Postindustrialization and Environmental Quality: An Empirical Analysis of the Environmental State*

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Abstract

Existing sociological analyses express differing expectations about state control over economic actors and the political feasibility of environmental regulation. Recent literature on the environmental state sees environmental protection as becoming a basic responsibility of postindustrial states, with economic actors no longer having the autonomy they once enjoyed. In contrast, much of the work in environmental sociology expects commitments to environmental state responsibilities to be largely symbolic. Scholars working from this perspective tend to see environmental damage as proportionate to economic prosperity. To assess the differing expectations, we analyze actual environmental performance among the most prosperous nation-states focusing on national-level emissions of carbon dioxide. The strongest predictors of emissions are found to be measures of ecological efficiency, which tend to be associated with potentially less symbolic policy decisions. For the future, there is a need to move beyond broad assertions, devoting greater attention to the conditions under which states are more or less likely to impose constraints on economic actors.

The social consequences of modernity have been of interest to sociologists at least since the days of Weber ([1904-5]1958), Tonnies ([1887] 1963), Durkheim ([1893]1933), and Marx (1889), but the nature of the interest has changed significantly in recent decades. Two types of transformations are particularly noteworthy; both of them result, in part, from the magnitude of the social, economic, and technological changes that have taken place over the past century. First, sociologists now focus routinely on the social structure of "advanced"

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capitalist states, often using terms such as *postindustrialization* (e.g., Bell 1973), advanced capitalism (e.g., Habermas 1970, 1975, 1998), or new modernity (e.g., Beck 1987, 1995, 1997, 1999; Beck et al. 1994). Second, in a related change, there is now growing attention to how such advanced capitalist states will affect their own biophysical infrastructures. This attention to the relationship between societies and the natural environment is particularly relevant as environmental problems continue to worsen around the globe.

When Weber closed his *Protestant Ethic* by noting that the "iron cage" of capitalistic systems might well last "until the last ton of fossilized coal is burnt" (Weber [1904-5] 1958:181), his comment was generally taken to mean that the metaphorical cage would continue for an almost indefinitely long time. So dramatic have been the changes in the societal use of natural resources, however, that present-day scientists from a variety of disciplines now predict such ending dates in far more specific ways. Although present-day industrial societies are significantly more dependent on oil than coal, world oil reserves are now seen as sufficient to supply present global petroleum needs for only another forty years (e.g., World Resources Institute 1994). This calculation points to the severity of global environmental conditions and the importance of the policies that address these issues. Both within the specialized field of environmental sociology and across the discipline as a whole, sociologists have devoted increasing attention to the fact that, in the words of Habermas (1975:42), "The exponential growth of population and production . . . must some day run up against the limits of the biological capacity of the environment" (see also Grant et al. 2002).

Different groups of sociologists, however, have assessed the biophysical constraints of advanced modernity in sharply different ways. On the one hand, a good deal of work within political sociology, which is largely European in origin, calls for the emergence of an *environmental state* (Mol & Buttel 2002; see also Buttel 2000a; Frank et al. 2000a, 2000b; Goldman 2001). As we will spell out in greater detail in the pages that follow, this work actually includes three main branches — reflexive modernization, ecological modernization, and postmaterialism — which are largely independent from one another, but which tend to share two commonalities. First, much of the work in all three branches reflects the view that, in the words of Anthony Giddens, environmental protection is becoming "a source of economic growth rather than its opposite" (Giddens 1998:19). Second, all three branches tend to include an expectation that advanced or industrialized nation-states will treat environmental protection "as a basic state responsibility" (Frank et al. 2000b: 96), with the state at least implicitly being seen as having enough autonomy or capacity to carry out that responsibility.

In terms of these two expectations — that environmental protection can be carried out in ways that will be economically beneficial, and that those responsibilities will be embraced relatively readily by the state — however, the work in this relatively new environmental state tradition stands in sharp contrast to the main body of work in the field that has come to be known as *environmental sociology* over the past several decades. First, most work in the environmental sociology literature has tended to see environmental regulations as being harmful — and often as being strongly antithetical — to continued economic growth. Important authors within environmental sociology, for example, have warned of a need to stop the expansion of capitalism and/or the processes of industrialization because of the risk of "overshooting" of global carrying capacity (e.g., Catton 1980), of the potential collapse of economic activity that may result from the self-exhausting tendencies of a "treadmill of production" (e.g., Schnaiberg 1980), or of the "second contradiction of capitalism" (e.g., Foster 1992; O'Connor 1991). Similarly, a more recent article concludes that "environmental threats to sustainability are . . . principally due to population growth and economic growth" (York, Rosa & Dietz 2003:296). Second, due in part to these economic expectations, work in environmental sociology tends to presume that state actors will avoid, rather than embrace, most tangible expansions of environmental responsibilities. In contrast to the work on the environmental state, in other words, the main body of work in environmental sociology is more consistent with the expectations put forth by scholars such as Edelman (1964), O'Connor (1973), and Block (1987), who see the legitimacy of the state as being dependent, to a significant degree, on the maintenance of "business confidence" and economic growth. Thus, scholars working within the environmental sociology tradition tend to find state constraints on business/economic autonomy as relatively problematic and highly unlikely (e.g., Alario & Freudenburg 2003; Dunlap & Mertig 1992; Schnaiberg 1980).

Although there are important exceptions — specifically including major figures in the ecological modernization literature who have made it clear that their work grows out of environmental sociology, such as Mol, Spaargaren, and especially Buttel — most authors working on either side of the environmental sociology/environmental state "divide," at least to date, have devoted relatively little attention to those working on the other side. Instead, as noted by recent assessments from Cohen (2000) and Fisher and Freudenburg (2001), there has been a marked tendency within each body of work to offer strong, relatively undifferentiated expressions of a given point of view. These views are sometimes accompanied by empirical examples, but there have been relatively few efforts to learn whether a more systematic empirical examination might lead to finer-grained conclusions. In the words of Fisher and Freudenburg (2001:704), the expectations and debates, to date, "have tended to be expressed in stark, black-and-white terms," while "the reality is likely to be more complex — a matter of degree, rather than of absolutes." Put differently, the greatest need may be not merely for more empirical work, but more specifically, for rigorous efforts to identify *the conditions under which* empirical outcomes will tend to resemble the expectations from one body of work or the other (e.g., York, Rosa & Dietz 2003).

As may already be clear, the present article seeks to respond to this challenge, not by prolonging the separation between these two bodies of literature, but instead, by examining the empirical implications of both in a more even-handed manner.

Examining the Empirical Implications

As a useful simplification, the differing degrees of optimism between the environmental sociology and the environmental state literatures can be traced to hypotheses in the latter works, holding that advanced societies will move toward the successful management of environmental problems. Many authors of the environmental state conclude that economic prosperity of a nation-state may increasingly come to be associated with *lower* levels of environmental input and emissions (e.g., Mol 1995; for analyses and supportive evidence, see Templett & Farber 1994; Repetto 1995; Freudenburg 1992; for opposing views, see Bunker 1996; Daly 1990; York et al. 2003). As already noted, however, these expectations are actually expressed in three main bodies of work, not just one. Although there is significant comparability in the overall outcomes expected by reflexive modernization, ecological modernization, and postmaterialism, the specific mechanisms that are hypothesized to lead toward those outcomes tend to be very different. Still, in comparison with the work in environmental sociology, all three of these literatures on the environmental state are far more likely to view environmental protection as involving low or acceptable costs, economically, and high levels of implementation, politically.

With respect to questions of *economic costs*, it is possible that the major reason for the higher level of optimism within the environmental state literature involves the expectation for improvements in technological and, therefore, ecological efficiency. Perhaps the most explicit statement of this expectation is provided by the theorists working within the framework of ecological modernization. The best-known proponents of ecological modernization in the English-language literature, for example, expect "unproblematic use of science and technology in controlling environmental problems" (Mol & Spaargaren 1993:454; see also Buttel 2000b, 2000c; Christoff 1996; Cohen 2000; Fisher & Freudenburg 2001; Hajer 1995; Huber 1985; Leroy & van Tatenhove 2000; Mol 1995, 1997, 1999, 2000a, 2000b; Mol & Sonnenfeld 2000; Mol & Spaargaren 2000; Spaargaren 1997, 2000; Spaargaren & Mol 1992; Spaargaren & van Vliet 2000). Scholars working on postmaterialism, meanwhile, have a somewhat different perspective, seeing the economic costs of tougher environmental protection as being not so much negligible as acceptable. In the words of Ronald Inglehart, one of the most well known proponents of postmaterialism, "*countries* that have relatively postmaterialistic publics, rank relatively high in their readiness to make financial sacrifices for the sake of environmental protection" (Inglehart 1995: 57, emphasis in original; see also Abramson 1997; Brechin & Kempton 1994, 1997; Dunlap & Mertig 1997; Inglehart 1990; Pierce 1997). Proponents of reflexive modernization tend to have a similar point of view, expecting civil society actors to see environmental damage as a greater concern than any associated constraints on production processes. In the words of Beck, "The goal is not a turning back but rather a *new modernity*, which would demand and achieve self-determination, and prevent its truncation in industrial society" (Beck 1995: 17, emphasis in original; see also Beck 1987, 1997; Beck et al. 1994).

This issue of economic feasibility also has clear relevance to the second main way in which proponents of the environmental state tend to differ from those who have worked within the traditions of environmental sociology, involving questions of *political implementation*. For this second area of difference, however, there is a certain degree of empirical support for the expectations of the environmental state literature, mainly in the realm of international institutions (see Frank et al. 2000a, 2000b; see also Haas 1989, 1990, 1995: Haas and Sundgren 1993; Levy et al. 1993; Young 1989, 1997), and within the context of an emergent world polity (e.g., Frank 1997, 1999; Meyer 1994; Meyer et al. 1997). At the same time, however, even these findings have come under criticism. Of particular relevance in the current context is the criticism put forth by Buttel (2000a). Specifically, Buttel points out that a focus on the establishment or diffusion of *institutional forms* of environmental protection may actually have little to say about the extent to which such measures or forms "have, or are likely to have, any definite connections with actual environmental protection *outcomes*" (Buttel 2000a: 118, emphasis added; for a comparable criticism, see York et al. 2003).

This distinction may well be important. At least since the time when Edelman (1964) discussed *The Symbolic Uses of Politics*, there has been a good deal of awareness within the social sciences of the potential for disjuncture between the *symbols* versus the *substance* of state activities. As subsequently pointed out by other authors such as Block (1987; see also Habermas 1970, 1975; O'Connor 1973), "advanced" or "late" capitalistic states can be expected to face the challenge of maintaining economic vitality, but to do so while at least *appearing* to carry out other responsibilities, ranging from the protection of worker rights to the protection of the environment. If it is, in fact, the case that vigorous efforts to provide environmental and other forms of protection will undermine "business confidence" in the state, then — as noted by analysts who have ranged from neoconservative economists (e.g., Freeman & Haveman 1972; Stigler 1975) to neo-Marxist critics of capitalism (e.g., Miliband 1969; see also Poulantzas 1973; Domhoff 1978) — it may well be reasonable to expect state actors to favor actions that are high in symbolic value, but low in the material constraints that they place on economic actors.

Such a tendency to favor symbolic over tangible measures is often in evidence in cases specifically regarding environmental protection. Although measures of what we will be calling *environmental institutionalization* — such as the establishment of national parks and protected areas, or the willingness to support international environmental treaties — may provide valid indicators of environmental state outcomes, as Frank et al. (2000b) have argued, a good deal of recent empirical work casts doubt on just such conclusions. As a number of scholars point out, the growth or proliferation of bureaucracy may well show an increased commitment to *symbols* of regulation.

In a detailed analysis of agency permits for the filling of wetlands, for example, Krogman (1999) notes that, despite legal requirements that included an explicit prohibition of "significant adverse environmental impacts" and a stated policy position that there would be "no net loss" of wetlands, there were actually so many "exceptions" in her Louisiana study that not even one application out of a thousand was ever denied. An earlier example of the tendency toward symbolic action in a very different political-economic context is reported by Stearns (1979). Her study finds that, in response to wildcat strikes among miners in 1964, the Swedish government dramatically increased the size of the bureaucracy that was purportedly devoted to occupational health and safety. Even after the personnel increase, however, the number of agency inspections actually *decreased*. In yet another study, Freudenburg and Gramling (1994) analyze a federal U.S. agency that is required to do longitudinal studies of the environmental and social impacts of offshore oil drilling; they find that the agency "implemented" the law through a process involving what they call "bureaucratic slippage." The agency used a series of individually gradual but collectively significant regulatory reinterpretations that, in effect, ultimately made it illegal for the agency to perform the very kinds of studies that the law required (see also Hawkins 1984, 1996; Heo 1997; Schnaiberg 1980; Stearns 1979; Yeager 1990).

The degree of environmental institutionalization, in other words, may provide a particularly inopportune measure for testing the difference between environmental state versus environmental sociology approaches. Instead, as emphasized by Buttel, there may be a need to join the small but growing number of recent works that focus on the overall *effects* of state measures to protect the environment, as indicated by material environmental protection *outcomes* (e.g., Grant et al. 2002; Roberts & Grimes 1997). The value of an outcome-focused approach may well extend beyond the potential for understanding the differences between the relatively recent theories of the environmental state and the earlier literature in environmental sociology. Instead, it may also offer opportunities for examining the dynamics of advanced or postmodern states more broadly (e.g., the collection edited by Spaargaren, Mol & Buttel 2000; see also Laumann & Knoke 1987; McCright & Dunlap 2000). It is precisely such a form of testing, accordingly, to which we turn in the following section.

Measuring Material Outcomes

Of many potential measures of "actual environmental protection outcomes," perhaps the one that has received the most attention in international circles in recent decades has involved national-level emissions of carbon dioxide, or CO_2. This compound is the largest single constituent of so-called "greenhouse gases" — the emissions that are now seen by the vast majority of atmospheric scientists as contributing to global warming by increasing the earth's propensity to retain the sun's heat (e.g., IPCC WGI 2001; US National Research Council 1992, 2001). As noted by Roberts and Grimes, "Carbon dioxide is now understood to account for over half of the effect of greenhouse warming" (1997: 192; see also Dietz & Rosa 1997).[1]

Carbon dioxide emissions also have another noteworthy characteristic: as noted by Rosa and Dietz (1998:437) they offer nearly a "pure case of a collective good" (see also Soroos 1997, 1998). In other words, in the views of a vast majority of the relevant scientists, there is a clear need to reduce CO_2 emissions on a planet-wide basis. At the same time, however, CO_2-reduction measures can often be resisted quite intensely by key economic actors within the relevant nation-states. In the U.S., for example, the Senate voted 95-0 in 1997 for a resolution that related directly to the economic and political expectations that separate the environmental state and environmental sociology literatures. In the words of the Resolution, the Senate expressed a "strong belief that the [climate change] proposals under negotiation . . . could result in serious harm to the U.S. economy, including significant job loss, trade disadvantages, increased energy and consumer costs, or any combination thereof," and thus that the "United States should not be a signatory to any protocol" (U.S. Senate 1997: Report Number 105-54; see also the text of recent debates on the Senate floor in the *Congressional Record*, U.S. Senate 2003:S10021).

Data and Methods

Since there would be little reason to expect theories of "advanced" or "late" capitalistic development to apply to nations having only limited economic prosperity — and because just 30 developed countries emit over half of the world's CO_2 (IEA 2001; see also Roberts & Grimes 1997; Roberts 2001) — this article's examination of CO_2 emissions will focus on just those nations, which also happen to be the most prosperous or developed nations of the world.[2] For our analysis, we will focus on the 29 out of the 30 nations that belong to the

Organization for Economic Cooperation and Development (OECD) for which data are available.[3]

Given the importance of population factors in many analyses of environmental problems (for summaries, see Dietz & Rosa 1997; York, Rosa & Dietz 2003), and given also that these 29 OECD nations differ greatly in their populations, our dependent variable for "environmental protection outcomes" will be standardized by population numbers. In other words, we will focus on CO_2 emissions *per capita*, per year, as compiled by the International Energy Agency (IEA), an autonomous agency linked with the OECD that focuses on energy issues.[4] The most recent CO_2 emissions inventory from the IEA provides data from 1998 (IEA 2001).

To address the two differing ways in which the recent environmental state theorists and the earlier environmental sociologists have dealt with the relationships between prosperity and environmental quality, we will bring in four sets of independent variables. The first set, which is the most straightforward, involves relatively standard economic indicators. Reflecting potentially important differences among (and even within) the three branches of work in the environmental state literature, the remaining three sets reflect differing indicators of environmental protection outcomes. In particular, they include: (1) four specific measures that we judge to provide the clearest of the available indicators of environmental performance of a nation-state; (2) the two best-known of the available indices that assess broader or overall environmental protection at the level of the nation-state; and (3) three measures of the extent of national environmental institutionalization, adapted from those used by Frank et al. (2000b). Table 1 presents a list of the specific variables used and their sources.

Economic Indicators

The first set of independent variables reflects the perspective of many present-day representatives of potentially regulated industries, as well as much of the literature in environmental sociology, namely that economic prosperity is associated with environmental degradation, and that emissions will thus generally be proportionate to the size of the economy. As will be recalled, these expectations are very different from the views put forth in the environmental state tradition, in much of which "environmental protection is seen as a source of economic growth rather than its opposite" (Giddens 1998:19). To test the competing expectations, we draw on two economic measures that are both considered "selected economic indicators" by the OECD (1999). The better-known measure involves each nation's Gross Domestic Product (GDP), per capita, as of 1998 (OECD 1999). Although this measure is well known and widely used, it has been criticized by a number of economists (e.g., Daly, Cobb

TABLE 1: Variables And Data Sources

Category	Variable	Data Source
Dependent Variable	CO_2 emissions per capita (tonnes of CO_2 per person 1998)	IEA 2001
Economic Measures	GDP per capita (1000 US$ per person 1998)	OECD 1999
	Total primary energy supply per capita (MTOE per person 1998)	IEA 2001
Environmental Performance Measures	Percent change in total 1980-97 primary energy supply (MTOE)	OECD 1999
	Motor vehicle travel per capita (billion vehicle-km 1997)	OECD 1999
	Municipal waste (kg per person 1998)	OECD 1999
	Industrial waste (kg/US $1000 GDP 1998)	OECD 1999
Overall Environmental Protection Measures	Ecological footprint (1997)	Wackernagel et al. 1997
	Sustainability index (2001)	Global Leaders of Tomorrow Environment Task Force 2001
Environmental Institutionalization Measures	National parks and protected areas (percentage of total land area)	World Conservation Monitoring Center 2001
	Country chapters of international environmental nongovernmental associations (annual number)	Union of International Associations 2000
	Nation-state contributions to intergovernmental environmental organizations ($US contributed/GDP)	Stokke and Thomessen 2001

& Cobb 1989; see also Cobb, Halstead & Rowe 1995 for a popularly written assessment) as being an excessively "gross" measure, in that it merely adds up a nation's economic transactions. A nation's GDP goes up, for example, when workers receive wages for cutting down a forest — and it goes up even more if the resultant deforestation leads, in turn, to other expenditures (e.g., for rebuilding homes that are destroyed in downstream flooding, or even for burying flood victims or hiring lawyers to sue the logging company). If a forest is not cut down but instead merely continues to grow, on the other hand, then even though such a forest could help to mitigate global climate change by absorbing CO_2, such a social benefit will not be reflected in GDP figures unless direct monetary transactions take place.[5]

The less well-known economic indicator involves each nation's total primary energy supply (TPES) per capita, which is measured in million tonnes of oil equivalent (MTOE), again standardized by population (IEA 2001). This indicator is the most straightforward of any of the available measures of the ways in which a nation contributes to CO_2 emissions through its energy consumption (for details on TPES calculations, see www.iea.org/statist/keyworld/keystats.htm). As recent analyses show (Hale 1997; Roberts & Grimes 1997; see also Farla & Blok 2000), there are strong correlations between energy consumption and GDP, but increases in the energy efficiency of most national economies have led to substantial *decoupling* of energy inputs and economic outcomes over the past three decades, particularly among the most prosperous nations of the globe. Similarly, total energy consumption can be decoupled from CO_2 emissions because available energy technologies are not equal to the amount of CO_2 they produce.

Specific Environmental Performance Indicators

Although the three main branches of the environmental state literature are generally compatible with one another in their expectations about the economic feasibility of environmental protection, they tend to be more varied in terms of what they expect for political feasibility and policy performance, in two main respects. First, there is some disagreement across the three branches of the environmental state literature about the extent to which environmental protection has already been accepted as "a basic state responsibility." At one end of the continuum, scholars such as Frank, Hironaka & Schofer (2000b:100-2) see a top-down process of diffusion, starting with international institutions and ending with isomorphism or even "universalism," particularly among those advanced nation-states having a larger number of "receptors," such as scientific associations and national environmental organizations. At the opposite end of the continuum, scholars such as Inglehart (1995) or Spaargaren and Mol (1992) are more likely to expect significant cross-national differences in environmental protection. In the analyses below, the differing expectations about environmental institutionalization will be readily addressed by examining the intercorrelations among the independent variables, specifically including variables identified by Frank et al. as indicating national-level "receptors" for top-down policy initiatives from international organizations.

Second, as noted in our earlier review of literature, Buttel (2000a) and others have called attention to a potentially vital distinction between the *proliferation of environmental institutions* versus *actual environmental protection performance*. Thus, our analysis needs to include well-accepted measures of environmental performance, and not just measures of environmental institutionalization: if there are, indeed, systematic variations in the tangible consequences of national policies for environmental protection — beyond any symbolic effects — then the results of environmental policies should lead to systematic variations in what Buttel (2000a) has called "actual environmental protection outcomes." In other words, the nations that have shown the greatest tangible or effective willingness to curb CO_2 emissions may also be the ones that would have taken steps to assure positive environmental protection outcomes of other types.

As there are no standard indicators of such patterns of environmentally protective policy outcomes, our first four measures of environmental protection outcomes all reflect the extent to which a nation could be seen as having pursued environmentally protective policy choices. Given the focus on efficiency within the ecological modernization literature, it is worth noting that all four measures can also be seen as reflecting, to some degree, the ecological efficiency of the national economies in question.

Our first environmental performance measure has particular relevance for ecological efficiency; it involves the percentage *change* in energy consumption, as measured by the change in the total primary energy supply (TPES) from 1980 to 1997. The variable is coded so that positive numbers indicate increases in energy consumption and negative numbers indicate decreases. Inclusion of this variable in the analysis responds to the emphasis of authors such as Roberts and Grimes (1997) and Hale (1997) on differential improvements in energy efficiency that have taken place since the energy price shocks of the 1970s.

The second environmental performance variable involves kilometers of motor vehicle travel, per capita, in 1997 (OECD 1999). This variable is generally expected to have a reasonably strong correlation with CO_2 emissions, although it needs to be recognized that less than a quarter of the CO_2 emissions in OECD countries (22.7% in 1997) came from the transport sector (IEA 2001). Since over three-quarters of CO_2 emissions come from other sources, this variable is perhaps best understood as providing an indicator of the policy choices that have been made in developing transportation infrastructures. The driving of trucks and automobiles, in other words, represents more than just a reflection of choices made by individuals in the absence of physical or social structures. Instead, motor vehicle travel also reflects national policy choices, which include, but are not limited to, a nation's decision to invest in superhighways rather than in rail systems, to levy lower or higher gasoline taxes, and to encourage sprawl or to build higher-density urban areas that have lower numbers (and distances) of automobile trips. Although the data do show a general correspondence to the expectation that the richest countries will have the highest levels of motor vehicle travel, there are also systematic variations that are not merely a function of differing levels of affluence across countries. Even though the richest country in the OECD, the U.S., has the highest level of motor vehicle travel per capita, for example, the second richest country, Japan, ranks number 20 out of the 29 states included in our analysis.

The third and fourth environmental performance measures are listed by the OECD as representing what it calls "selected environmental data" (OECD 1999). The third, which offers the most straightforward measure available of the extent to which *individual consumers* have become part of a so-called "throw-away culture," involves the number of kilograms of municipal waste discarded, per capita, in 1998. The fourth, by contrast, is better understood as a measure of the wastefulness (or conversely, the efficiency) of each nation's *industries*: kilograms of industrial waste, per US $1000 GDP, also for 1998 (except in the cases of Canada and the U.S., where no data were available for 1998, and where we have used the most recent data available, from 1994 [OECD 1994]). This measure does have a potential weakness that needs to be noted with respect to the present article, in that it is standardized in terms of the dollar value of production output, not in terms of population. Still, given the importance of what we are calling "ecological efficiency" in the literature on ecological modernization (see also works in the popular literature such as Hawken 1993; Repetto 1995), a measure of industrial waste or efficiency per unit of production provides a better measure of a nation's industrial or production efficiency than would a measure that would be standardized per unit of population, particularly since industrial output may or may not be associated with a nation's population size.

Broader Environmental Protection Measures

Given the challenges involved in measuring overall environmental performance, we will also make use of the two best-known efforts by other researchers to produce composite measures of nations' overall environmental impacts and environmental quality. Both of these measures have a minor drawback, in that they omit data for an additional OECD country (Luxembourg), but in other regards, both measures have received a good deal of favorable attention. The first is the "Ecological Footprint of Nations" measure, which has been developed by Wackernagel et al. (1997; see also Wackernagel & Rees 1996) to quantify ecological impacts. The basic intent of the Footprint variable is to measure each nation's resource consumption and waste accumulation, relative to its productive land area. This variable has been praised by York, Rose & Dietz (2003:280) as "the most comprehensive measure of environmental performance available" (see also Wilson 2000; Wright & Lund 2000), although other academics have criticized the measure for ignoring the role of trade (e.g., Ayres 2000). The second such measure is the environmental sustainability index, which was developed by scholars at the Yale University Center for Environmental Law Policy, the Earth Institute Center for International Earth Science Information Network (CIESIN) at Columbia University, and the Global Leaders of Tomorrow Environment Task Force of the World Economic Forum (Global Leaders of Tomorrow Environment Task Force 2001). The sustainability index was developed to represent "a country's environmental success . . . in the management and improvement of common environmental problems"[6] and to measure a nation's "overall progress toward environmental sustainability."[7] In other words, this index was designed to reflect the capability of a nation to internalize environmental protection and develop in a sustainable manner (see Global Leaders for Tomorrow Environment Task Force 2000). Finland, for example, received the highest ranking in the sustainability index. In the words of a press briefing, it "ranks at the top because of its success in minimizing air and water pollution, its high institutional capacity to handle environmental problems, and its comparatively low levels of greenhouse gas emissions."[8] Various organizations and academics, however, have also criticized this index, with the New Economics Foundation, for example, calling it a measure of "global misleadership" (Capella 2001). Rather than siding arbitrarily with past assessments that have argued either for or against these measures, we include both of the measures in our analyses as a way of testing the empirical utility of the available approaches.

Environmental Institutionalization Measures

To address Buttel's questions about the associations between environmental bureaucratization and actual environmental outcomes (2000a), our third set of independent variables are adapted from three specific measures of levels of institutionalization that were identified by Frank, Horonaka & Schofer (2000a:96) as reflecting actions by nation-states to protect the environment.[9] The first directly replicates the operationalization used by Frank and colleagues. It involves the number of national-level chapters of international environmental nongovernmental associations in each country (Union of International Associations 2000). The second variable, which reflects a country's commitment to international environmental organizations, has been operationalized somewhat differently here than in the work by Frank and colleagues. Rather than simply using the raw financial contributions, we have standardized the contributions by the sizes of the economies in question, using the percentage of a country's GDP in 1998 that was contributed to three of the largest funds for

TABLE 2: Product-Moment Bivariate Correlation Coefficients for OECD Countries

	CO_2 Emissions per Capita	GDP per Capita 1998	Total Primary Energy Supply per Capita 1998	Percent Total Primary Energy Change 1980-1997	Motor Vehicle Travel per capita 1997	Municipal Waste 1998	Industrial Waste 1998
CO_2 emissions per capita	1.00						
GDP per capita 1998	.648 **	1.00					
Total primary energy supply per capita 1998	.677 **	.733 **	1.00				
Percent total primary energy change 1980–1997		−.260	−.306	−.185	1.00		
Motor vehicle travel per capita 1997	.723 **	.864 **	.716 **	−.382 *	1.00		
Municipal waste 1998	.484 **	.703 **	.501 **	−.207	.687 **	1.00	
Industrial waste 1998	.519 **	.012	.250	−.209	.076	−.123	1.00
Ecological footprint	.518 **	.684 **	.764 **	−.209	.758 **	.481 **	−.015
Sustainability index	.297	.658 **	.562 **	−.398 *	.624 **	.477 *	.023
National parks and protected areas	.281	.344	.152	−.289	.358	.267	.032
Country chapters of international environmental nongovernmental associations	.300	.380 *	.224	−.234	.473 **	.456 *	.002
Nation-state contributions to intergovernmental environmental organizations	.214	.673 **	.331	−.316	.412 *	.298	−.068

TABLE 2: Product-Moment Bivariate Correlation Coefficients for OECD Countries (Cont'd)

	Ecological Footprint	Sustainability Index	National Parks and Protected Areas	Country Chapters of International Environmental Nongovernmental Associations	Nation-State Contributions to Ingergovernmental Environmental Organizations
CO_2 Emissions per capita					
GDP per capita 1998					
Total primary energy supply per capita 1998					
Percent total primary energy change 1980-97					
Motor vehicle travel per capita 1997					
Municipal waste 1998					
Industrial waste 1998					
Ecological footprint	1.00				
Sustainability index	.648**	1.00			
National parks and protected areas	.296	.344	1.00		
Country chapters of international environmental nongovernmental associations	.081	-.023	.150	1.00	
Nation-state contributions to intergovernmental environmental organizations	.188	.523 **	.267	.199	1.00 *

* p < .05 (two-tailed) ** p < .01(two-tailed)

international environmental implementation: the Multilateral Fund for the Implementation of the Montreal Protocol, the Global Environmental Facility, and the Environment Fund of the United Nations Environment Programme (Stokke & Thomessen 2001). The third variable measures the land that has been set-aside as national parks or protected areas. Again here, rather than using the raw number of such areas — in countries that vary in size from Luxembourg to the U.S. — we have standardized this measure as well, expressing the protected areas as a percentage of the total land area of each country. These numbers are compiled by the United Nations Environment Programme's World Conservation Monitoring Center Protected Areas Database (2001).[10]

Bivariate Analysis

Given the exploratory nature of our analysis, our first step was to perform a screening of all the independent variables at the level of basic construct validity: at least at the zero-order level, were the potential explanatory variables correlated with CO_2 emissions in the expected direction? Referring to Table 2, most of the potential explanatory variables passed this relatively simple test, but one variable clearly fails — the second of the overall environmental performance indicators, namely the so-called sustainability index. As can be seen from the positive correlation for this index, the nations having higher scores — meaning the ones that were supposedly the more "sustainable" — actually had *higher* CO_2 emissions than nations that were identified as being less "sustainable." Because of the failure to pass this simple test of validity, this measure was dropped from further analysis. All other variables were retained for subsequent steps, but it is worth drawing attention to three other variables that fall into an intermediate category, indicating a potential reason for concern. Three variables that measure environmental institutionalization are also positively associated with CO_2 emissions — indicating potentially *worse* environmental performance in those states that have greater environmental institutionalization. Still, given the importance of these variables in addressing the question raised by Buttel (2000a), regarding the relationship between environmental bureaucratization and actual environmental outcomes, these three variables clearly need to be retained in the analyses.

Overall, perhaps the clearest pattern to emerge from Table 2 is that the variables having significant associations with the dependent variable at the zero-order level do not exclusively support either the earlier work on environmental sociology or the more recent environmental state literature. On the one hand, as might be expected on the basis of work by Roberts and Grimes (1997) or Dietz and Rosa (1997; see also York, Rose & Dietz 2003), both of the independent variables that reflect the expectations of environmental sociologists — GDP per capita and total primary energy supply per capita — are significantly associated with CO_2 emissions (r = .648, and .677 respectively).

Both of these variables reflect the tendency for more prosperous nations to contribute more to global climate change. At the same time, however, three of the four variables that represent actual environmental performance of the sort that are more consistent with the expectations from the environmental state literature — municipal waste per capita, industrial waste per unit of economic output, and motor vehicle travel per capita — are also significantly associated with CO_2 emissions (r = .484, .519, and .723 respectively). In addition, the national-level ecological footprint is also significantly associated with the dependent variable (r = .518). These latter findings suggest that the countries that are less environmentally efficient will tend to contribute more to global climate change, although another efficiency measure, the 1980–97 change in energy consumption, is not significantly correlated with CO_2 emissions.

Multiple Regression Analysis

Our next step is to move to multivariate analysis. The most straightforward approach to such an analysis is through the use of ordinary least squares (OLS) regressions, but the potential for multicollinearity in such a national-level analysis creates the need for extra safeguards. As pointed out in statistical textbooks, the central challenge of multicollinearity has to do, not with bias, but with instability, in that samples with highly intercorrelated independent variables "may render the values of the estimates seriously imprecise" (Koutsoyiannis 1973:228).

In response to the need for caution, we have employed five different safeguards in the analyses being reported here. The first involves the examination of construct validity that was summarized above. The next three are relatively standard statistical safeguards, each of which will be noted briefly in this section. The fifth and final safeguard will involve one more pair of tests that will take place at the end of all the others, with the reconsideration of the two sets of variables that are most important in differentiating between the environmental sociology and environmental state literatures, namely those reflecting prosperity and environmental institutionalization.

The first of the three statistical safeguards is the most formal, involving the explicit consideration of tolerance statistics. The standard rule of thumb is to exclude a variable from the analysis if its tolerance level drops below 0.01, or if it causes the tolerance of other variables to drop below that same level; in the present case, there were no problems of multicollinearity that were severe enough to require elimination by this test. The second statistical safeguard involves the practice recommended by statistical textbooks such as Hamilton (1990:581-82), namely "simplifying a regression by dropping nonsignificant variables," in a process sometimes called *backward elimination*. We will begin our analyses with so-called "saturated models," which include all of the variables in the equation. Although these are the models that have the highest

TABLE 3: Standardized Regression Coefficients and Significance Level for Regression of Carbon Dioxide Emissions per capita on Selected Independent Variables, OECD, 1990

	Full Model	Second Model	Third Model	Fourth Model	Fifth Model
GDP per capita 1998	–.004 (–.03004) .992				
Total primary energy supply per capita 1998	.161 (.307) .482	.161 (.305) .454	.153 (.290) .456	.130 (.253) .436	.122 (.236) .452
Municipal waste 1998	.163 (.005396) .424	.162 (.005359) .340	.160 (.005279) .332	.119 (.004228) .434	.120 (.004257) .421
Industrial waste 1998	.425 (.0227)** .006	.425 (.02275)** .005	.428 (.02287)** .003	.475 (.02662)** .001	.483 (.02705)** .000
Percent change in energy consumption 1980–97	.097 (.005727) .483	.096 (.005709) .461	.098 (.005824) .439	.101 (.00338) .420	.110 (.006914) .358
Motor vehicle travel per capita 1997	.684 (.840) .061	.682 (.838)* .021	.656 (.805)** .009	.547 (.707)* .012	.540 (.699)** .000
Ecological footprint 1997	.540 (.699)** .533	–.165 (–.305) .520	–.140 (–.258) .512		
National parks and protected areas	.091 (.04125) .491	.091 (.04120) .477	.090 (.04091) .468	.058 (.02180) .624	.053 (.02562) .645
Country chapters of international environmental nongovernmental associations	–.030 (–.04321) .854	–.030 (–.004327) .849			
Nation-State contributions to intergovernmental environmental organizations	–.170 (–.000006) .343	–.171 (–.000006060) .207	–.171 (–.000006062) .194	–.041 (–.000001363) .737	
Constant	(–.298)	(–.300)	(–.336)	(–1.029)	(–1.118)
Adjusted R^2	.653	.672	.689	.692	.705

(N = 29)

TABLE 3: Standardized Regression Coefficients and Significance Level for Regression of Carbon Dioxide Emissions per capita on Selected Independent Variables, OECD, 1990 (Cont'd)

	Sixth Model	Seventh Model	Eighth Model	Final Model
GDP per capita 1998				
Total primary energy supply per capita 1998	.111 (.216) .479			
Municipal waste 1998	.124 (.004383) .399	.133 (.004697) .359		
Industrial waste 1998	.485 (.02713)** .000	.511 (.02861)** .000	.488 (.02734)** .000	.466 (.02610)** .000
Percent change in energy consumption 1980-97	.102 (.006394) .380	.118 (.007430) .294	.122 (.007665) .278	
Motor vehicle travel per capita 1997	.561 (.726)** .006	.639 (.827)** .000	.733 (.949)** .000	.688 (.891)** .000
Ecological footprint 1997				
National parks and protected areas				
Country chapters of international environmental nongovernmental associations				
Nation-state contributions to intergovernmental environmental organizations				
Constant	(–.941)	(–.957)	(.536)	(1.341)
Adjusted R^2	.715	.721	.722	.719
(N = 29)				

Notes: Unstandardized Regression Coefficients in parentheses.

* p < .05 ** p < .01

risks of containing what statistical textbooks sometimes call "redundant variables" (e.g., Lee & Maykovich 1995:472), this approach allows our readers to join us in examining the influence of each variable while controlling for the influence of all other variables, including overall prosperity levels and environmental institutionalization. We will then simplify these complete or saturated models by eliminating nonsignificant variables in the specific manner recommended by Hamilton (1990) — one at a time, beginning with those variables that are farthest from achieving statistical significance, and continuing until all remaining variables meet standard levels of statistical significance ($p < .05$). This process allows us to eliminate the redundant and statistically insignificant variables and to move cautiously (and transparently) toward the identification of conclusions that are most plausible substantively, as well as statistically. The third form of statistical safeguard follows directly on the second; it involves paying attention to the coefficients that remain in the equation as other variables are removed, being on the alert for wild fluctuations. The results of this process are presented in Table 3, which summarizes the results from the analyses, allowing readers to observe for themselves the striking absence of any such wild changes.

The first column of Table 3 presents the results of the full or saturated model, which need to be interpreted with caution in light of the potential for multicollinearity noted above. As can be seen from this column, only one of the independent variables is significant at $p < 0.05$ when all other independent variables are included: Kilograms of Industrial Waste produced per US $1000 GDP. One additional variable, Vehicle Travel per capita, reaches a lower level of significance ($p < .10$). The middle columns of this table show the coefficients of the variables that remain in the equation as each of the "least significant" variables is eliminated, one at a time. The actual results are remarkable mainly for the absence of wild fluctuations in coefficients: Out of 44 coefficients reported in the second through the final (ninth) models of Table 3, there is not a single case where the direction (sign) of a variable reverses, and there is only one case where the coefficient shifts by as much as .10 — the change from β =.656 to .547 for Motor Vehicle Travel per capita between the third and fourth models. Even for the case of this independent variable, however, the coefficient in the original or saturated model is .684, while the coefficient in the final or reduced-form model is .688 — scarcely the kind of dramatic change that would normally be taken as indicating reasons for concern. Instead, so stable are the underlying relationships that, even after completing the entire process of reverse elimination, the two variables that emerge as statistically significant are the same two that have the strongest associations in the full model. The final regression equation yields an adjusted R^2 of .719, with the two significant predictors of CO_2 emissions being *per capita* Motor Vehicle travel (β = .688) and *per dollar* Industrial Waste generation — the latter of which also has a final or reduced-form *beta* (.466) that shows very little change from its initial value (.425) in the saturated model.[11]

The last of the double-checks, as mentioned above, involves a final pair of tests of the differing expectations derived from work in environmental sociology and the environmental state, respectively. For the environmental sociology literature, and the argument that there will be an "enduring conflict" between the economy and environmental protection (Schnaiberg & Gould 1994), it is important to make sure that the lack of significance for *per capita* Gross Domestic Product is not merely an artifact of the way in which the analysis has been carried out. It is not: even when we attempt to force this variable back in to the final equation, along with Motor Vehicle Travel and Industrial Waste Generation, the GDP measure proves to have no significant effect on CO_2 emissions per capita ($p >.300$). For the environmental state literature, similarly, when we add back in the three measures of environmental institutionalization adapted from Frank et al. (2000a) — National Parks/Protected Areas, Chapters of Environmental NGOs, and Contributions to Intergovernmental Environmental Organizations, also in combination with Motor Vehicle Travel and Industrial Waste Generation — there are no statistically significant effects for any of the three measures ($p >.6$).

Discussion

All in all, the empirical findings provide a mixed picture: they provide some support but also raise questions regarding the expectations that are drawn from both the environmental sociology and environmental state literatures. First, in contrast to the expectations of the environmental sociologists of past decades — and in stark contrast to the claims by major political leaders of some nations — straightforward economic indicators such as the GDP prove not to have significant effects on CO_2 emissions in *any* of the multivariate analyses. At least for the relatively prosperous nations of the OECD, in other words, despite the apparent strength of the political leaders' convictions, the correlations between CO_2 emissions per capita and economic output per capita drop to insignificance once other variables are controlled, just as they do in recent economic assessments that correct the shortcomings of earlier models (see Krause et al. 2002, 2003).

Second, in contrast to expectations from the more recent literature on the environmental state, measures of environmental institutionalization *also* have no significant associations with actual CO_2 emissions, in *any* of the multivariate analyses. Instead, as can be seen in Table 3, these measures actually drop out of the analysis more quickly than any of the other potential explanatory variables in the analysis. As noted initially in the context of Table 2, even the zero-order correlations suggest that it may be unwise to assume that increased levels of environmental institutionalization will mean that environmental protection "has been accepted as a basic state responsibility": All three of the environmental institutionalization measures adapted from Frank et al. (2000a, 2000b) actually correlate *positively* with CO_2 emissions and with one of the two significant predictor variables, namely Motor Vehicle Travel. (Two of the specific correlations — those involving national chapters of International Environmental Nongovernmental Associations and nation-state contributions to Intergovernmental Environmental Organizations — actually prove to be statistically significant in the "wrong" direction in the zero-order correlation matrix; $r = .473$ and .412, respectively.) If taken at face value, those correlations would suggest that the environmental institutionalization measures used by Frank et al. are actually predictors of *worse* environmental performance. As evidence that such an interpretation would be too simplistic, however, these same variables are essentially uncorrelated with the other significant independent variable, namely Industrial Waste per unit of output.

Rather than providing clear or unproblematic support for either set of expectations, in short, the findings from the present study suggest that there may be a need to move away from arguments about whether one body of work *or* the other should be seen as clearly superior. At least in the present study, the measures that emerge as having clear and stable statistical significance are ones that do not correspond neatly with the expectations derived either from the more recent literature on the environmental state or from the established literature in environmental sociology. Instead, as suggested by one branch of the literature on the environmental state, namely the literature on ecological modernization, the findings point to the importance of ecological efficiency. At the same time, however, the findings point to the importance of the recognition that national-level political processes cannot be ignored and that we cannot assume that top-down processes of diffusion will result in isomorphism, or universalism, in environmental protection. For the future, as these findings suggest, there may be greater value in developing a more nuanced recognition of the importance of contributions that are derived from both bodies of literature, rather than expecting that there will be black-and-white incompatibilities between the two (cf. Buttel 2000a; Fisher & Freudenburg 2001).

At least in the case of actual CO_2 emissions per capita across the industrialized nations, to be more specific, the two measures that jointly explain nearly three-fourths of the variance are perhaps best seen as representing *specific forms* of ecological efficiency that do not appear to be emerging "naturally" or consistently across the full range of OECD countries. Instead, these two forms of ecological efficiency may be more accurately seen as representing relatively explicit, *nonsymbolic* policy choices by nation-states, as well as by individual firms. The first has to do with the degree to which a nation's transportation infrastructure has become dependent upon individual vehicles (as measured by the number of vehicle-kilometers of travel per capita). To repeat the point raised earlier in this article, vehicular travel does not merely represent an automatic force of nature, even though it is sometimes seen that way in particular countries. Instead, it also reflects the accumulation of policy decisions — decisions, for example, to subsidize specific fuels, invest in specific forms of transportation infrastructure, and to subsidize or encourage certain forms of urban development but not others (see e.g. the discussion by Gramling 1995). The second measure has to do with the ecological efficiency of national industrial output (as measured by *non-*CO_2 waste from manufacturing industries, per unit of economic output). Because the measure of industrial emissions is standardized not in terms of population (as is the case for CO_2 emissions) but in terms of economic output or dollars, these results effectively provide a clear independent measure of industrial waste, or its obverse, industrial-ecological efficiency.

Implications for the Future

Although the issues involved in state constraints on late or advanced capitalism have received a good deal of attention from sociological theorists in recent decades, the debates have shown few signs of moving toward closure. Part of the reason may be that so much of the discussion thus far has been carried out at relatively high levels of abstraction, but with relatively low levels of empirical evidence. Another factor, which may well be related, is that many of the debates have been carried out in terms of relatively stark distinctions. Such debates, of course, are important, and in view of the complex and multifaceted issues involved, they are certainly deserving of continued theoretical examination. We would argue, however, that these issues deserve theoretically informed empirical examination as well.

Lest there be any confusion, we wish to stress again that we see the present analysis as *beginning* the movement toward a more thorough empirical analysis of environmental outcomes, and not as bringing the process to an end. To repeat our earlier warnings, the multivariate analyses in the present article need to be understood not as providing the definitive word on the topic, but as offering an initial empirical examination of the competing expectations that have been expressed to date in two bodies of work that have largely been developed under conditions of excessive isolation from one another to date. There is clearly also a need to recognize that future analyses might provide definitive evidence for the universal superiority of expectations derived either from the literature in environmental sociology or from the newer literature on the environmental state, although in light of this article's findings, it also needs to be recognized that the ultimate verdict may not provide an unconditional endorsement of either perspective.

On the one hand, the more pessimistic views about the economic feasibility of environmental protection, as expressed in the literature of environmental sociology, do not hold in this case. Although variables reflecting economic strength are significantly associated with CO_2 emissions on the bivariate level, those relationships reduce to insignificance — and rapidly drop out of the analysis — when readily available measures of ecological efficiency are included in the equation. At the same time, however, the empirical findings reinforce the warnings of environmental sociologists such as Buttel (2000a:118), about the importance of assessing "actual environmental protection outcomes" rather than simply assuming that *the proliferation of environmental institutions* can be taken as being synonymous with the *effective protection of the environment.* At least in the case of this study, the measures that reflect environmental institutionalization were found to have no significant association with actual levels of CO_2 emissions from advanced nation-states. Rather than showing international convergence toward the actual acceptance of environmental protection as a "basic state responsibility," in short, our findings suggest that the *actual* levels of state acceptance of any responsibility to protect the environment appear to vary quite widely. In fact, they tend to vary in ways that simply are not believably associated with sheer levels of environmental institutionalization — at least not in the "expected" direction.

In terms of future research directions, accordingly, perhaps the central implications of the present article involve the need to do more to bring together the often-separated worlds of theoretical and empirical work, and in the process, to improve both. In the case of the variables predicting actual environmental performance, the analysis in the present article leads to findings that are mixed but that are also readily interpretable. Over the longer run, sociology may well find that the most fruitful lines of analysis will involve conceptual as well as empirical analyses that move beyond relatively crude, either/or discussions, and that move instead toward more rigorous examinations of *the conditions under which* the advanced or postindustrial state will see the kinds of outcomes predicted by theorists of environmental sociology or of the environmental state. These types of analyses are particularly important because of their relevance to the politics of environmental regulation. In other words, rather than being content with a mere repetition or even a refinement of relatively undifferentiated arguments, sociologists need to insist on increased theoretical precision in conjunction with empirical work that is more focused, more carefully differentiated, and more rigorous.

Notes

1. As spelled out in greater detail in the technical literature, other important greenhouse gases include methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6) (for a summary, see Intergovernmental Panel for Climate Change (IPCC) Working Group 1 2001). Recent research from organizations such as the Organization for Economic Cooperation and Development (OECD) has begun to look at the "other greenhouse gases" (e.g., Burniaux 2000), but there are important methodological reasons for focusing on CO_2. As noted by Dietz and Rosa, "Data on other greenhouse gases are also less reliable than the industrial CO_2 data. Current estimates of CH_4 (methane) emissions are uncertain to at least a factor of two and do not take account of biomass burning, which may contribute perhaps one-fifth of the total anthropogenic emissions. Data on chlorofluorocarbons are reported as an aggregate for the European community nations, which are among the highest chlorofluorocarbon producers and consumers. Nitrous oxide emissions are available only for a handful of nations" (Dietz & Rosa 1997:77).

2. Although India and China also have been identified as potentially large emitters of carbon dioxide, their emissions have not yet begun to rival those of the world's largest economies, in part because their *per capita* emissions continue to be significantly less than those of OECD members (only 0.91 and 2.47 tonnes per person, respectively, as compared to 20.35 tonnes per person in the United States in 1998 [see OECD 2001]).

3. The one excluded nation is the most recent addition to the OECD, the Slovak Republic, for which few data are presently available.

4. See www.iea.org/about/index.htm for more information.

5. A reviewer of an earlier draft of this paper asked for a comparison between GDP and GNP, or Gross *National* Product. The practical differences are modest, but the GDP is generally seen as the better indicator for analyses of CO_2 emissions in that, unlike GNP figures, the GDP totals are intended to reflect only the economic activities (and jobs) that exist within a given country. Thus for example, if a coal-fired power plant in Bolivia were to be owned by a company in Spain, it would contribute to the Gross *Domestic* Product of the same country where its CO_2 emissions are produced, namely Bolivia, while contributing to the Gross *National* Product of Spain.

6. www.yale.edu/envirocenter/research/esi.html.

7. www.ciesin.columbia.edu/indicators/ESI/ESI_01a.pdf (Accessed October 1, 2003). Intriguingly, although the index includes measures of multiple components of sustainability for 122 countries, there is no overlap between the variables used in the index and those in our analysis.

8. http://www.ciesin.columbia.edu/indicators/ESI/press_rel.html.

9. The other two dependent variables of Frank et al. have to do with the years in which laws were passed or ministries were established. Given the changing policies of recent decades, most analysts of the debates surrounding the issue of global warming would be quite critical of including such measures as reflections of present-day policies. Particularly during the 1960s and 1970s, the U.S. was one of the early adopters of energy policies

that affect emissions, but during the 1980s and 1990s, the U.S. came to be seen as one of the most intractable opponents of policies to mitigate against global warming; for more detailed discussions, see Fisher (2004); McCright and Dunlap (2000, 2003).

10. www.unep-wcmc.org/protected_areas/data/un_annex.htm.

11. Although a reviewer for this article suggested that the results of this analysis might be biased by the inclusion of the U.S., removing the U.S. leads to little change in the results: even though the adjusted R^2 drops somewhat, to .620, the same two independent variables emerge as the only significant variables.

References

Abramson, Paul R. 1997. "Postmaterialism and Environmentalism: A Comment on an Analysis and a Reappraisal. *Social Science Quarterly* 78:21-23.

Alario, Margarita and William R. Freudenburg. 2003. "The Paradoxes of Modernity: Scientific Advances, Environmental Problems, and Risks to the Social Fabric?" *Sociological Forum* 18:193-214.

Ayres, Robert U. 2000. "Commentary on the Utility of the Ecological Footprint Concept." *Ecological Economics* 32:347-49.

Beck, Ulrich. 1987. "The Anthropological Shock: Chernobyl and the Contours of the Risk Society." *Berkeley Journal of Sociology* 32:153-65.

———. 1995. *Ecological Politics in an Age of Risk*. Polity Press.

———. 1997. "Subpolitics." *Organization and Environment* 10:52-65.

———. 1999. *World Risk Society*. Polity Press.

Beck, Ulrich, Anthony Giddens and Scott Lash. 1994. *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order*. Stanford University Press.

Bell, Daniel. 1973. *The Coming of Post-Industrial Society: A Venture into Social Forecasting*. Basic Books.

Block, Fred. 1987. *Revising State Theory: Revising State Theory: Essays in Politics and Postindustrialism*. Temple University Press.

Brechin, Steven R. and Willett Kempton. 1994. "Global Environmentalism: A Challenge to the Postmaterialism Thesis?" *Social Science Quarterly* 75:245-69.

———. 1997. "Beyond Postmaterialst Values: National versus Individual Explanations of Global Environmentalism." *Social Science Quarterly* 78:16-25.

Bunker, Stephen G. 1996. "Raw Material and the Global Economy: Oversights and Distortions in Industrial Ecology." *Society and Natural Resources* 9:419-29.

Burniaux, Jean-Marc. 2000. "A Multi-Gas Assessment of the Kyoto Protocol." *OECD Economics Department Working Paper, no. 270.*

Buttel, Fredrick H. 2000a. "World Society, the Nation-State, and Environmental Protection." *American Sociological Review* 65:117-21.

———. 2000b. "Classical Theory and Contemporary Environmental Sociology." Pp. 17-40 in *Environment and Global Modernity*, edited by G. Spaargaren A.P.J. Mol and F.H. Buttel. Sage Studies in International Sociology.

———. 2000c. "Ecological Modernization As Social Theory." *GeoForum* 31:57-65.

Capella, Peter. 2001. "Global Warming Dangers 'Buried' in New Rankings." *Guardian*. London. January 29, 2001. <www.commondreams.org/views01/0129-03.html> (Accessed Jan. 9, 2004).

Catton, William R., Jr. 1980. *Overshoot: The Ecological Basis of Revolutionary Change*. University of Illinois Press.

Christoff, Peter. 1996. "Ecological Modernisation, Ecological Modernities." *Environmental Politics* 5:476-500.

Cobb, Clifford, Ted Halstead, and Jonathan Rowe. 1995. "If the GDP Is Up, Why Is America Down?" *Atlantic Monthly* (October). <http://www.theatlantic.com/politics/ecbig/gdp.htm>.

Cohen, Maurie J. 2000. "Ecological Modernization, Environment Knowledge and National Character: A Preliminary Analysis of the Netherlands." Pp. 77-107 in *Ecological Modernisation Around the World: Perspectives and Critical Debates*, edited by A.P.J. Mol and D. A. Sonnenfeld. Essex: Frank Cass.

Daly, Herman. 1990. "Sustainable Growth: An Impossibility Theorem." *Development* 3:45-47.

Daly, Herman, John B. Cobb Jr., and Clifford W. Cobb. 1989. *For the Common Good : Redirecting the Economy toward Community, the Environment, and a Sustainable Future*. Beacon Press.

Dietz, Thomas, and Eugene A. Rosa. 1997. "Effects of Population and Affluence on CO_2 Emissions." *Proceedings of the National Academy of Science* 94:175-9.

Domhoff, G. William. 1978. *The Powers That Be: Processes of Ruling-Class Domination in America*. Random House.

Dunlap, Riley E., and Angela G. Mertig. 1992. *American Environmentalism: The U.S. Environmental Movement, 1970-1990*. Taylor & Francis.

———. 1997. "Global Environmental Concern: An Anomaly for Postmaterialism." *Social Science Quarterly* 78:24-29.

Durkheim, Emile. [1893] 1933. *The Division of Labor in Society*. Translated by George Simpson. Free Press.

Edelman, Murray. 1964. *The Symbolic Uses of Politics*. University of Illinois Press.

Farla, Jacco C.M., and Kornelis Blok. 2000. "Energy Efficiency and Structural Change in the Netherlands (1980-1995)." *Journal of Industrial Ecology* 4:93-117.

Fisher, Dana R. 2004. *National Governance and the Global Climate Change Regime*. Rowman & Littlefield.

Fisher, Dana R., and William R. Freudenburg. 2001. "Ecological Modernization and Its Critics: Assessing the Past and Looking Toward the Future." *Society and Natural Resources* 14:701-709.

Foster, John Bellamy. 1992. "The Absolute General Law of Environmental Degradation Under Capitalism." *Capitalism, Nature, Socialism* 2:77-82.

Frank, David John. 1997. "Science, Nature, and the Globalization of the Environment 1870-1990." *Social Forces* 76:409-35.

———. 1999. "The Social Bases of Environmental Treaty Ratification 1900-1990." *Sociological Inquiry* 69:523-50.

Frank, David John, Ann Hironaka, and Evan Schofer. 2000a. "Environmentalism as a Global Institution: Reply to Buttel." *American Sociological Review* 65:122-27.

———. 2000b. "The Nation-State and the Natural Environment over the Twentieth Century." *American Sociological Review* 65:96-117.

Freeman, A. Myrick, III, and Robert H. Haveman. 1972. "Clean Rhetoric and Dirty Water." *Public Interest* 28 (Summer):51-65.

Freudenburg, William R. 1992. "Addictive Economies: Extractive Industries and Vulnerable Localities in a Changing World Economy." *Rural Sociology* 57:305-32.

Freudenburg, William R. and Robert Gramling. 1994. "Natural Resources and Rural Poverty: A Closer Look." *Society and Natural Resources* 7:5-22.

Giddens, Anthony. 1998. *The Third Way*. Polity Press.

Global Leaders of Tomorrow Environment Task Force. 2001. *2001 Environmental Sustainability Index*. Report from the Annual Meeting of the World Economic Forum, Davos, Switzerland.

Goldman, M. 2001. "Constructing an Environmental State: Eco-governmentality and Other Transnational Practices, of a 'Green' World Bank." *Social Problems* 48:499-523.

Gramling, Robert. 1995. *Oil on the Edge: Offshore Development, Conflict, Gridlock*. SUNY Press.

Grant, Don S., II, Andrew W. Jones, and Albert J. Bergesen. 2002. "Organizational Size and Pollution: The Case of the U.S. Chemical Industry." *American Sociological Review* 67:389-407.

Haas, Peter M. 1989. "Do Regimes Matter? Epistemic Communities and Mediterranean Pollution Control." *International Organization* 4:377-403.

———.1990. *Saving the Mediterranean: The Politics of Environmental Cooperation*. Columbia University Press.

———. 1995. "Global Environmental Governance." Pp. 333-70 in *Issues in Global Governance, edited by Commission on Global Governance*. Kluwer Law International.

Haas, Peter M., and Jan Sundgren. 1993. "Evolving International Environmental Law: Changing Practices of National Sovereignty." Pp. 401-29 in *Global Accord: Environmental Challenges and International Responses*, edited by N. Choucri. MIT Press.

Habermas, Jürgen. 1970. "Technology and Science As 'Ideology'." Pp. 81-122 in *Towards a Rational Society*. Beacon.

———. 1975. *Legitimation Crisis*. Beacon Press.

———. 1998. *Between Facts and Norms*. MIT Press.

Hajer, Maarten A. 1995. *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process*. Clarendon Press.

Hale, Cameron. 1997. "More Is Not Enough: National Energy and International Power." *Contemporary Journal of International Sociology* 34:17-38.

Hamilton, Lawrence C. 1990. *Modern Data Analysis: A First Course in Applied Statistics*. Brooks/Cole.

Hawken, Paul. 1993. *The Ecology of Commerce*. HarperCollins.

Hawkins, Keith. 1984. *Environment and Enforcement: Regulation and the Social Definition of Pollution*. Clarendon Press.

———. 1996. "Using Legal Discretion." Pp. 247-73 in *A Reader on Administrative Law*, edited by D.J. Galligan. Oxford University Press.

Heo, Jang. 1997. Politics of Policy-Making: Environmental Policy Changes in Korea. Ph.D. dissertation, University of Wisconsin.

Huber, J. 1985. *Die Regenbogengesellschaft. Okologie und Sozialpolitik*. Fisher Verlag.

Inglehart, Ronald. 1990. *Culture Shift in Advanced Industrial Society*. Princeton University Press.

———. 1995. "Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 Societies." *PS: Political Science and Politics* 28:57-72.

Intergovernmental Panel for Climate Change Working Group I [IPCC WGI]. 2001. *Summary for Policymakers: A Report of Working Group I of the Intergovernmental Panel on Climate Change* — Third Assessment Report. January. <http://www.usgcrp.gov/ipcc/wg1spm.pdf>.

International Energy Agency [IEA]. 2001. *CO_2 Emissions from Fuel Combustion 1971-1998*. Paris: OECD.

Krause, Florentin, Stephen J. DeCanio, J. Andrew Hoerner and Baul Baer. 2002. "Cutting Carbon Emissions at a Profit (Part I): Opportunities for the United States." *Contemporary Economic Policy* 20 (4 Oct.):339-65.

Krause, Florentin, Stephen J. DeCanio, J. Andrew Hoerner, and Baul Baer. 2003. "Cutting Carbon Emissions at a Profit (Part 2): Impacts on U.S. Competitiveness and Jobs." *Contemporary Economic Policy* 21(1):90-105.

Krogman, Naomi. 1999. "Bureaucratic Slippage in Environmental Agencies: The Case of Wetlands Regulation." *Research in Social Problems and Public Policy* 7:163-81.

Koutsoyiannis, A. 1973. *Theory of Econometrics: An Introductory Exposition of Econometric Methods*. Macmillan.

Laumann, Edward O., and David Knoke. 1987. *The Organizational State*. University of Wisconsin Press.

Lee, Ivy, and Minako Maykovich. 1995. *Statistics: A Tool for Understanding Society*. Allyn & Bacon.

Leroy, Pieter, and Jan van Tatenhove. 2000. "Political Modernization Theory and Environmental Politics." Pp. 187-208 in *Environment and Global Modernity*, edited by G. Spaargaren, A.P.J. Mol, and F.H. Buttel. London: Sage Studies in International Sociology.

Levy, Marc A., Robert O. Keohane, and Peter M. Haas. 1993. "Improving the Effectiveness of International Environmental Institutions." Pp. 397-426 in *Institutions for the Earth*, edited by R.O. Keohane, P.M. Haas, and M.A. Levy. MIT Press.

Marx, Karl, Samuel Moore, Edward Bibbins Aveling, and Friedrich Engels. 1889. *Capital: A Critical Analysis of Capitalist Production*. Appleton; Swan Sonnenschein.

McCright, Aaron M., and Riley E. Dunlap. 2000. "Challenging Global Warming as a Social Problem: An Analysis of the Conservative Movement's Counter-Claims." *Social Problems* 47:499-522.

———. 2003. "Defeating Kyoto: The Conservative Movement's Impact on U.S. Climate Change Policy." *Social Problems* 50:348-73.

Meyer, John W. 1994. "Rationalized Environments." Pp. 28-54 in *Institutional Environments and Organizations*, edited by W.R. Scott and J.W. Meyer. Sage.

Meyer, John W., John Boli, George M. Thomas, and Francisco O. Ramierez. 1997. "World Society and the Nation-State." *American Journal of Sociology* 103:144-81.

Miliband, Ralph. 1969. *The State in Capitalist Society*. Basic.

Mol, Arthur P.J. 1995. *The Refinement of Production*. Utrecht, Holland: Van Arkel.

———. 1997. "Ecological Modernization: industrial transformations and environmental reform." Pp. 138-49 in *The International Handbook of Environmental Sociology*, edited by M. Redclift and G. Woodgate. Edward Elgar.

———. 1999. "Ecological Modernization and the Environmental Transition of Europe: Between National Variations and Common Denominators." *Journal of Environmental Policy and Planning* 1:167-81.

———. 2000a. "The Environmental Movement in an Era of Ecological Modernisation." *Geoforum* 31:45-56.

———. 2000b. "Globalization and Environment: Between Apocalypse-Blindness and Ecological Modernization." Pp. 121-50 in *Environment and Global Modernity*, edited by G. Spaargaren, A.P.J. Mol, and F.H. Buttel. London: Sage Studies in International Sociology.

Mol, Arthur P. J., and Frederick H. Buttel. 2002. "The Environmental State Under Pressure." In *Research in Social Problems and Public Policy*, vol. 10, edited by W. R. Freudenburg and T. I.K. Youn. JAI Press.

Mol, Arthur P.J., and David A. Sonnenfeld (eds.). 2000. *Ecological Modernisation around the World: Perspectives and Critical Debates.* Essex: Frank Cass.

Mol, Arthur P. J., and Gert Spaargaren. 1993. "Environment, Modernity and the Risk Society: The Apocalyptic Horizon of Environmental Reform." *International Sociology* 8:431-59.

———. 2000. "Ecological Modernization Theory in Debate: A review." Pp. 17-49 in *Ecological Modernisation Around the World: Perspectives and Critical Debates*, edited by A.P.J. Mol and D.A. Sonnenfeld. Essex: Frank Cass.

O'Connor, James R. 1973. *The Fiscal Crisis of the State*. St. Martin's.

———. 1991. "On the Two Contradictions of Capitalism". *Capitalism, Nature, Socialism* 2(3 Oct.): 107-109.

Organisation for Economic Cooperation and Development [OECD]. 1999. *OECD Environmental Data, Compendium.* Paris: OECD.

———. 1994. *OECD Environmental Performance Review: Japan.* Paris: OECD.

Pierce, John C. 1997. "The Hidden Layer of Political Culture: A Comment on 'Postmaterialist Values and the Environment: A Critique and Reappraisal.'" *Social Science Quarterly* 78:30-35.

Poulantzas, Nicos. 1973. *Political Power and Social Classes.* New Left Books.

Repetto, Robert. 1995.*Jobs, Competitiveness, and Environmental Regulation: What Are the Real Issues?* Washington, D.C.: World Resources Institute.

Roberts, J. Timmons. 2001. "Global Inequality and Climate Change." *Society and Natural Resources* 14,6:501-24.

Roberts, J. Timmons, and Peter E. Grimes. 1997. "Carbon Intensity and Economic Development 1962-91." *World Development.* 25:191-98.

Rosa, Eugene A., and Thomas Dietz. 1998. "Climate Change and Society: Speculation, Construction and Scientific Investigation." *International Sociology* 13:421-55.

Schnaiberg, Allan. 1980. *The Environment: From Surplus to Scarcity.* Oxford University Press.

Schnaiberg, Allan, and Kenneth Gould. 1994. *Environment and Society: The Enduring Conflict.* St. Martin's Press.

Soroos, Marvin S. 1997. *The Endangered Atmosphere: Preserving a Global Commons.* University of South Carolina Press.

———. 1998. "The Thin Blue Line: Preserving the Atmosphere As a Global Commons." *Environment* 40:7-13, 32-35.

Spaargaren, Gert. 1997. *The Ecological Modernization of Production and Consumption: Essays in Environmental Sociology*. Wageningen, Netherlands: Wageningen University.

———. 2000. "Ecological Modernization Theory and the Changing Discourse on Environment and Modernity." Pp. 41-72 in *Environment and Global Modernity*, edited by G. Spaargaren, A.P.J. Mol, and F.H. Buttel. London: Sage Studies in International Sociology.

Spaargaren, Gert, and Arthur P.J. Mol. 1992. "Sociology, Environment, and Modernity: Ecological Modernization as a Theory of Social Change." *Society and Natural Resources* 5: 323-44.

Spaargaren, Gert, Arthur P.J. Mol, and Fredrick H. Buttel. 2000. *Environment and Global Modernity*. London: Sage Studies in International Sociology.

Spaargaren, Gert, and Bas van Vliet. 2000. "Lifestyles, Consumption and the Environment: The Ecological Modernisation of Domestic Consumption." Pp. 50-76 in *Ecological Modernisation Around the World: Perspectives and Critical Debates*, edited by A.P.J. Mol and D. A. Sonnenfeld. Frank Cass.

Stearns, Lisa. 1979. "Fact and Fiction of a Model Enforcement Bureaucracy: The Labor of Inspectors of Sweden." *British Journal of Law and Society* 6:1-23.

Stigler, George J. 1975. *The Citizen and the State: Essays on Regulation*. University of Chicago Press.

Stokke, O.S., and þ.B. Thomessen (eds.). 2001. *Yearbook of International Co-operation on Environment and Development*. Earthscan.

Templett, Paul H., and Stephen Farber. 1994. "The Complementarity between Environment and Economic Risk: An Empirical Analysis." *Ecological Economics* 9:153-65.

Tonnies, Ferdinand. [1887] 1963. *Fundamental Concepts in Sociology (Gemeinschaft und Gesellschaft)*. Translated by Charles P. Loomis. American Book.

Union of International Associations [UIA]. 2000. *Yearbook of International Organizations*. K.G. Saur.

United States National Research Council, Committee on the Human Dimensions of Global Change. 1992. *Global Environmental Change: Understanding the Human Dimensions*. Washington D.C.: National Academy Press.

United States National Research Council. 2001. *Climate Change Science: An Analysis of Some Key Questions*. Washington DC: National Academy Press.

United States Senate. 1997. "Senate Resolution 98." *Congressional Record*. 12 June 1997: Report Number 105-54.

———. 2003. "Proceedings and Debates of the 108th Congress." *Congressional Record*.

Wackernagel, Mathis, Larry Onisto, Alejandro Callejas Linares, Ina Susana Lopez Falfan, Jesus Mendez Garcia, Ana Isabel Suarez Guerrero, Ma. Guadalupe Suarez Guerrero. 1997. *Ecological Footprint of Nations*. Xalapa, Mexico: Centro de Estudios para la Sustentabilidad, Universidad, Anahuac de Xalapa.

Wackernagel, Mathis, and William E. Rees. 1996. *Our Ecological Footprint: Reducing Human Impact on the Earth*. Gabriola Island, BC: New Society Publishers.

Weber, Max. [1904-5] 1958. *The Protestant Ethic and the Spirit of Capitalism*. Translated by Talcott Parsons. Scribner's Sons.

Wilson, Edward O. 2001. "The Ecological Footprint." *Vital Speeches of the Day* 6 (9, Feb. 15):274-8.

World Resources Institute. 1994. *World Resources 1994-1995.* Oxford University Press.

Wright, Scott D., and Dale A. Lund. 2000. "Gray and Green? Stewardship and Sustainability in an Aging Society." *Journal of Aging Studies* 14:229-50.

Yeager, Peter C. 1990. *The Limits of the Law: The Public Regulation of Private Pollution.* Cambridge Univ. Press.

York, Richard, Eugene A. Rosa, and Thomas Dietz. 2003. "Footprints on the Earth: The Environmental Consequences of Modernity." *American Sociological Review* 68:279-300.

Young, Oran. 1989. "The Politics of International Regime Formation: Managing Natural Resources and the Environment." *International Organization* 43:340-75.

———. (ed.). 1997. *Global Governance: Drawing Insights from the Environmental Experience.* MIT Press.