Environmental Problems and Policy: 2000–2050

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The next fifty years will bring continued environmental improvement in the United States, wider use of incentive-based regulations, and a shift in power away from the federal government, RFF's president believes.

It is with great trepidation that one writes about the future. After all, it hasn't happened yet and one could end up looking pretty silly, depending on the acuity of one's vision. For that reason, and like many other forecasters, I have adopted the convention of choosing as the end of my forecast horizon a date sufficiently far in the future that there is no chance of my being around to be held accountable.

Not everyone is so fortunate. In 1982, the Scientific Forecasting and Trends Staff of the Environmental Protection Agency's (EPA's) Office of Research and Development commissioned a consulting company to undertake an "environmental foresight study" to help the EPA anticipate future environmental problems and recognize emerging trends. The study report was completed in late 1984.[1] Among other things, it identified the ten highest priority environmental problems in the years to come, as well as a group of problems of "second order importance"—some thought to have been serious at the time, others viewed merely as potential problems. Carbon dioxide in the atmosphere—or global climate change, as it is now known—did not make the top ten list and was not even identified as a continuing or increasing problem of second order importance. Rather, it was identified as a *potential* second order problem, the effects of which "…are unlikely to be important by 2020." This was only thirteen years before 130 nations met in Kyoto, Japan to craft a treaty aimed at dealing with what many of them viewed as the gravest environmental threat the world has ever faced.[2]

It is of interest to speculate about both the future of environmental regulation and the environmental problems that regulation will confront. We can be a bit more confident with respect to the former.

The Future of Environmental Regulation

While our regulatory system will no doubt be buffeted by many fads and fancies over the next fifty years, at least three changes are beginning to take shape that will endure. First, and of greatest interest to economists, incentive-based (IB) approaches to environmental protection will grow more and more prominent. Here I refer principally to Pigouvian taxes on externalities, the use of marketable permits (or quantity instruments) to limit pollution, and the use of deposit-refund systems—all in lieu of (or occasionally to complement) more prescriptive, often uniform technology-based standards. This change is farthest along in the United States, in part because we have always relied to a greater extent than most other countries on markets. Nevertheless, they are the future of environmental policy everywhere.

In a sense, this is a remarkable change. It is now more than thirty years since Allen Kneese and his colleagues at Resources for the Future, as well as a

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number of university-based researchers, began making the case for IB approaches to environmental protection with both theoretical and empirical demonstrations of their static and dynamic efficiency. "A license to pollute," huffed legislators and their staffs at the time—virtually all of whom were trained in law but few of whom were exposed (as most law students are today) to the case for market approaches to environmental protection.

Today in the United States we have taxes on emissions of ozone-depleting chlorofluorocarbons, marketable permits sharply limiting emissions of sulfur dioxide from coal-fired powerplants, and municipalities levying waste-disposal charges on households based on the number or weight of garbage bags set out at curbside.[3] Moreover, no discussion of international policy regarding global climate change—what to do about emissions of carbon dioxide and other greenhouse gases, in other words—is complete without a lively argument about whether this ought to be pursued via carbon taxes or through a system of marketable permits. Not a single serious proposal to control greenhouse gases has been advanced in international forums that is predicated principally on governments specifying "approved" production technologies or mandating the characteristics of consumer durable goods or other products. While it would be exaggerated to report the death of the command-and-control era, IB approaches to environmental regulation will be increasingly common in the years ahead; we will all benefit from this change in policy.

A second trend in environmental regulation that can only be expected to accelerate relates to requirements on firms to report publicly their emissions into air, water, and land. The first major program along these lines was contained in the 1986 amendments to the Superfund law in the United States and established something called the Toxics Release Inventory. Under this program an ever-expanding list of industries must report to the EPA their annual emissions of a comparably expanding group of substances; these reports are made public by the EPA, although many firms beat the EPA to the punch and announce their emissions themselves. Information provision requirements are beginning to be written into other federal statutes and also state and local environmental laws; they are also being used in developing countries where regulatory authorities are weak or nonexistent.

The reason for this proliferation is simple: experience has shown that when firms are required to make public their emissions, they feel pressure to reduce those emissions even when they are perfectly legal. The Environmental Defense Fund, arguably the most influential environmental advocacy group in the United States, has gone one step further. It takes the emissions information that firms report, couples it with Census data, and makes it possible, via the Internet, for each citizen not only to see how much of each pollutant is discharged in his or her neighborhood, but also to send an e-mail to the plant manager registering concern about these emissions. The spread of electronic communication makes it all but inevitable that governments will require more and more public disclosure about firms' environmental performance (including the amount of fines they may pay for accidents or noncompliance), their occupational safety and health record, and perhaps other dimensions of their operations.

It also seems highly likely that the next half-century will see both more decentralization of environmental authority to lower levels of government, but at the same time more international negotiation over and harmonization of certain environmental standards. There are several reasons for this apparent paradox. Domestically, the United States and other western democracies have effectively federalized all environmental policy. This makes sense for virtually all air and water pollution problems because of the likelihood of interstate (or provincial) externalities if regulation were handled at lower levels of government (one jurisdiction could export its pollution problems to others, in other words).

But there is no obvious reason why states in the United States should not have the authority to regulate the degree of stringency for solid waste landfills, for instance, or even for setting standards for drinking water contaminants, since in both these cases there is no obvious interstate externality that would be associated with one state's choosing a much weaker standard than that of its neighbor.[4] Even under the current, largely federal system in the United States, important environmental regulatory responsibilities are delegated to the states.[5] Given the growing budgets and sophistication of state (and in some cases even regional or local) environmental authorities, as well as the growing mistrust of the federal government, it would be most

surprising if we did not see in the future a devolution of even more authority from the federal government to regional, state, or even local governments. This possibility is only reinforced by the fact that many of the (increasingly minor) pollution problems that will remain in the United States are best handled at the sub-federal level. These include air pollution associated not so much with large factories or other stationary sources as with the effects of the decisions of small businessmen and women and individual motorists.[6]

At the same time, everyone is becoming increasingly aware that environmental problems like climate change, stratospheric ozone depletion, the overexploitation of fish stocks, and the loss of biodiversity due to habitat disruption require coordinated international action if they are to be successfully addressed. International trade negotiations can be expected to revolve increasingly around the kind of bilateral and multilateral environmental issues that arose in talks over the North American Free Trade Agreement. Pressures will increase for gradual harmonization of regulatory regimes, especially those of the western industrial democracies.

Very difficult issues will remain, however. First, developing countries generally will—and should—resist adopting the same standards prevailing in the developed countries. Especially for environmental problems that are more or less confined within one nation's borders, there is no reason why a country ought to hold its polluters to the same discharge standards as those of other countries, especially wealthier ones. Rather, it makes sense to allow each country to tailor its regulations to local economic circumstances and tastes—as countries' per capita incomes increase, so too will their demand for environmental quality. Also, even among the wealthier countries, we can expect to see bitter disputes over environmental issues. These will occur with increasing frequency as businesses under the threat of foreign competition seek protection under the guise of environmental concerns. For instance, German cattle growers have successfully protected themselves against beef imported from the United States by arguing that it contains hormones that, while lawful in the United States, pose risks that Germans are unwilling to bear. Clever lawyers everywhere will seek to use environmental law as a way to circumvent the breakdown of nontariff barriers to trade.

The Environment of the Future

At least at one level, one can speak confidently about environmental quality in the years to come. It is inconceivable that ambient environmental conditions in the United States, as well as in most other western democracies, will not continue to improve. The past record has been most pronounced in the United States with respect to air quality, which is significantly better in virtually every United States city along almost every dimension.[7] Water quality has also improved substantially in most places, and there can be little doubt that both solid and hazardous wastes are being handled and disposed of with much greater care than in the past.[8] Generally speaking, the experience of the OECD countries mirrors that of the United States.

In these developed countries, this favorable experience has been a triumph of technology. That is, the ratio of pollution per unit of GDP has fallen fast enough in the developed world to offset the increase in both GDP per capita and the growing number of "capitas" themselves. There are reasons to believe that this will continue to be the case in the wealthier countries. First, natural gas is now the fuel of choice for virtually all new electricity generation capacity in many places; moreover, it is likely that over the next fifty years or so natural gas will gradually replace coal for much of the baseload generation that coal now provides. This will have positive effects on ambient air quality, and will reduce emissions of carbon dioxide, as well. Nuclear power is quite attractive on these grounds, as well, though it faces technological problems of its own regarding the disposal of radioactive wastes, as well as political opposition.

Second, and slightly more speculatively, it appears that cars, trucks, and buses will in the not-too-distant future be powered not by internal combustion engines but rather by fuel cells that extract hydrogen, initially from gasoline or methanol and eventually from even cleaner sources. Since these mobile sources, as they are called, are increasingly the major contributors to the urban air pollution problems that remain, this change bodes well for the future.

The picture is less bright in the developing world.[9] First, that is where most of the five billion or so new inhabitants of the earth will be born and where they will live during the next century (in fact, in Japan and parts of western Europe, populations will fall unless

the decline in fertility rates is reversed). Second, inhabitants of the developing world will continue to migrate to already very crowded mega-cities. There they will want cars and electricity. It is hard to see how China, India, and other rapidly growing countries will meet their needs for electrification without making use of the vast coal reserves they have. And while these developing countries, too, will one day see cars powered by fuel cells, it seems more likely that they will much longer rely on gasoline-powered internal combustion vehicles. This spells trouble for air quality in developing countries. Moreover, the press of more and more people into cities will also overwhelm water supply and sewage treatment systems—where they exist—as well as transportation infrastructure.

Though this may seem Panglossian, there is reason to believe that even these serious problems to be faced in the decades ahead will eventually be overcome. After all, it was only thirty years ago in the United States that a major river spontaneously combusted and that air pollution would occasionally get so bad that motorists would turn their headlights on during the day to be seen. The rise in living standards here increased the demand for environmental quality to the point that people preferred to take additional increments in the quality of life in the form of a better environment, rather than a fatter paycheck. Evidence on the so-called "environmental Kuznets curve" suggests that this is also true in developing countries; that is, environmental quality may deteriorate during a period in which developing countries begin to industrialize, but at some point this deterioration is stopped and reversed as incomes rise.[10] *The principal environmental challenge for the developed world today is helping the developing countries to increase their standards of living in ways that help them skirt, to as great an extent as possible, the pollution-intensive period the developed countries underwent.*

Even in the developed world, there is reason to be concerned about the problems caused by land clearing and other habitat disruption. While air or water quality degradation can eventually be reversed, we cannot resuscitate a species once driven to extinction or regrow (in any meaningful time scale) a redwood or other old-growth forest lost to logging, urban growth, or second-home development. While the forested area of the United States and a number of other western democracies is greater than it was a century ago, forests are being lost at a rapid clip in many developing countries. As Waggoner, Ausubel, and Wernick have argued elegantly, this need not be the case.[11] They point out that if agricultural productivity could be lifted up around the world to the average level of today's U.S. corn grower, even a world inhabited by ten billion people would need only half as much acreage in agricultural production. This would greatly reduce pressure to convert forested areas to subsistence agriculture. Similarly, recent increases in forest productivity[12] could make it possible to meet the needs for wood of even a much more populous world while increasing, not decreasing, forested acreage. Here, too, the developed world could play a key role in the next fifty years helping the developing world take advantage of these more productive agricultural and silvicultural technologies. Whether they will or not is another question.

Other New Technologies

But what about the Internet? Won't the so-called communications revolution, as well as other technological and biomedical innovations, make it possible to neatly avoid all these environmental problems?[13] Nope. Heretical as it sounds, life fifty years ago was in many respects not at all unlike life today. Our fathers (and a few mothers) drove to work, generally by themselves, as most of us do today; in fact, many more of them used public transportation than today. They worked in offices, factories, stores, or on farms that—while more labor- and pollution-intensive than today—aren't *all* that different. Similarly, we ate and recreated in ways not unlike we do today. The best guess we can make about the world of 2050 is that we'll recognize it easily (and be able to communicate this fact to others even more instantaneously than today).

To be sure, we will know much, much more about the genetic causes of death and disease, and it would be surprising indeed if lifespans did not continue to increase. This will mean that more goods and services will be consumed than would have been the case, of course. Genetically modified organisms will make it possible to further increase agricultural and silvicultural productivity, although plain old cultural objections may result in their potential never being realized. Still other such organisms will facilitate the cleanup of soil and groundwater contamination.

Nevertheless, even though the Internet may change how businesses and individuals communicate with one another, we'll all still need stuff. This stuff may be delivered to us as a follow-up to electronic commerce, but we'll probably make another trip using the time saved shopping. Other, as yet unimagined technological wonders will no doubt change to some extent what we eat (and how it is grown), how long we live, and what we do with our spare time. But unless these changes profoundly affect in ways unforeseen here the way we use energy—particularly for electricity generation and personal transport—and the incentives people have to clear land, the environmental problems we will grapple with, as well as the policies we use to address them, will be those described above.

Would that I could be here in 2050 to see how wrong I was!

Notes

1. Vary T. Coates, Joseph F. Coates, and Lisa Heinz, "Clues to the Future Environmental Agenda: An Environmental Foresight Study," December 1984, Office of Exploratory Research, U.S. Environmental Protection Agency, Contract Number 68-02-3762.

2. To be fair to the authors of the report, even those greatly concerned about global climate change would likely agree that the world has yet to see any of the adverse effects they believe it will eventually pose.

3. See Stavins, Robert N. Forthcoming. "Market-Based Environmental Policies" in *Public Policies for Environmental Protection*, 2nd edition. Portney, Paul R. and Robert N. Stavins, eds. Washington: Resources for the Future.

4. There are certain biological contaminants that can appear in drinking water for which even one exposure can make someone very sick or even die. For these contaminants, it makes sense for the federal government to set uniform national standards so that someone drinking from a water fountain at O'Hare Airport, for instance, can do so in confidence that the state of Illinois has not set a standard much weaker than that in his or her home state.

5. For instance, even where the federal government sets uniform national air or water quality standards, the states are given the responsibility to monitor compliance with the standards; the states also issue most operating permits and bring the majority of enforcement actions.

6. This does not mean, incidentally, that states are clamoring for these added regulatory responsibilities. In some cases, governors would prefer to be told what to do by the federal EPA rather than be forced to make difficult tradeoffs between environmental quality and economic growth. But if the effects are principally local, that is exactly where the buck ought to stop.

7. See U.S. Environmental Protection Agency. 1999. *National Air Quality and Emissions Trends Report, 1997.* EPA 454/R–98–016. Washington.

8. See Pollution Control in the United States: Evaluating the System. 1998. J. Clarence Davies and Jan Mazurek, eds. Washington: Resources for the Future.

9. For an excellent discussion of the environmental problems of the developing world, see *World Development Report 1992: Development and the Environment.* World Bank. 1992. New York: Oxford University Press.

10. See Grossman, Gene and Alan Krueger. 1991. "Environmental Impacts of a North American Free Trade Agreement." Princeton University. Princeton, NJ.

11. See Waggoner, Paul, Jesse Ausubel, and Iddo Wernick. 1996. "Lightening the Trend of Population on the Land: American Examples." *Population and Development Review*. 22.3, pp. 531–45.

12. See Sedjo, Roger. 1999. "Land Use Change and Innovation in Forestry," in *Productivity in Natural Resource Industries*. Simpson, David, ed. Washington: Resources for the Future, pp. 141–74.

13. See Cohen, Nevin. Forthcoming. "Greening the Internet: Ten Ways E–Commerce Could Affect the Environment." *Environmental Quality Management*.