies new policy issues, generates knowledge relevant to their resolution, and puts that knowledge to use in making decisions. For the modern state, science is a key component of civic epistemology. The concept, however, refers to a broader array of activities and processes than just science, including but certainly not limited to accounting frameworks, styles of assessment, formal and informal policy analysis, local knowledge, the media, and public perceptions and understanding of policy issues.

The state's role as producer and consumer of statistical knowledge occupies a prominent place in modern civic epistemologies. The disciplining of the quantitative social sciences and their deployment in policy contexts have become a celebrated topic of research among historians, philosophers, and sociologists of science and democracy (see, e.g., Rueschemeyer and Skocpol 1995; Hacking 1990; Porter 1995). Since the mid-nineteenth century, states have profited from the drive to quantify and measure features of social and economic life, and, in turn, have reinforced that drive and supplied it with substantial resources. In the late 1800s and early 1900s, expert bureaucracies became sites for the collection, aggregation, and publication of increasingly larger and larger databases of statistical information, and the applied social scientific disciplines became training grounds for both the elite researchers who analyze statistics and the uncounted bureaucratic officials who translate them into public management decisions. In the process, quantitative statistics emerged as one of the principle tools of statecraft, used both to imagine society, the economy, and the nation and to lend to the exercise of public policy a semblance of rationality, control, and accountability.

Even in this paradigmatic case of the state's role in the sponsorship and use of a specific form of knowledge, however, crucial differences appear in the adoption and, perhaps more importantly, style of quantitative reasoning when one compares across time and place.[3] This is when the concept of civic epistemology begins to have bite. The civic epistemology of quantification differs among political cultures, even in advanced, industrial democracies. Polities vary in the historical timing and rate of adoption of quantitative

modes of public knowledge, as well as the extent to which quantitative reasoning displaces other civic epistemologies. Government officials in different countries developed very different relationships with their social science colleagues, with consequences that remain visible today in the organization of both political and scientific institutions (Nowotny 1991; Wittrock and Wagner 1995; Rabinbach 1995). Americans came to widespread quantification late, not having much of a state until the early twentieth century, but subsequently adopted it more thoroughly than most other countries, often to the exclusion of other forms of knowing. In a comparative study of Britain and the United States, for example, Sheila Jasanoff found that American regulators relied heavily on quantitative risk assessment methods in regulating chemical risks, giving them a prominent place in their defense of policy choices, whereas their British counterparts pursued quantitative analyses much less frequently and often discounted their importance (Jasanoff 1991). After World War II, Americans not only thoroughly quantified public policy and administration but also became the most important driving force behind efforts to export quantitative tools of public management to developing countries (especially in areas such as government accounting and policy analysis), and American educational institutions have become an essential training ground for foreign officials wanting to learn those techniques.[4]

Quantitative civic epistemologies also vary in the organization of knowledge production, methodology, and the degree to which knowledge production is explicitly adapted to the needs of policy. Recent research on environmental modeling offers many useful examples.[5] Simon Shackley has observed that climate modelers in the United States and Europe organize their scientific ideas and institutions into distinct "epistemic lifestyles" (Shackley 2001; Shackley and Wynne 1994). Climate modeling in the United States is characterized by several competing academic research institutions, funded by different federal agencies, each of which has its own approach to modeling and, of course, its own climate model. By contrast, in Europe, it is much more common to find a single, national climate laboratory, often housed in a government agency, such as the UK government's Hadley Centre or the Dutch RIVM. Because of their close ties to government policy making, these models often are tailored to addressing policy-relevant questions. This feature is strongly apparent in RIVM's integrated assessment models, which incorporate social and economic factors directly into the modeling exercise. Likewise, Sheila Jasanoff has observed notable differences in how American and British regulators evaluate and weigh cancer risk assessment data from epidemiological and animal testing models, with the former accorded greater credibility in Britain and the latter seen as more reliable in the United States (Jasanoff 1986).

The Civic Epistemologies of American Environmentalism

Environmental policy offers an ideal site for exploring more deeply the place of quantitative reasoning in the civic epistemology of American democracy, as well as the changes wrought in it in association with the decentralization and globalization of public management. Alongside social welfare, taxation, and defense, the environment has played a decisive role in debates about the proper scale and jurisdiction of the state in American affairs (Hays 1959, 1987; Cronon 1992). For most of the twentieth century, policies for natural resources and the environment have largely fallen under the jurisdiction of the federal government—in spite of the successful sloganeering of the American environmental movement, "Think globally, act locally." Both during the conservation movement of the first decades of the century and during the era of the creation and growth of the U.S. Environmental Protection Agency (EPA) in the 1970s and 1980s, environmental politics centered on national policies and political organization.

Throughout the century, the federal government also dominated the production and use of policy-relevant environmental knowledge. Early in the twentieth century, the U.S. Geological Survey, Bureau of Land Management, Forest Service, and other federal agencies dramatically expanded scientific research into the nation's natural resources. Since its creation in 1970, the EPA has likewise overseen a tremendous expansion in scientific investigation of environmental pollutants and their effects on human health. Yet, the public administrators of these two eras melded science and democracy in subtly different ways that help illuminate the concept of civic epistemology. As I describe in greater detail below, these differences cut across several important aspects of civic epistemology, including the organization and presentation of expert knowledge, the institutionalization of knowledge production, the relevant policy to which knowledge was applied, the underlying regime of trust and credibility, and the definition of sustainability. An overview and comparison of the differences in civic epistemology in the two cases are provided in Table 1.

Conservation and Natural Resource Management

Nature has always figured prominently in American understandings of human welfare and well-being. In the eighteenth and nineteenth centuries, the open spaces and abundant resources of the frontier drew settlers westward in successive waves to new regions of natural wonder and plenty.

Table 1. Civic Epistemologies of American Environmentalism in the Twentieth Century

	Conservation	*Environment and Public Health*
Spatial frame	Nation	Nation
Form of knowledge	Surveys: natural resource, economic production, labor statistics, census	Risk assessments, cost/benefit assessments, pollution inventories
Institutional organization	Expert bureaus	In-house laboratories, university-contracted studies, government-mandated industrial research
Policy relevance	Administrative management and resource use decisions	Regulatory decisions and standard setting
Regime of trust	Government experts, expert judgment, distrust of private management of public resources	Scientific objectivity, standardization of protocols, distrust of industry
Definition of sustainability	Efficient use of natural resources	Reduction of pollution and protection of public health

European immigrants to America saw private ownership and exploitation of nature as their principle avenue to wealth and prosperity, displacing (often violently) earlier notions of communal stewardship held by the continent's indigenous peoples (Cronon 1983). In the two decades after Frederick Jackson Turner declared the frontier closed (in 1899), however, Americans substantially reorganized the management of natural resources—turning it from a private to a public affair. Conservationists like Gifford Pinchot and Theodore Roosevelt decried the waste and inefficiency of private failures to manage the nation's forests, minerals, water, and land, and advocated new ideas about the rational and efficient use of nature for the country as a whole. Under their influence, nature was transformed from a source of private wealth to a resource for national economic growth and prosperity managed by the federal government.

Samuel P. Hays has long been recognized as the premier historian of the conservation movement. His now classic study, *Conservation and the Gospel of Efficiency* (1959), articulates clearly the policy and ideological battles waged by conservationists in the name of efficiency—the greatest good for the greatest number of people. Hays's purpose in writing the book has been often misunderstood, however, as he pointed out in the preface to the second edition:

> Examination of the evolution of conservation political struggles, therefore, brings into sharp focus two competing political systems in modern America. On the one hand the spirit of science and technology, of rational system and organization, shifted the location of decision-making continually upward so as to narrow the range of influences impinging upon it and to guide that decision-making with large, cosmopolitan considerations, technical expertness, and the objectives of those involved in the wider networks of modern society. . . . On the other, however, were a host of political impulses, often separate and conflicting, diffuse and struggling against each other within the larger political order . . . in which complex and esoteric facts possessed by only a few were not permitted to dominate the process of decision-making. . . . The conservation movement in the Progressive Era, therefore, sheds light not so much on the content of public policy but on the entire political structure, the types of human interaction, perspective and goals peculiar to the different portions of that structure, and the rival systems of decision-making which have developed in modern society. (Hays 1959, xiii)

For Hays, then, the conservation movement was important not merely for its ideals and policies but also for the extensive organizational changes in the state, the production of knowledge, and the role of experts in democratic governance wrought in pursuit of and opposition to conservation.

The civic epistemology of the conservation movement links several important features: the production of large-scale statistical surveys of the nation's resources, the growing employment of experts by federal government agencies, the centralization of natural resource management in the federal government, the creation of educational schools to train expert bureaucrats, and the growing importance of the idea that natural resources must be managed wisely if they are to enhance national welfare to the greatest extent possible. These features are summarized in Table 1. The conservation movement marks the first large-scale mobilization of expertise in the service of a wide range of federal government policies outside of the military (similar changes are afoot in agriculture; see Fitzgerald 2000). Desiring to better manage the country's natural resources, the Roosevelt administration created a number of new agencies, such as the Forest Service and the Bureau of Reclamation, while expanding others, such as the U.S. Geological Survey. These agencies quickly hired large numbers of experts in different fields, stimulating the creation of new schools, such as the Cornell and Yale Schools of Forestry (the first of their kind in the United States), to train this new breed of public officials.

A central function of these new agencies was to survey the United States's natural resources, particularly although not exclusively in the vast unexplored territories of the West. Foresters were dispatched to measure and map the nation's forests. Hydrologists surveyed rivers and waterways, systematically measuring streamflow statistics throughout several years and mapping

river geography. Geologists catalogued the underground mineral resources, including phosphate, oil, and coal. The result was a dramatic expansion of knowledge of the distribution of the West's resources that could be put to use by public administrators in the rational management of federal government programs from water development projects to store water and irrigate farmlands to forestry policies to regulate wood harvests and grazing and settlement policies on public lands.

Consider briefly, for example, the U.S. Geological Survey's surveys of public lands for mineral resources and other nonagricultural uses. Beginning in 1905, the Survey launched a systematic effort to assess the "highest use" of publicly owned lands in the American West. Experts working for the Survey quantified the oil, coal, and phosphate resources available on public lands as well as the potential for hydroelectric development on public lands surrounding the nation's rivers. Spurred by disputes over "settlers" who homesteaded lands with valuable mineral resources, conservation leaders temporarily withdrew lands from private sale or entry while the Survey carried out its analyses. Once the land had been classified, agricultural lands were returned to the pool available for public sale or entry, but more highly valued lands with significant mineral resources, water power sites, and other classifications were exempted from the homesteading process. Pinchot and his colleagues then developed alternate policies and management strategies to govern how the resources on these more valuable lands could be developed.

Pollution and Public Health

After World War II, the focus of American environmental policy shifted from the conservation of natural resources to environmental protection, attempting to prevent the degradation of both nature and human health from the pollution associated with rapid industrialization. Despite this shift in policy focus, however, the postwar environmental movement carried over a number of important aspects of civic epistemology from the conservation era. First and foremost, environmental issues have remained largely the province of the national government. The state, thrust into the role of managing the country's natural resources in the first decades of the century, largely retained the role as protector and manager of nature as the century closed. Although a great deal of political conflict occurred in local settings, driven by "not-in-my-backyard" organizing tactics, and although the courts became much more heavily involved in environmental management and regulatory decisions, the stage for these conflicts was set in Washington, D.C., via the passage of a series of national environmental laws and the creation of the EPA as an independent regulatory agency of the federal government.

Likewise, the production of policy-relevant science remained centered on national environmental policy making, although subtle shifts occurred in just how that knowledge was produced. The EPA built some research laboratories of its own but relied far more heavily than its cousins, such as the U.S. Forest Service or the U.S. Geological Survey, on contracts with corporate and university scientists. The EPA has also involved state governments much more heavily both in its regulatory activities, such as permitting and inspections, and in its data-collection and analysis programs. For the most part, however, these programs remain hierarchically organized. The EPA sets standards, as required by many of the environmental laws passed in the 1970s, and simply asks states to implement them. For example, in its regulatory programs regarding particulate matter, facilities desiring a permit must supply their state government with data regarding their emissions. State officials then use an EPA-standardized model to determine whether facilities meet appropriate National Ambient Air Quality Standards.

In its efforts to regulate pollution and protect public health, the EPA relies heavily on quantitative risk assessment of chemicals, as do other independent regulatory agencies such as Occupational Health and Safety Administration (OSHA) and even the Food and Drug Administration (FDA).[6] Quantitative risk assessment methodologies carry over some of the features of civic epistemology in the conservation era—an emphasis on nationally uniform standards and protocols, and a commitment to explicit rules for the production and interpretation of data—but also differ in important ways. In contrast to nationwide surveys of social, economic, and natural phenomena, risk assessment tends to focus on the properties of chemical substances as abstract quantities divorced from specific places. Also, scientists outside the federal government play much more significant roles than in previous eras, not only carrying out risk assessment studies but also serving on advisory and review boards—an institutional innovation of the postwar era. The imprimatur of science, too, has acquired a unique status as guarantor of both the quality and the political neutrality of knowledge that was previously secured by the more general term *expert*.

Globalizing and Decentralizing Policy-Relevant Knowledge Production

The development and use of indicators of sustainable development have taken place against this background of the use of quantitative knowledge in environmental policy throughout the twentieth century. Since the World Commission on Environment and Development (WCED) first adopted the

phrase *sustainable development* in their 1987 report *Our Common Future*, the concept of *sustainability* has become increasingly important in environmental and economic policy (World Commission on Environment and Development 1987). Although many observers have been struck by its vague and imprecise definition—people can and do take sustainability to mean very different things—the concept of sustainability has acquired a certain reality in policy settings, in part through efforts to quantify and measure it and to use the results to guide public decisions.[7] Several hundred towns, cities, and counties in the United States and around the world have formulated and adopted ISD, as have the World Bank, the United Nations, and many individual countries. The indicators chosen vary considerably, but the goal is similar in local and global settings: to specify in concrete terms what sustainability means to a given community. Below, I develop brief analyses of five different ISD projects to illustrate the variety of activities going on and to explore the ways in which ISD projects are reshaping civic epistemologies in American democracy.

An important commonality among all five cases I describe below is the extent to which the projects tie together innovations in both the production of knowledge and the ordering of political activity. People working in these various sites are busy rearranging civic epistemologies and, in the process, *coproducing* knowledge and order. At stake are many of the same aspects of civic epistemology described in the previous section: the organization and presentation of expert knowledge, the institutionalization of knowledge production, the relevant policy to which knowledge was applied, the underlying regime of trust and credibility, and the definition of sustainability. In Table 2, I give a brief overview and comparison of the new civic epistemologies being experimented with in the five case studies.

Green GDP

For many people, "greening the GDP" epitomizes the drive to integrate environmental considerations into the economic practices of the welfare state—although, as we will see in the cases below, it hardly counts as anything like an exemplar of ISD. The goal of Green GDP programs is to reformulate national economic accounting frameworks to take nature into account. For example, under current GDP calculations, a tree chopped down and turned into lumber counts exactly the same regardless of whether the company in question adopts so-called sustainable forest management practices such as replanting the tree. Yet, as should be easily apparent from this example, the company's choice of forest management practices will have an enormous impact on the country's long-term wealth by determining whether,

Table 2. Civic Epistemologies of Indicators of Sustainable Development

	Green GDP	*Local ISD*	*Metropatterns*	*NGOs*	*IGOs*
Spatial frame	Nation	Community	Metro region	Globe	Globe
Form of knowledge	National accounting systems	Indicators of community well-being	Regional GIS maps	Indicators of planetary health	Reports of measures and statistical inventories
Institutional organization	Expert bureaus	Citizen activists and local planners	University research centers and private think tanks	NGO scientists	State-produced statistics; expert and diplomatic networks
Policy relevance	Administrative decisions, market signals, public understanding of economy	Local land use planning	Metropolitan politics and planning	Lobbying, public education, conservation partnerships	Monitoring and verification
Regime of trust	Expert judgment and statistical routine	Community participation	University prestige; political experience; charisma	Demonstrated commitment to issue specific values	Standardization of protocols
Definition of sustainability	Conservation of natural capital	Community well-being	Urban renewal and smart growth	Planetary health	Global pollution reduction

NOTE: GDP = gross domestic product; ISD = indicator of sustainable development; NGO = nongovernmental organization; IGO = intergovernmental organization.

thirty years from now, it will have another crop of trees to harvest. Green GDP systems would account for such choices and their impact on natural capital—the stocks of natural resources from which the nation draws its economic growth—when calculating a country's economic welfare.

Throughout the past decade, many countries have developed programs to green their GDPs, and the United Nations and World Bank have launched a joint program to encourage all countries to adopt similar policies and develop standard practices for environmental accounting. A group of experts from national accounting agencies, who call themselves the London Group, regularly meets to discuss concrete questions about how to account for ecosystem services in the GDP.[8] In the United States, the Bureau of Economic Analysis has developed a prototype system of Integrated Economic and Environmental Accounts that addresses subsurface minerals and mining (thought to be one of the simplest and most straightforward types of calculation of natural capital). In response to congressional inquiries regarding the methods used in calculating these subaccounts (which would be calculated and reported alongside but separately from the traditional economic accounts), the U.S. National Academy of Sciences commissioned a study led by Yale economist William Nordhaus, whose report, *Nature's Numbers*, strongly endorsed the Bureau's approach to environmental accounting and the country's need for it (Nordhaus and Kokkelenberg 1999). Fearing political controversy, however, government economists have halted all further activity in this area until directed and provided funding to recommence by either the president or Congress.

Although greening the GDP is often represented as a technical fix, it is clearly not. In the United States, where future progress awaits political impetus, past efforts to introduce environmental accounting have closely approximated a purely technical approach carried out by government statistical experts with little or no outside attention. By contrast, in Canada, where the state has embarked on a major initiative to develop national environmental accounting, Statistics Canada has sought extensive outside participation in the process, consulting with businesses, environmental groups, nongovernmental experts, and individual citizens. Their approach is based on the idea that traditional legitimating and warranting practices familiar from the sciences, such as peer review, are inadequate in cases in which shifts are contemplated in the knowledge base on which key governmental policies are made. Instead, new civic epistemologies seem to demand for them that experts seek assent from a wide variety of groups in society, disciplinary and interdisciplinary, expert and lay, public and corporate—much as, in Europe, recent crises such as bovine spongiform encephalopathy (BSE)

have led to extensive experimentation with public participation in expert advisory processes.

At bottom, the issue is simple. The GDP is not merely an example of what Theodore Porter has described as a generalized "trust in numbers" (Porter 1995); it is a *trusted number*, an "intangible artifact of cultural reverence" and an object of calculation with deep social meaning (K. Bandhauer, personal communication, 2002). Investors, workers, and citizens watch it carefully, alongside other key indicators such as the Dow Jones industrial average, for signs and portents of their economic fortunes. Changes in the GDP calculus will entail widespread social accommodation, as people relearn what new calculations of national accounting imply for their own lives and livelihoods. Will economists still define recession as two or more consecutive quarters of negative GDP growth? Can a green GDP reliably guide the decisions of central bankers as they regulate the money supply? Should Main Street or Wall Street worry most about declines in the nation's natural capital? Answers to such questions will not be simple, as people struggle to make sense of fluctuations in a measurement about which they know little and with which they have little experience.

Local ISD

Since the publication of *Our Common Future*, in a separate social movement on Main Street rather than among ecological economists, hundreds and possibly thousands of communities in the United States and around the world have compiled and published sets of local indicators of sustainable development; these communities range from Burlington, Vermont, and Grantsville, Utah, to Seattle, Washington, and Cleveland, Ohio.[9] States, such as Oregon, Minnesota, and Florida, and regional projects, such as the Central Texas Sustainability Indicators Project for regional planning in Bastop, Caldwell, Hays, Travis, and Williamson Counties, have also gotten into the act (see Florida Sustainable Communities Center n.d.; Oregon Progress Board n.d.; Minnesota Environmental Quality Board n.d.; Central Texas Sustainability Indicators Project 2004). Several NGOs serve this rapidly expanding market in community sustainability initiatives, providing information on principles, methodologies, and case studies and serving as facilitators and consultants.[10]

Community ISD typically involve sets of dozens and sometimes hundreds of indicators covering everything from conventional environmental concerns, like air and water quality, to land use issues and biodiversity, as well as a host of nonenvironmental quality of life measures, like nonstandard economic development statistics (percentage of high-pay, high-skill jobs), health care quality and accessibility, and measures of the strength of local

democratic participation. These lists look like what they often are: grab bags designed to include everyone's favorite indicators. Policy planners often complain that they are too broad and include too much to be reliable guides to local officials. Yet, as a first step, as a statement of the community's values and of what people care deeply about, they are valuable tools. Collectively, they are an indicator of the motivation of people throughout the country to measure the well-being of their communities along additional axes besides economic wealth.

Despite the extensive involvement of NGOs as facilitators, consultants, and advisors to communities, there is a remarkable absence of standardization in local ISD projects. No two communities' indicator sets replicate one another in their entirety. Indeed, for the most part, communities' lists of indicators typically only overlap in at most one or two indicators. Unlike many other initiatives, in which for various reasons governments exhibit a strong tendency to adopt frameworks, protocols, and measures common in other locations, communities have essentially gone their own way in developing sustainability measures. Part of the reason for this stems from the observation that local sustainability projects only rarely, if ever, reflect policy initiatives in the traditional sense. Instead, they tend to emerge from bottom-up, populist agendas motivated and organized by community activists. Local officials are often intimately involved in putting them together, but the impetus for pursuing community sustainability typically lies outside local government administration. There is thus a strong commitment to public participation and involvement in most community sustainability initiatives, and it is no surprise that such programs differ markedly from place to place.

One of the most interesting features of community ISD is the altered expert-citizen relationships they often exhibit. In democratic governance in the twentieth century, citizens have in most cases turned over authority for identifying and defining policy problems, as well as for measurement and analysis, to communities of experts—many of whom work for the state. Yet, an important part of most community sustainability initiatives is the sense citizens derive that they are taking back or revitalizing their community. This sense comes not only from active participation in the process but also from the accomplishment of defining the goals and values that sustainability indicators will target in their community. Sustainability indicators frequently get defined in town meeting settings and are only later turned over to public officials and statistical experts for compilation and measurement. One important consequence is that ISD are chosen and evaluated according to different criteria than when experts define them. For example, citizens often attach a lower priority to accuracy, standardization, and consistency than to other criteria such as whether the measures capture key aspects of community life

to which they attach substantial meaning or how the measures comport with local knowledge. As the upshot of active public participation and involvement, the creation and use of sustainability indicators become tangible evidence both that community members have asserted control over self-reflexive definitions of communal life and that the community attributes meaning to more than just economic welfare when assessing quality of life.

Metropatterns

Metropatterns is the brainchild of Myron Orfield, Minnesota state legislator and adjunct professor of law at the University of Minnesota, and, like many of its counterparts in the Internet generation, the endeavor runs frequently on the hype and hyperactivity of its charismatic young leader. The Web advertisement for Orfield's new book, *American Metropolitics* (Orfield 2002), sells not only his previous book but also the whole package delivered by Metropolitan Area Research Corporation (MARC)—the quasi-private, quasi-university, quasi–public research institute created and run by Orfield.

In 1998, Myron Orfield introduced a revolutionary program for combating the seemingly inevitable decline of the United States's metropolitan communities. Through a combination of demographic research, state-of-the-art mapping, and resourceful, pragmatic politics, his groundbreaking book, *Metropolitics*, revealed how the different regions of St. Paul and Minneapolis pulled together to create a regional government powerful enough to tackle the community's problems of sprawl and urban decay (see Metropolitan Area Research Corporation [MARC] 2003a).

MARC's sales pitch is simple. Metropolitan regions in the United States are in decline in large part because they lack regional government. Suburbs fight with cities for jobs and tax base, inner-ring suburbs compete with newer suburbs, and downtowns compete with mall complexes, all leading to urban blight, suburban sprawl, fierce jurisdictional rivalries, enormous duplication of services, and all but zero regional planning. What is the solution? Help people to see that metropolitan politics is regional politics and that without regional cooperation, they have little hope of solving basic problems. How? Provide them with information in a regional format that can be compared to data describing other metropolitan regions so as to illustrate that all metropolitan regions face the same problems. As with ecologists and climate modelers, who have striven to demonstrate that ecosystems and the Earth's climate system must be managed according to systemic boundaries, so, too, Orfield and others seek to illustrate that the metropolitan region is a natural form that must be managed in its entirety if it is to avoid the problems that currently plague it.

Enter the geographic information system (GIS) illustrated in Figure 1, which gives an example map of Atlanta, Georgia, taken from Orfield's upcoming report, *Atlanta Metropatterns*.[11] MARC's Web site (MARC 2003b) offers downloads of reports for an additional seventeen major U.S. cities and the State of Kentucky. In a standard GIS layout, MARC presents the region, divided into its formal legal jurisdictions (in this case, townships and cities), with each given a color depending on its score on whatever indices are being used for the particular graph in question. Urban blight zones are typically colored red, whereas wealthier suburban districts are blue. What is often surprising to many people, however, is the number of inner-ring suburbs (generally settled in the 1950s and early 1960s) that face similar or identical problems as their urban neighbors. In contrast, the furthest out suburbs face the problem of geography: as the distance from the city center increases, the spatial territory covered expands. More jurisdictions mean more competition for scarce business development, leading to outer-ring suburbs with wealthy residents but little tax income with which to provide roads, electricity, and water to the rapidly expanding areas filled with country estates. Regions that can visualize these problems as an integrated pattern on MARC maps have a leg up—or so the argument goes—on achieving regional cooperation, because residents and officials will identify themselves as inhabitants and managers of a region, not a local jurisdiction.

Two additional features of MARC's program should be noted. First, the ultimate goal of Orfield's activities is to spur regional governance. Orfield was a key player in the emergence of cooperative regional planning in Minneapolis/St. Paul, including the creation of a regional development fund that reallocates tax revenues from economic growth among all of the metropolitan jurisdictions, substantially reducing competition for new business developments. In public presentations to other cities, Orfield has stressed that such a solution became possible only after citizens and officials adopted a metropolitan identity that encompassed the entire region. Regional GIS data are the basis of such an identity transformation, Orfield has claimed, although few other regions have experienced the kind of success Minneapolis and St. Paul have in constructing regional identities and regional governance, even after commissioning studies from MARC, suggesting that political identities and economic realities can also shape how one reads quantitative data.

Second, although popular, Metropatterns is not the only approach to regional knowledge, planning, and governance. The Brookings Institution has developed a comparable approach centered on inner-ring suburbs,[12] and the Center for Urban and Regional Analysis at Ohio State University also offers metropolitan research and planning activities (Center for Urban

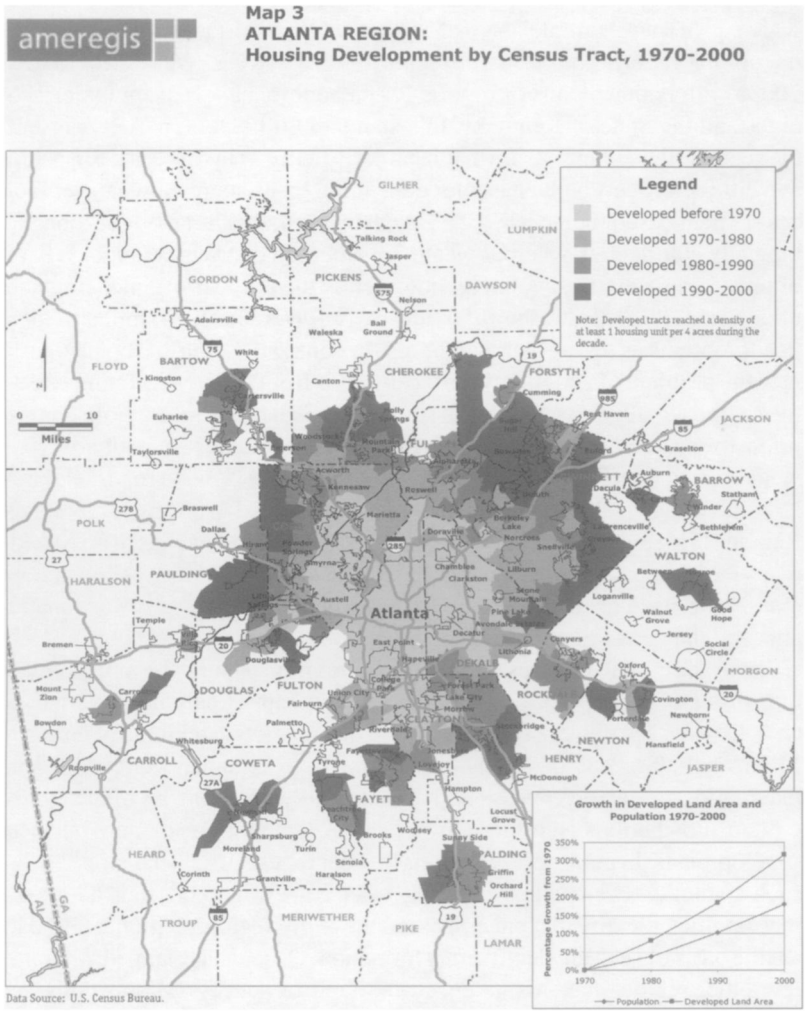

Figure 1. A geographic information system (GIS) image of Metropatterns data for Atlanta, Georgia.

SOURCE: © Amergis Corporation, All Rights Reserved, Used with Permission of Amergis Corporation.

and Regional Analysis 2005). Together, these three examples illustrate the amalgamation of private think tanks, consulting firms, and university research facilities that tend to be linked to support metropolitan research. Interestingly, however, the bulk of basic data used in metropolitan studies

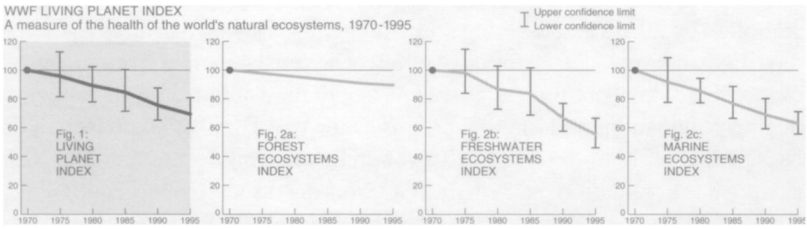

Figure 2. WWF Living Planet Index, 1970-1995.
SOURCE: Reproduced with permission from WWF. © 1999 WWF—World Wide Fund for Nature (Formerly World Wildlife Fund). All rights reserved.

come from a wide variety of federal government statistical programs. Organizations like MARC and Brookings thus become second-order processing units, collecting, aggregating, and repackaging data from federal statistical agencies to help residents and officials of cities see themselves and their communities in a new light.

The Living Planet

In 1998, the World Wildlife Fund (WWF) introduced its Living Planet Index (LPI), "a measure of the health of the world's natural ecosystems."[13] The LPI is a composite of three other indices of the "health" of terrestrial, freshwater, and marine ecosystems, each of which measures a component of global species loss against a 1970 baseline. Since 1998, WWF has published an annual revision of the index, showing a steady decline in the planet's biological diversity. Figure 2 shows the LPI for 1970-1995.

There are several pertinent observations to make about the LPI and other comparable efforts to create indicators of sustainability for the planet as a whole. First, as a matter of practice, LPI is a hybrid, aggregated statistic. The authors of the *Living Planet Report* (World Wildlife Fund [WWF] 2005) have not traveled the world, busily counting species in different ecosystems. Rather, they have developed the LPI from numerous other primary and secondary sources of data on species loss. Their sources include scientific studies, UN reports, national government data sets, and publications of other NGOs. Like MARC in the previous case, WWF acts as a center of calculation but not in the conventional sense of the phrase as used by Latour (Latour 1987, 1988). WWF is neither Pasteur's lab nor Kew Gardens but a new, postmodern refraction of these imperial institutions that scans the world's

information networks, aggressively collecting and aggregating information compiled by others and weaving it into meaningful social narratives. Nor are the LPI's authors like Pasteur or like Kew's botanists, hard at work in the lab or the field. Many are trained as scientists, but they now work full-time producing publications and running programs for WWF and other conservation NGOs, including the World Conservation Monitoring Centre and the New Economics Foundation—a British NGO working on ecological economics.

The LPI is no mere statistic; it is the centerpiece of WWF's global effort to reduce human pressure on the environment, the Living Planet Campaign (WWF 2005). The campaign operates on three levels. The first is a prioritization of the world's ecosystems. WWF scientists have compiled what they term the *Global 200*—a "blueprint" for conservation activities that identifies slightly more than 200 ecosystems that represent "the broadest variety of the world's habitats." By preserving these habitats, WWF has contended, "We can conserve the broadest variety of the world's species, as well as the ecological and evolutionary processes that maintain the web of life," and in the process stem the drop-off in the LPI.[14] The second level of the campaign is worldwide fundraising. WWF has launched the Living Planet Campaign as a new fundraising effort, separate from other appeals, including mass mailings to individual supporters of WWF and the publication of a coffee table book, *The Living Planet: Preserving Edens of the Earth* (WWF 1999). The volume contains photographs of wildlife in each of the Global 200 habitats, and part of the proceeds from its sale go to the campaign.

The third piece of the campaign is a set of contractual relationships with a wide variety of other players in world affairs: local, regional, and national governments; private businesses and corporations; religious institutions; other NGOs; and intergovernmental organizations—anyone who will promise to work with WWF to sustainably manage identified conservation sites in the Global 200 list. WWF designates these private agreements as Gifts to the Earth, bringing worldwide attention to both WWF and its partner organizations.[15] Through the Living Planet Campaign, WWF has thus situated itself at the focal point of a web of networked connections with public, private, and nongovernmental organizations that embodies, on one hand, the production of statistical knowledge about what is happening in the world and, on the other hand, efforts to change the management of the world's natural resources. The advantages of this kind of network are its flexibility and ability to adapt its procedures and partnerships to widely varying circumstances from site to site. The primary disadvantage is its lack of political accountability to groups other than its donors.[16]

Accounting for Climate Change

Efforts to standardize an international accounting framework for climate change began in 1989 under the auspices of the Organization for Economic Cooperation and Development (OECD). Thirteen years later, no common protocol yet exists, although a set of "default methodologies" was approved by the Conference of the Parties to the UN Framework Convention on Climate Change in 1997. The Framework Convention dictates that countries use "comparable" accounting methods, whereas the Kyoto Protocol, whose ultimate adoption remains in question, is somewhat stricter in requiring standard accounting practices. Both tie accounting to the measurement of emissions of so-called greenhouse gases (the most important of those covered by the treaty are carbon dioxide, methane, and nitrous oxide) and their compilation into national inventories.

As one might imagine after witnessing recent corporate accounting scandals in the United States, the challenges of developing a global accounting framework are legion. To achieve agreement among hundreds of countries, treaty negotiators often paper over differences with vague language that must later be resolved in the standardization of concrete accounting practices. Countries frequently opt to count or measure different sources and sinks in their inventories, and they likewise count and measure the same sources and sinks using different methods. National governments have generally proven unwilling to cede authority over the definition of accounting standards to international bureaucracies, let alone the production of statistical knowledge that might be used to hold the state to account.[17] There is, as well, an almost complete absence of institutions that are sufficiently trusted or authoritative to negotiate and formalize global accounting frameworks. Consequently, as scientists and diplomats work to develop accounting standards, they have found it necessary to simultaneously develop, from the ground up, processes and procedures for securing trust among not only themselves but also the wider communities of experts, officials, activists, scholars, and citizens attentively watching their work.

Some of the difficulties have arisen because groups in global society hold differing views regarding the purpose of accounting. Some see accounting as a formal mechanism for holding states to account for what they do and do not do.[18] Consequently, they have sought to establish clear definitions of which state is responsible for which emissions of greenhouse gases. Even among these groups, however, the definition of responsibility differs. Some wish to assign responsibility on the basis of territorial jurisdiction. Others support more instrumental approaches that would assign responsibility on the basis

of the citizenship or nationality of the individuals or corporations whose activities led to the emissions or who profited from them.[19] By contrast, still other groups approach the accounting problem not in terms of responsibility but in terms of incentives for good behavior. Here, accounting becomes a tool for encouraging countries to adopt climate-friendly policies. This results in different approaches to accounting under those conditions in which a country not obviously responsible for emissions nonetheless has policy options available that would significantly reduce those emissions, through, for example, export or import controls.

Other disagreements stem from principled differences regarding fundamental values and concepts. Both the Framework Convention and the Kyoto Protocol insist that countries be held responsible for anthropogenic emissions but not natural emissions. Yet, the precise boundary between these categories is contested, particularly in debates over reforestation and carbon sequestration projects (see Fogel 2002). At one point, negotiators had fixed a set of standards that required countries to account for changes in carbon stored above ground in forests (due either to deforestation or reforestation) but not for changes in carbon stored below ground. At another point, standards required accounting for changes in stored carbon from forests but not from other kinds of terrestrial vegetation and soils (such as scrublands or agriculture). Similar debates about boundaries have raged over how to account for so-called bunker fuels consumed by ships, airplanes, and other modes of travel that cross national boundaries or international waters.

In developing accounting standards, scientists and diplomats have found themselves paying careful attention to institutional relationships in their efforts to create standards that satisfy both scientific and political criteria. Although the OECD sponsored the original work, in 1991 the standards became the primary responsibility of the Intergovernmental Panel on Climate Change (IPCC), an international scientific advisory body with informal ties to the then-ongoing climate negotiations. Some observers objected to the OECD on the grounds that it represents the interests of its members, who come primarily from among the rich nations of Europe and North America. Ironically, at the time of the transfer, the IPCC's reputation among developing countries did not fare much better—although it was at least officially a body open to any country who wished to join. More recently, the IPCC has had to develop a close working relationship with the Framework Convention's Subsidiary Body for Scientific and Technological Advice (SBSTA) to shore up its political credibility (see Miller 2001b). As disputes arose, such as those described above over boundary work, IPCC scientists working on the accounting framework found themselves facing uncomfortable choices that seemed to involve explicit policy choices. SBSTA has proven an effective

setting for them to solicit feedback from governments and for governments to negotiate with one another over how to resolve disagreements over the cognitive and political details of accounting frameworks.

Discussion and Concluding Remarks

These five cases offer valuable insights into coupled processes of cognitive and political change in contemporary societies. The creation and use of indicators of sustainable development are one place in which people in the United States and international organizations are working out new arrangements for making public knowledge and connecting it to public decisions, shifting power and authority from the nation-state both upward and downward. Reflecting subtle shifts in political identities and also helping give those identities conceptual and administrative reality, several of these ISD projects have displaced the nation in favor of the globe or the community as the focus of statistical calculus. At the same time, government experts have been displaced from their position of monopoly over the definition and production of statistical knowledge. In some cases, the widespread availability of statistical data has given rise to new agents who repackage and reinterpret that data for local and global actors. In other cases, citizens, NGOs, and local officials have defined new statistical measurement programs on their own terms and put in place programs for implementing them. Nature, in the process, looks less and less like the commodified natural resources or the polluted environments imagined by the American state during the course of the twentieth century, although just which new vision of human-nature interactions will replace these images—the Earth at risk, the provider of ecosystem goods and services, or planned ecological utopias—remains to be seen.

Within these processes of change, quantification functions principally as a technology of visibility (see Scott 1998; Anderson 1991). This differs significantly from other modes of civic epistemology in the United States and elsewhere in which quantification serves as a technology of trust and accountability (see esp. Porter 1995; Jasanoff 1991) or of discipline and control (Foucault 1977; see also Dear 1995). These modes obviously overlap, but ISD have not (yet?) in American democracy or in global governance become tools for holding governments accountable or for disciplining errant behavior. Even in the case that most closely approximates the former, the compilation of greenhouse gas emission inventories, no nation has yet been held accountable for its actions via these numbers, and it is not clear how they would be. Rather, ISD have primarily served in these cases as tools that communities can use to see things they have not seen before. Local ISD and

Green GDP seek to make visible aspects of human well-being not well captured in measures of wealth. Metropatterns seeks to redraw the political landscape, creating a new identity for metropolitan regions. In conjunction with other technologies of visualization and computation, like satellite photography and computer simulations, global ISD have helped to transform the environment into an entity to be understood, managed, and governed on scales no smaller than the globe itself (see Cosgrove 2001; Jasanoff 2001).

Not surprisingly, of course, if we take the idea of coproduction seriously, new modes of visibility proceed at an uneven pace, with frequent reversals, and with a great deal of uncertainty about eventual outcomes. Persuading people to see in new ways is not necessarily straightforward (Law and Lynch 1990). Reworking how Americans measure nature and link those measures to the formulation of policy entails complex epistemological and normative challenges. Hence, we should also not be too surprised that some of the furthest along ISD projects are taking place in local communities and in transnational professional and single-issue networks in which the small size of the community or its ideological homogeneity makes it easier to arrive at simultaneous technical and political accommodations. By contrast, efforts to green the GDP and standardize global accounting rules have encountered much deeper opposition, both cognitively and politically.

Pace Porter, then, these cases offer grounds for skepticism that quantification operates as a technology of distance (Porter 1995). People who do not live in face-to-face communities, Porter argued, can only communicate about common concerns using languages that do not depend on standards of credibility internal to those communities. Thus, they rely on languages of numbers, whose adherence to mathematical rules enables people to derive external markers of credibility. Even if one assumes universal mathematical education, however, which is far from reality even in the richest countries, there is a problem with this analysis that becomes immediately apparent in several of the ISD examples described above. Public numbers are not simply mathematical entities; they inevitably carry social meaning, and the production of those meanings takes place in community. One may trust that the numbers have been produced correctly, but if one does not grasp the purpose in compiling a particular number in a particular way, one faces enormous difficulties of communication.

Despite the best efforts of groups like the International Institute for Sustainable Development, Sustainable Measures, and Redefining Progress, no two communities in the United States have developed comparable sets of ISD. Indeed, only rarely do individual indicators overlap in more than a few towns or cities. The construction of standard methods for accounting for

greenhouse gas emissions has taken, to date, more than twelve years of intricate negotiations among scientists and diplomats from around the world. And still, no uniform statistics exist, even for the United States and Europe, where technical expertise, state investment, and commitment to universal standards all run high. Compromise was only achieved on a set of default international standards by agreeing to let each country deviate from those standards when and where it feels appropriate. In Minneapolis/St. Paul, where Metropatterns statistics emerged out of a political realignment of the relations between the cities and their suburbs, regional data today guide a powerful regional development program. Elsewhere, metropolitan communities would love to use similar data to rev the engines of economic growth, but it does little good unless it can be accompanied by a growing sense of regional identity and regional public goods.

Put simply, numbers do not travel well outside of community, even in a highly mathematical world. No set of calculations, no matter how simple or complex, can provide by itself the glue to tie people together, absent other social connections. When numbers do seem to travel from place to place, look carefully for regularized social interactions, if not institutions or communities—odds on, you will find them.[20] Or look to see if the numbers really travel as well as they seem. ISD have perhaps as much potential as any other recent invention to become a robust part of local and global civic epistemologies. But to do so, they must become more than just numbers; they must come to reflect and also help establish and secure the political identities, practices, and organization of the communities they inhabit. Unfortunately, ISD are not a magic bullet. For those who wish to enhance the sustainability of human activities through ISD, patient transformation of community must still accompany any new calculus of nature.[21]

Notes

1. The phrase *civic epistemology* was first used by Sheila Jasanoff in a series of European lectures in the spring of 2002. I define civic epistemology as the broad array of activities, social processes, informal practices, and institutionalized procedures by which people collect, aggregate, validate, and wield claims to knowledge about nature and society in public and policy settings. This includes, in addition to science, accounting frameworks, styles of assessment, formal and informal policy analysis, local knowledge, the media, and public understanding.

2. The term *coproduction* refers to the constructivist perspective I take to knowledge *and* order—I treat both as creative products of human work and imagination—and to their interdependence as constructed entities. I use the term *imagination* in its productive sense, following Anderson (1991), who referred to nations as imagined communities, referring to people's capacity to imagine things that exist beyond their personal experience, rather than in its more pejorative sense to mean not real.

3. For a detailed, philosophical discussion of styles of reasoning, see Hacking (2002), ch. 12, 178-99. For a specific discussion of statistical reasoning as a style of reasoning, see Hacking (1992a).

4. During an interview with an official at the Organization for Economic Cooperation and Development (OECD), an institution that serves to disseminate and harmonize policy analyses among leading industrial states, I was told that the organization preferred to hire American and Dutch researchers who come with greater training and familiarity with quantitative reasoning.

5. These variations in national styles of quantitative reasoning are only a small example of cross-national variations in the organization and content of expert advisory processes observed by researchers during the past two decades. This research has found that science advice is deeply bound up with political culture from the way that people frame risks and judge the relative importance of policy problems to the forms and styles of expert reasoning, the criteria used to demarcate expertise in the public domain, and the institutional apparatus for generating and filtering scientific research for use in policy decisions (see esp. Jasanoff 1995, 1986).

6. For a more extensive discussion of quantitative risk assessment as a tool of U.S. regulatory agencies, see Jasanoff (1991).

7. The variation among definitions of sustainable development is remarkable. Most observers have taken sustainable development to mean something akin to "bringing human activities back into balance with nature"—that is, finding ways to sustain ecological systems and processes—although meanings vary even among environmental activists, from deep ecology to "limits to growth" and Malthusian arguments to promoting green business strategies. In contrast, some economists have suggested that sustainability be approached as a search for ways to sustain technological progress and economic growth. Some definitions of sustainability focus on natural resource management, offering a modification of ideas of conservation. Whereas conservation sought to optimize natural resource use to support economic growth, this use of sustainability seeks to define a level of resource use that can be maintained throughout long periods of time. Other approaches to defining sustainability adopt the human-centered focus of conservation by focusing on human well-being but insist on preserving natural systems and areas that provide what are termed "ecosystem goods and services" (Daily 1997). Another important line of difference among definitions of sustainability involves their incorporation of uncertainty. In some definitions of sustainability, full knowledge of the impacts of any human activity on nature demand that we adopt a precautionary approach to large-scale modifications of natural systems or processes. For others, however, the key to sustainability is to provide better knowledge of the determinants of human well-being, often simply by measuring other things besides wealth.

8. The phrase *ecosystem services* has become popular, especially among conservation biologists, who use it to refer to services that nature performs for communities that would be difficult and costly (if not impossible) for communities to replace with technologies if the ecosystems providing them no longer existed (see Costanza et al. 1997; Daily 1997).

9. Extended descriptions of many of the indicators projects discussed in this article can be found through the Internet. See the Smart Communities Network's "Sustainable Burlington" (1997), the Sustainable Communities Network's "Grantsville General Plan for a Sustainable Community" (2002), Sustainable Seattle (n.d.), and EcoCity Cleveland (2005).

10. Some of the more prominent include the International Institute for Sustainable Development (2005), the Sustainable Communities Network (n.d.), Sustainable Measures (1998-2000), and Redefining Progress (n.d.).

11. The complete report will be available in the near future (see MARC 2003b).

12. See, for example, Puentes (2002).

13. WWF's annual *Living Planet Report* containing the LPI can be downloaded from the Web (see WWF 2005).

14. Quote taken from "The Global 200: A Blueprint for Saving Life on Earth," a poster-sized removable map published by WWF (1999).

15. As of July 22, 2002, WWF had designated 77 Gifts to the Earth. For a list, see the campaign's Web site at http://www.panda.org/about_wwf/how_we_work/gifts_to_the_earth/index.cfm.

16. For example, details of WWF's agreements with other groups are generally held in confidence by WWF and its partners and are not released to the public.

17. Chayes and Chayes (1995) suggested that international law and accounting tend to have a more informal and negotiated flavor, held in place by a great deal of persuasion and "jawboning" rather than the strict legalistic approaches to accounting familiar in the United States. Nonetheless, states have proven unwilling to allow others to hold them to account using data they themselves have not produced.

18. Generally, states themselves have assumed that this would be the principle purpose of an accounting framework.

19. Within the default methods approved by climate negotiators, responsibility is almost entirely divided up on the basis of whose territorial jurisdiction emission occurs within.

20. International economic statistics travel (although arguably not well), for example, in large part as a result of standardized training received by many government administrators around the world, often in American universities.

21. Jasanoff and Wynne (1998) made a similar point about global environmental knowledge.

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Clark A. Miller is an assistant professor of public affairs and science studies at the La Follette School of Public Affairs, University of Wisconsin–Madison.