

Since Earth Day 1970

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If environmental problems appear far more complex today than they did on the first Earth Day, reflections on them—at least at *Resources for the Future*—have remained fairly consistent. A perusal of some issues of *Resources* from 1970 reveals a remarkable similarity between the themes sounded then and contemporary meditations on the environment. For instance, the kinds of environmental problems we face today were certainly within the realm of the imaginable two decades ago. In a June 1970 article in *Resources*, RFF's Hans H. Landsberg argued that the disposal of nuclear fission products and the emission of carbon dioxide into the atmosphere, with its long-run potential for climatic change, would be among the most serious environmental issues to be faced in the future.

One contributor to *Resources* in 1970 already spoke of "global" environmental problems. He noted that processes of weather and climate formation were ill-understood, necessitating a greater allocation of monetary and intellectual resources to monitoring and analysis. He might have uttered the same words today with respect to global warming.

Perhaps more important than their prognostications, those earlier contributors to *Resources* diagnosed a fundamental flaw in the traditional strategy for confronting environmental problems. As Landsberg remarked in 1970, environmental problems resist "swift and simple solutions." Because each derives from

multiple causes, there is no single cure. The tendency to speculate about single determinants of environmental deterioration, he warned, is likely to deflect attention from a complex of factors, some of which may be of critical immediacy.

This theme of the complexity of environmental problems and the inappropriateness of quick and easy fixes is touched on by all the contributors to this issue of *Resources* as they reflect on developments in the environmental arena since the first Earth Day. Thus Paul R. Portney asserts that after two decades of environmental legislation it is time to make benefit-cost analysis one of the bases of regulatory and other decisions concerning the environment. Hans Landsberg sheds light on why energy policy goals and mechanisms have often met with unexpected results, particularly with respect to environmental protection. Peter M. Morrisette identifies the uncertainties surrounding global warming that will make international agreement on this issue difficult to achieve. In examining the federal government's involvement in outdoor recreation, Marion Clawson reveals how acknowledgment of the inaccuracy of one assumption concerning recreation trends is forcing a reevaluation of recreation funding. Finally, Allen V. Kneese explores three major environmental problems that we will have to grapple with in the future. Not surprisingly, they are the same ones envisioned in *Resources* in 1970. ■

Melissa Edeburn

Taking the measure of environmental regulation

Paul R. Portney

One way of measuring the success of environmental policies is benefit-cost analysis. Yet no such analyses exist with respect to the vast majority of environmental laws and regulations implemented since Earth Day 1970. As the United States enters its third decade of environmental regulation, it may be prudent to supply decision makers with benefit and cost valuations that will help them weigh the pros and cons of legislative initiatives from both environmental and broader social perspectives.

There are many ways to measure the success of public policies. These include public opinion polls and ballot box results; by either of these measures the environmental laws and regulations enacted since Earth Day 1970 appear to have been successful. Several studies of public opinion polling have recently pointed to the record-high support now being given to environmental regulatory measures. This is made all the more impressive by the fact that questions asked in these polls explicitly require respondents to balance environmental protection against economic growth. Similarly, when environmental initiatives are put to popular votes, they are generally strongly supported no matter how uncompromisingly worded.

Another way to measure the success of environmental initiatives is benefit-cost analysis. This approach involves ascertaining the improvements that have resulted from environmental regulations and translating these improvements into physical effects such as the reduced incidence of human disease, curtailment of damage to materials and crops, and so on. Dollar values are then assigned to these favorable effects and compared with the costs of the regulations. Such comparisons are very difficult — sometimes impossible — to make, but those that do

exist suggest a more sober assessment of the last two decades of environmental regulation.

In spite of the considerable progress environmental economists have made in estimating benefits, there exists no estimate of the cumulative benefits associated with the environmental regulatory programs implemented since 1970. Notwithstanding this unfortunate fact, there exists a fair bit of scattered evidence worth reviewing.

While some serious problems remain, the substantial improvements in urban air quality between 1970 and 1990 have been the most impressive success story in federal environmental regulation. To be sure, other factors have played a role in these improvements—not the least of which are the closings or relocations of some major industrial facilities—but the 1970 amendments to the Clean Air Act have played a major role. Among the most notable improvements in air quality is a decline in the average ambient concentration of lead of more than 90 percent since 1980. Since 1978 the average ambient concentrations of sulfur dioxide and particulate matter have decreased 35 and 21 percent, respectively. These are truly significant accomplishments since lead and fine particles, particularly sulfate aerosols, are among the most harmful pollutants from the standpoint of human health. Averaged nationally, ambient concentrations of carbon monoxide, nitrogen oxides, and even ozone—the most stubborn air pollution problem facing the nation—have declined over this same period.

But what is the dollar valuation of the health improvements, reduced damage to exposed materials, increased agricultural output, improved visibility, and other physical changes that have accompanied reduced air pollution concentrations? More than a decade ago, A. Myrick Freeman III, a senior fellow at Resources for

the Future, attempted to make such an estimate for the year 1978. In 1984 dollars, his best estimate of air pollution control benefits for that year was about \$37 billion, although he said the true number could fall anywhere in a range of \$9 billion to \$90 billion. At the time of his analysis, Freeman's estimate was limited by some gaps in information and by unavoidable assumptions that he readily acknowledged; recent developments in epidemiology and economics have further eroded the confidence we can place in the estimate. Nevertheless, Freeman's attempt stands as the only one thus far to comprehensively estimate annual air quality control benefits.

When it comes to estimating water pollution control benefits, the situation is more discouraging. Because of the inadequacy of the national water quality monitoring network, there are fewer data concerning the overall improvements in water quality since the 1972 amendments to the Clean Water Act. Dramatic improvements in water quality in a number of major metropolitan areas are, unfortu-

There exists no estimate of the cumulative benefits of the environmental regulatory programs implemented since 1970.

nately, an insufficient basis for comprehensive benefit estimates. What is needed are better and broader data on changes in water quality, coupled with credible estimates of the increase in water-based recreation such changes would effect, along with estimates of any health and other improvements that would follow. Once again making use of any and all existing information on changes in water quality and individual valuations thereof, Freeman pegged the most likely national benefits associated with the Clean Water Act at \$14 billion for the year 1978. His uncertainty range was between nearly \$6 billion and \$28 billion.

No such comprehensive estimate of national water quality benefits has been made since that time. This is unfortunate because now-available data on physical

changes in water quality and an improved understanding of the way individuals value fishing, boating, swimming, and other types of water recreation benefits would allow an up-to-date estimate to be more accurate.

The Clean Air and Clean Water acts are only two of more than twenty major federal environmental laws. Statutes exist for regulating pesticides and herbicides, drinking water contaminants, solid and hazardous wastes, and new chemicals, but there are virtually no estimates of the annual benefits of these laws.

Although information is lacking, it is likely that the corpus of environmental laws and regulations passed since 1970 has produced substantial economic benefits—surely in the tens of billions of dollars annually. Considering the substantial costs of implementing and enforcing this legislation, one should hope so.

Measuring environmental costs is not straightforward. As RFF researchers Raymond J. Kopp and Michael Hazilla have pointed out, the costs associated with a particular regulation should be measured by the amount of money required to compensate those harmed by the regulation (through higher prices, job losses, and the like) so that they are just as well off after the regulation as before. This is analogous to, and no simpler than, measuring benefits by willingness to pay, the widely accepted metric. Nevertheless, the appropriate measure of costs bears some resemblance to out-of-pocket expenditures for pollution control equipment, cleaner fuels, sewage treatment, and other environmental ends. About such expenditures better data exist.

A survey of a wide variety of estimates suggests that total annual expenditures necessitated by federal environmental regulation are now on the order of \$85 billion. Approximately \$30 to \$35 billion of this is a result of regulations written pursuant to the Clean Air Act. Another \$30 billion can be attributed to the Clean Water Act requirements. The remainder arises from regulations to protect drinking water, ensure the safe disposal of solid and hazardous wastes, control pesticides and toxic substances, and further other environmental goals.

It is important to realize that this \$85 billion is just an estimate: there is no



The 1970 Clean Air Act amendments improved urban air quality, but estimates of air quality control benefits such as improved health are lacking.

very precise way to tally up just what industries, governments, and individuals are required to spend for environmental protection. The true total may be somewhat higher or lower than \$85 billion, but it is probably close (within 10 percent or so)—something that cannot be said about estimates of aggregate national benefits. As further evidence of the accuracy of the \$85 billion total, the Environmental Protection Agency independently estimates, in a draft report, that the annual costs associated with all federal environmental regulations is \$93 billion.

For purposes of comparison it is worth noting that the federal government spends about \$40 billion annually on health care for the indigent under the Medicaid program and another \$10 billion for the Food Stamp program.

There is always interest in knowing what the macroeconomic effects of these environmental compliance expenditures may be. That is, what effect does this spending have on the inflation and unemployment rates, the rate of growth of GNP, the trade balance, and so forth? The most recent study came to about the same conclusions as previous ones: environmental regulation adds slightly to the inflation rate, has a negligible effect on the unemployment rate, and somewhat reduces the rate of productivity growth.

Two important caveats must be attached to these findings. First, these macroeconomic analyses looked only at the effects of compliance costs on the economy. They did not attempt to factor in the effects on the economy of improved human health (which might stimulate labor productivity, for example); reduced damage to exposed materials at factories, homes, and apartment buildings; increased agricultural output; or other beneficial effects. Second, the models used for these studies are often unable to detect the macroeconomic effects arising from other subtle yet important costs of environmental regulation: disincentives to modernize plant equipment, the increased likelihood that new plants will be constructed abroad rather than in the United States, and reduced levels of innovative activity in the chemical and pharmaceutical industries, to take but a few examples. In the long run, these *may* be as important as the direct effects of compliance expenditures, but it is impossible to know because of the inadequacies of current analytic tools.

What about expenditures for environmental purposes over the whole twenty-year period since Earth Day 1970? Based on the annual reports of the Council on Environmental Quality from 1971 through 1981, studies performed by or for the EPA since that time, and other

sources, it would appear that total expenditures necessitated by federal environmental regulation have been on the order of \$600–700 billion. (In the early 1970s, few regulations had been written under the Clean Air and Clean Water acts; as a result compliance expenditures began to grow in earnest only toward the middle of the decade.) The draft EPA report alluded to above puts cumulative spending from 1970–1990 at closer to \$1 trillion; however, the report may count spending for solid waste disposal that is more correctly attributed to local ordinances. Either way, the total is eye-catching.

Future cost-benefit analysis

It is discouraging for environmental economists to have to admit that they know as little about annual or cumulative benefits and costs as they do. Nevertheless, there are reasons to believe that understanding about such costs and benefits will increase in the future. For one thing, the art of benefit estimation has improved dramatically over the last two decades. It is now rare, for instance, to see the benefits of life-saving regulations calculated by reference to lost earnings. Although in vogue until the mid-1970s, this approach was offensive to those not in the labor force (since they earned nothing there were no benefits from extending their lives) and theoretically inconsistent with applied welfare economics. Similarly, economists have made great strides in understanding individuals' willingness to pay for reduced risks of acute and chronic morbidity, for improved visibility, for the preservation of unique wilderness areas, and for other types of benefits. Particularly useful in this regard has been the development of the so-called contingent valuation technique in which individuals' valuations are elicited through their responses to questionnaires.

Research at RFF and elsewhere is shedding light on the relationship between environmental compliance expenditures and true social costs—the latter being the appropriate measure to use in benefit-cost analyses. This, too, is a welcome development because the distinction has been—and is—poorly understood even within the economics profession.

There is another reason for encouragement as the nation stands on the brink of a third decade of environmental regulation. Although it may be difficult to make precise benefit-cost comparisons, we have always known that it is possible to reduce the costs of meeting predetermined environmental goals by making better use of economic incentives in regulation. It is not unusual for studies to conclude that these savings are on the order of 30 or 40 percent.

Until recently, however, incentive-based approaches fared poorly in legislation when compared to more centralized command-and-control regulation. In June of 1989, though, President Bush announced that marketable pollution allowances—that is, tradable permits—would form the centerpiece of his ambitious proposal to reduce emissions of sulfur dioxide (SO_2), a precursor of acid rain. Under this approach, the electricity-gen-

The technique of benefit estimation has improved dramatically over the last two decades.

erating plants that would be required to reduce SO_2 emissions would be given an option. They could make the reductions themselves, or they could pay other sources to reduce emissions by more than their mandated amount—so long as the total emissions reduction target is met. Such “swaps” would be pursued in cases in which it would be cheaper for a plant to buy emissions reductions elsewhere than accomplish them itself.

Led by the Environmental Defense Fund, other environmental groups soon threw their support behind marketable permits, even though such groups had steadfastly opposed incentive-based approaches in the past. It now appears that marketable permits will become a legislative reality. Compared to the standard legislative approach to air pollution control—mandating the installation of specific technologies—the tradable permits approach will save about \$4 billion per

year, yet accomplish the same reduction in SO_2 emissions.

If this initiative is successful, and if it leads to a reconsideration of incentive-based approaches elsewhere in environmental regulation, the potential savings are considerable. Suppose, for example, the substitution of incentive-based rules for their command-and-control counterparts would save but 10 percent of the \$60 billion currently spent on air and water pollution control in the United States each year. That \$6 billion would be enough to operate the Environmental Protection Agency for three years at its present level, test for and remediate elevated radon concentrations at hundreds of thousands of homes around the country, provide for emergency removals at thousands of abandoned hazardous waste disposal sites, or accomplish other important environmental (or non-environmental) goals. That is a savings worth pursuing.

Those who oppose the use of benefit-cost analysis in environmental policymaking often do so on the grounds that there are important values and effects that defy quantification. They are absolutely right, and for that reason benefit-cost analysis can never—and should never—be the only basis for making regulatory or other decisions. From this vantage point, at least, an overreliance on benefit-cost analysis is not the problem in environmental regulation today. Rather it is that many of the most important environmental statutes explicitly *prohibit* even a qualitative balancing of favorable and unfavorable effects. This denies decision makers access to information that just might help them make better decisions from an environmental and from a broader social point of view. ■

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Two decades of energy policy

Hans H. Landsberg

After the 1973 OPEC oil price shock the goal of U.S. energy policies shifted from the attainment of abundant and cheap energy to that of secure and clean energy. Where regulatory measures had failed to achieve earlier policy objectives, successive administrations relied on market forces—an approach that has often yielded poor results. In the search for energy security and in the interest of environmental protection, a greater stress on government intervention seems inevitable.

There is a perennial debate over whether the country has ever had—or now has—an energy policy or merely a collection of policies, each applying to a specific segment of the industries that comprise the U.S. energy sector. Whatever the answer, it is arguable that the early seventies constitute a dividing line between an era for which the second characterization holds true, and an era that saw a closer approach to an energy policy with broadly defined goals applicable across the board. In the latter era energy policy appears to have been driven initially by concern for supply security and stability, including diversification of source; by efforts to use energy more efficiently; and, increasingly, by the need to reconcile energy production and consumption with the maintenance of environmental integrity. It is fair to say that few realized on Earth Day 1970 how difficult it would be to understand the underlying complexities of that last-named goal; agree on specific targets; make the required measurements; and shape appropriate, effective, efficient, and equitable policies.

To appreciate the change in the focus of energy policy that began in the early seventies, it is useful to review the 1960s, during which the United States was on an energy binge. In that decade energy consumption averaged 5.2 percent per year as compared to 1.4 percent per year be-

tween 1970 and 1980. Oil consumption soared 4.8 percent per year in the sixties but slowed down to an average annual rate of 1.6 percent between 1970 and 1980. Electricity generation rose an average 10.3 percent per year in the sixties and decreased to a rate of 4.9 percent annually between 1970 and 1988. This trend continued into the 1980s.

Obviously the rate of growth in demand that prevailed in the 1960s could not long be sustained. A number of factors suggested that in the future energy would no longer be in abundant supply and at low cost from domestic sources. These factors included a turnaround in the decline of the Btu/GNP ratio, which indicated a worsening in the efficiency of energy use; the failure of oil and gas reserves to grow commensurate with increases in consumption; the declining efficiency of power plants; environmental deterioration requiring remedies that would entail higher energy costs; and doubts about the availability of nuclear energy supplies at the low costs previously predicted. In the case of oil imports, many expressed concern about their future cost and reliability.

Pre-OPEC energy policy

It has become conventional wisdom that late 1973 constitutes the great divide between “pre-OPEC” and “post-OPEC” energy. It is convenient to think in these terms as long as one realizes that the 1973 OPEC oil price shock merely accelerated the consequences of worsening supply and demand trends and aggravated the impact of rising environmental concerns.

On the whole, energy policy in the pre-OPEC era addressed separately the issues of each energy system, without any attempt to produce an integrated policy system. Moreover, policies were heavily directed at controlling the fiscal environment in which the energy industry operated, and employed regulatory meas-

ures to do so. For instance, oil policies addressed matters such as the industry’s tax situation and the extent and nature of state regulation of the industry’s output. Beginning in the late fifties, these policies were supplemented by attempts to curb oil imports that were perceived as threatening to domestic producers because they cost less than domestic oil supplies. Ironically, the control system collapsed just months before the OPEC oil price shock. Among other things, it had encouraged the depletion of domestic energy resources and disturbed oil exploration and development decisions.

Regarding coal, pre-OPEC policies addressed principally three areas: the conditions under which federal land was to be leased for mining purposes, the health and safety of miners, and the fate of surface-mined land. All three affected coal prices, the location of mining activity, and the financial condition of coal companies—none of which were the policies’ objectives. No attempt was made to link policies concerning coal to those affecting oil. As for natural gas, the third fossil fuel, policies primarily addressed the price that gas producers could charge.

Hydro and nuclear energy were relatively small contributors to the nation’s total energy supply in the pre-OPEC era. With hydro energy, the issue had long been the power of the federal government to fix the conditions, including rates, under which a given hydro project could be built and operated. With nuclear energy, the main issues were, in the early years, safety, health, proliferation, and management of nuclear waste, all within the purview of the federal government.

The above sampling suggests that policies for each of the energy systems were separate lots, related to the others at best inadvertently. At times the policies conflicted. Nonetheless, they reflected a common goal—the supply of abundant, cheap, and reliable energy to support a growing economy and allow a reasonable profit to producers. A secondary goal was to retain, or where necessary establish, a role for the federal government, initially as steward of the nation’s resources, and later as provider of acceptable conditions of life for those involved in the production process. The government’s role as steward of the nation’s



Photo courtesy of the AMERICAN PETROLEUM INSTITUTE

The 1973 OPEC oil embargo led to long lines at gas stations and energy policies aimed at supply security.

resources had wide ramifications, as indicated by the establishment of a prorationing system for oil production, the regulation of shipping rates for coal transported by rail, and the regulation of natural gas prices, to name only three. The government's regulation of the electric power industry affected everything from the siting of plants to allowable returns on investment to rates charged to different classes of customers.

The government's role was strong throughout the energy system. Yet there was no mechanism to assess whether energy policies, either singly or jointly, in fact favored cheap, abundant, and reliable energy supplies, or whether low cost, abundance, and reliability were indeed consistent objectives. For example, the prorationing of oil coupled with the setting of output targets only served to make oil more, not less, costly, though not necessarily so for the long run. Land reclamation policies no doubt raised the price of coal. Certainly the restrictive leasing of federal land containing oil made energy supplies less abundant.

Post-OPEC energy policy

By the 1970s it was obvious that the goal of abundant and cheap energy was becoming obsolete. The OPEC embargo of 1973 undermined the goal of reliabil-

ity. As a result the post-OPEC era generated energy policies that directly addressed both the supply of and demand for energy within the context of the performance of the overall economy. These policies have been driven by the search for supply security and a concern for environmental protection. In particular, security acquired a priority status. Legislation now aimed at both reducing the consumption of energy and increasing

Pre-OPEC energy policies focused separately on each energy system without attempting to forge an integrated energy policy.

the supply of energy sources that could replace oil. There was a good deal of ambiguity regarding these policies, for the idea of suppressing demand and letting prices rise was indeed alien to a country richly endowed with energy resources. The government's gut reaction to OPEC's price-boosting enterprise was to control prices. However, the cure was worse than the disease. By holding down the price of domestic oil and thus confronting the consumer with an average domestic/import price that was lower than

the OPEC price, the government masked the high OPEC price and prevented demand from responding adequately. Moreover, keeping prices low slowed oil exploration and development. This counterproductive policy was not abandoned until 1981. Freeing the price of natural gas took even longer and was accomplished by a highly complex regulatory regime.

Attempts to reduce demand took various forms, all of them laid down in elaborate statutes. Indeed, the 1970s were the most intensive years of energy legislation. Starting in 1974 Congress passed a series of laws that aimed at imposing efficiency in the use of energy, reducing the consumption of oil and gas, establishing tax and fiscal incentives for the use and research and development of renewable energy sources, strengthening supply security by building a strategic petroleum reserve, and so on. Some laws were short-lived and others proved ineffective, but increasingly the goal of energy policies shifted from the attainment of abundant and cheap energy to that of secure and clean energy with prices shaped by market forces.

Congress first attempted to address the need for energy security in 1974 when, ignoring coal's adverse impact on the environment, it ordered oil- and gas-burning power plants to convert to coal—provided they were equipped with coal-handling and transportation facilities. The effort accomplished little, as few plants made the switch.

In 1975 Congress tried to promote conservation by setting automobile efficiency standards and mandating a ten-year reduction in energy consumption in federal buildings, as well as efficiency standards for household appliances. Unhappily, this measure also greatly broadened the oil price control policy that began in 1971 under President Nixon, thus frustrating conservation. Appliance standards never became law, and improving energy efficiency in federal installations remained a minor effort.

Congress made still another stab at conservation in 1976 by requiring the establishment of energy-efficient building standards and by authorizing so-called "weatherization" grants for low-income households. The first of these measures

was stillborn. The second had minimal results.

One of the early actions of the Carter administration was to develop the National Energy Plan, which called for conservation and fuel efficiency, rational pricing and production policies, reasonable certainty and stability in government policies, substitution of abundant energy resources for those in short supply, and development of nonconventional technologies for the future. Its targets for 1985 were to reduce gasoline consumption by 10 percent, establish a petroleum reserve of one billion barrels, increase coal consumption to more than one billion tons per year, bring 90 percent of the existing U.S. homes and all new buildings up to minimum efficiency standards, and use solar energy in more than two million homes. Monetary incentives and disincentives associated with specified standards were to bring about these changes. While the plan reflected a lack of realism in such areas as buildings and solar energy and overestimated industry's willingness to switch to coal, it correctly diagnosed price controls as counterproductive and called for their demise.

Congress responded by establishing the gas guzzler tax to penalize grossly inefficient automobiles and by authorizing subsidies for alcohol fuel. It also authorized residential energy audits by utilities, ordered the Department of Energy to set appliance standards, and set rules for phasing out price controls. In addition, Congress required utilities to purchase independently generated electricity and encouraged them to institute rate reform. It extended the existing restriction on oil and gas-burning in power plants and large industrial facilities, and authorized federal loans for investment in pollution control equipment, as well as assistance to areas with increased coal and uranium mining.

Collectively, this legislation aimed at the promotion of energy efficiency and security through diversification of sources; environmental considerations were a minor feature. Indeed, by stressing coal use it was apt to aggravate environmental stress.

One unhappy legislative initiative rounded out the major energy actions of the post-OPEC era. The Energy Security

Act of 1980 is notable because it established the ill-fated Synfuels Corporation, though it also provided additional assistance to alcohol fuel plants and established a Solar Energy Bank. None of these provisions bore much fruit, especially as this kind of federal activity was anathema to the incoming Reagan administration. The rise and fall of the Synfuels Corporation is important not so much for failing to lead to a viable alternative fuel as for leaving a bad taste for federal enterprises that get involved in "picking winners and losers"—a cliché that fig-

Post-OPEC energy policies have been driven by the search for supply security and a concern for environmental protection.

ures in the ongoing tug-of-war between interventionists and free marketeers.

What has survived since the legislative frenzy of the 1970s? There is the strategic petroleum reserve, not at the legislated 1-billion-barrel level, but approaching a respectable size of 600 million barrels. Lengthened daylight savings time and a reduced speed limit have also proved sturdy survivors. Price controls are gone. Automobile efficiency standards continue to be in force, but are not being tightened. Federal aid to nascent technologies has continued, though the fitful nature of annual appropriations has tended to slow research efforts.

There are other encouraging developments. Recently President Bush requested a \$19 million congressional appropriation to construct a new laboratory to advance the work of the Solar Energy Research Institute. Photovoltaics may be on the threshold of commercial viability in special utility applications.

Successes are matched by the failures noted earlier. Looking at this ledger, one is tempted to say that consumer- or demand-oriented legislation has fared poorest. Conservation is hard to foster by government fiat. Trying to motivate millions of consumers is a daunting task. But then, some would argue, so is commercializing new technologies.

No easy solutions

What will the 1990s bring? Most likely a return to more regulation, and that for several reasons. Perhaps the most important is the ever-increasing significance of environmental issues associated with energy. Acid rain, greenhouse gases, and urban smog are three examples. Though there are attempts to manage acid rain through the use of market forces, regulation appears unavoidable. Urban air pollution will require tighter tail-pipe emissions standards, possibly modification of cars, and life-style changes—none of which will be "demanded," in the market sense, by fuel users. Use of market forces appears even less promising in the management of greenhouse gases.

Connected with these issues is the need to de-emphasize coal; yet coal is the most abundant, most widely distributed, and cheapest source of heat and electricity. Nothing short of government intervention will make its users abandon it in favor of oil and gas, which are more costly, less abundant, and, in the case of oil, subject to supply perturbations outside the nation's control. Nor does nuclear energy offer a way out unless or until nuclear reactor designs meet with public approval and waste disposal problems are satisfactorily resolved. Despite continuing advances in technology, the diffusion of renewable energy sources will be years in coming. Nor will the ongoing restructuring of the electric power industry proceed without major government participation.

Looking back on the seventies and early eighties, one finds a broadly spread technological optimism. Nuclear fission, the breeder reactor, fusion, coal liquefaction, oil from shale, gas from unconventional sources, and other technological advances were widely believed to bring relief in the foreseeable future. They have so far failed to do so. At the same time, we have run out of easy solutions. Above all, environmental considerations no longer allow us to regard coal as the universal alternative fuel.

The big question remains: How can we tell when government intervention is indicated? During the Reagan years the federal government sanctioned intercession when the task in question had a high

risk, an extended time horizon, and, if successful, a high payoff. It now seems that this triple test holds true for more and more initiatives—a test that therefore becomes increasingly useless. Thus, more than ever, technological enterprises will, like it or not, call for greater government intervention. So will attempts to

motivate consumers, as well as increased international collaboration concerning energy matters. The tendency in the 1980s to rely on the market to bring about desirable results is likely to be reversed in the 1990s—no matter one's ideological inclination. ■

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Negotiating agreements on global change

Peter M. Morrisette

Building international consensus on how to deal with global environmental problems is an essential but rarely easy task. In formulating international policy on global warming and other transnational environmental issues, a recent landmark agreement concerning the production and use of chloroflourocarbons that deplete stratospheric ozone offers some useful insights.

In the twenty years since the first Earth Day there has been a growing tendency to view environmental issues, both ecologically and politically, from a global perspective. Scientists and policymakers are beginning to realize that while environmental problems such as deforestation, desertification, and air and water pollution are regional in their manifestation, they are also linked globally. They are also beginning to understand that other environmental problems such as stratospheric ozone depletion and greenhouse warming are truly global in scope. The international community now recognizes that these problems must be dealt with as global issues.

The recent Montreal Protocol on Substances that Deplete the Ozone Layer is a manifestation of the globalization of environmental issues. A landmark international agreement, the Montreal Protocol was a response to the growing international consensus on the

need to protect stratospheric ozone from depletion by chloroflourocarbons (CFCs)—synthetic chemical compounds used as coolants, foam-blowing agents, aerosol propellants, and cleaning solvents. In the stratosphere CFCs work catalytically to destroy the ozone layer, which shields the earth from the harmful ultraviolet radiation known as UV-B. An increase in the amount of UV-B radiation that reaches the earth's surface could result in an increased rate of skin cancer and cataracts in humans, and could cause other biological and environmental damage as well.

Like stratospheric ozone depletion, global warming has begun to receive worldwide attention. Participants in meetings such as the 1988 Toronto Conference on the Changing Atmosphere have urged an international response to the problem of global warming, as did heads of state convening in the Hague and in Paris in 1989. As a result of increased attention to this phenomenon, the Intergovernmental Panel on Climate Change (IPCC), established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), is investigating international policy responses to climate change.

Global warming is also a major domestic political issue in many countries, including the United States and Canada, as well as among the member nations of

the European Community. In the United States, for example, legislation has been proposed in Congress to control emissions of greenhouse gases, and the Environmental Protection Agency (EPA) has suggested a range of domestic and international policy options for controlling the rate of global warming.

Several factors have spurred the rise of global warming on the international environmental agenda. These include growing scientific evidence concerning the role of carbon dioxide and other trace gases as greenhouse gases, and improved global circulation models that demonstrate that the emission of these greenhouse gases could result in a global warming of 1.5 to 4.5 degrees centigrade—an increase that could have profound climatic effects. In addition, recent studies have revealed the potential impacts of a greenhouse-induced climatic change. For example, rising sea levels could flood low-lying coastal areas, and

Scientists and policymakers now tend to view environmental issues from a global perspective.

shifting agricultural patterns necessitated by climate changes could have significant regional and global implications. Moreover, the growing inclination of scientists and policymakers to consider environmental issues from a global perspective has intensified concern about the global warming problem.

However, formulating international agreements for responding to problems of global environmental change is a

complex undertaking. The task is complicated by differences among nations in their perceptions of environmental problems and by the reality that the costs and benefits of implementing international agreements on the environment are seldom evenly distributed. Yet mitigation of truly global environmental problems such as ozone depletion and global warming ultimately requires international cooperation such as that reflected in the successful negotiation of the Montreal Protocol. The product of a seventeen-year policymaking process, the Protocol was built on a complicated set of policy decisions and actions. It is this history that gives the Protocol its meaning and credibility in a political context and that suggests its value as a model for forging international agreements concerning other global environmental problems.

The Montreal Protocol outlines specific measures and timetables for reducing production and consumption of CFCs and halons—other ozone-depleting compounds that are used in fire extinguishers. Under the provisions of the Protocol, developed countries must freeze production of CFCs at 1986 levels beginning in 1989. They must reduce production to 80 percent of 1986 levels by 1994 and to 50 percent of 1986 levels by 1999. Developing countries are allowed a ten-year delay in implementing provisions as long as production of CFCs does not exceed a specified limit. The Protocol was implemented in January 1989.

A flexible agreement, the Protocol is subject to reevaluation as new scientific information emerges. In fact, it is already being revised as a result of more conclusive evidence that CFCs are at least partly responsible for ozone depletion over the Antarctic and new findings suggesting that CFCs may also be responsible for ozone depletion over mid- and high-latitude areas of the northern hemisphere. It now appears likely that an 85 percent reduction or full phase-out of ozone-depleting compounds will be adopted.

Emergence of the CFC issue

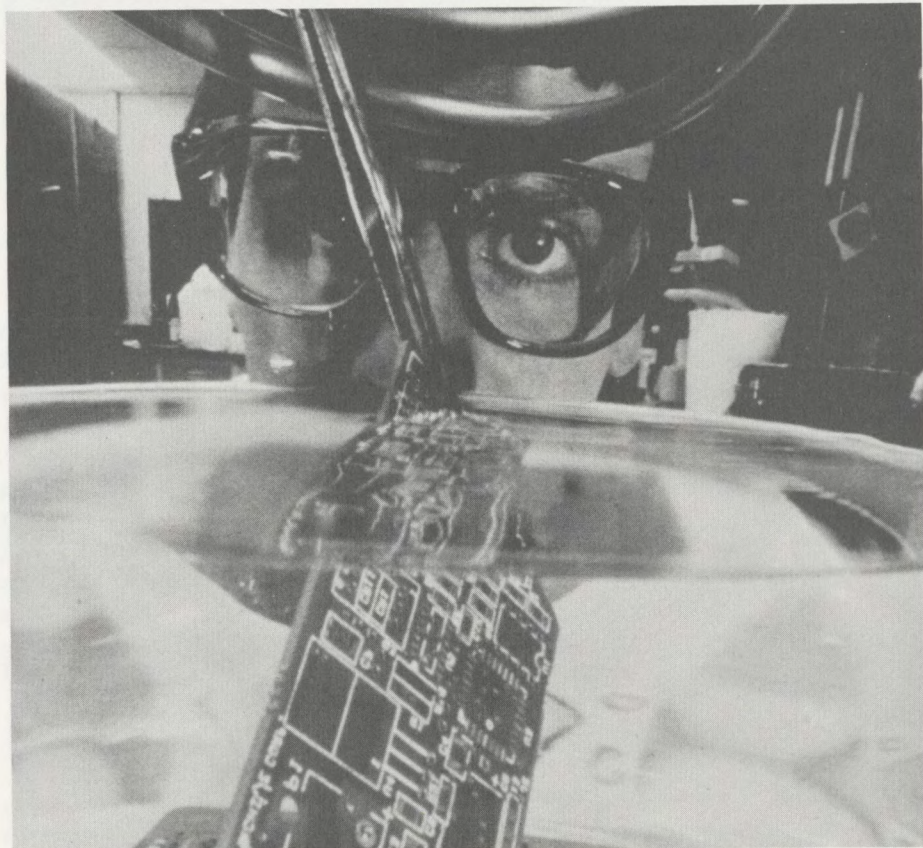
The issue of stratospheric ozone depletion was first raised in the United States in 1970 in the context of concern over potential impacts on the ozone layer from

the proposed large commercial fleet of high-flying supersonic transports (SSTs). However, ozone depletion did not become an important issue on the environmental and political agendas in the United States until the discovery, in 1974, that CFCs used as aerosol propellants could deplete stratospheric ozone. As a result of the scientific and political debate following this discovery, the EPA banned the nonessential use of CFCs as aerosol propellants in 1978. Canada, Sweden, Norway, and Denmark took similar action.

By the late 1970s, it was becoming clear that ozone depletion was a global problem and that an effective response would have to be international in scope. Several international organizations became actively involved in the issue, including the United Nations Environment Programme, the World Meteorological Organization, and the Organization for Economic Cooperation and Development. They began coordinating international research on and monitoring of the CFC/ozone depletion problem.

In 1981, the United Nations Environment Programme began drafting an ozone protection convention. The resulting Vienna Convention for the Protection of the Ozone Layer was adopted by 43 nations at a conference in March 1985. Although no specific protocol on the control of CFCs was included, the convention did outline the responsibilities of nations for protecting human health and the environment from the adverse effects of human activities that modify the ozone layer. It also called for international cooperation in research, monitoring, and information exchange and for continued discussion of CFC controls.

In 1986, a new sense of urgency arose concerning stratospheric ozone depletion. Talks on a CFC protocol to the Vienna Convention resumed in December 1986. A few months later—influenced by new scientific evidence and by pressure from the public, politicians, and environmental groups—negotiators reached an initial compromise on the need for a 50 percent reduction in CFC production and a freeze on halon production. The resulting



An engineer at du Pont's Experimental Station tests an alternative cleaning agent targeted to replace an agent containing CFCs.

Photo courtesy of E. I. du PONT de NEMOURS & COMPANY

Montreal Protocol represents a remarkable achievement in building consensus and fostering compromise among parties with varied and competing interests. It evolved from a decision-making environment in which key stakeholders such as the scientific community, industry, governments, international agencies, and nongovernmental organizations could develop a shared understanding of the CFC/ozone depletion problem and approaches for dealing with it.

Building international consensus

Between the Vienna Convention in 1985 and the meeting in Montreal in 1987, three key factors evolved, leading to international agreement on a CFC proto-

col. The first factor was the growing scientific understanding of the stratospheric ozone depletion problem. Improvements in the collection and assessment of data and in the development of atmospheric models led to a stronger scientific base on which to argue for and develop control strategies. Reports issued jointly by WMO/NASA and EPA/UNEP in 1986 were particularly important because they demonstrated a strong consensus among scientists and policymakers that the ozone depletion problem was real, that it was global in scope, and that society would have to deal with its effects for perhaps, centuries to come.

The second factor was the increasing public and political concern for the problem. This concern was based on the threat of increased skin cancer and the percep-

tion of potential global catastrophe associated with the 1985 discovery of the hole in the ozone layer over the Antarctic. In particular, the ozone hole, as a symbol of the potential impacts of ozone depletion, galvanized world opinion.

The third factor was the availability of economical CFC substitutes that would not deplete stratospheric ozone. Industry perceived that an international protocol was a necessary mechanism for providing economic incentives to further develop and market CFC substitutes that it had begun developing in the 1970s. In 1986, E. I. du Pont de Nemours & Company, the world's largest producer of CFCs, announced that suitable alternatives could be available within five years given the right market conditions, and industry representatives endorsed a position favoring a reasonable global limit on the growth of CFC production capacity.

The case of global warming

Agreement on the Montreal Protocol was achieved because there was scientific consensus, public and political interest, and the support of major negotiators. With respect to the global warming issue, however, less agreement exists. Certainly there is scientific consensus that the atmospheric concentration of greenhouse gases has been increasing and that the greenhouse effect is real. However, scientists do not agree on the rate of onset and the potential magnitude of the problem. Nor do they agree on greenhouse impacts, particularly at the regional level.

In the case of ozone depletion, a concerted international effort was made to build a strong scientific base on which to formulate policy. All of the uncertainties concerning ozone depletion were not resolved when the Montreal Protocol was signed; however, at that time scientific consensus did exist on the potential magnitude of the problem and on potential health and environmental risks. Building such a scientific assessment concerning global warming is just beginning.

Although public and political interest in global warming is considerable—particularly as a result of the North American drought in 1988 and the attention that the greenhouse issue has been re-

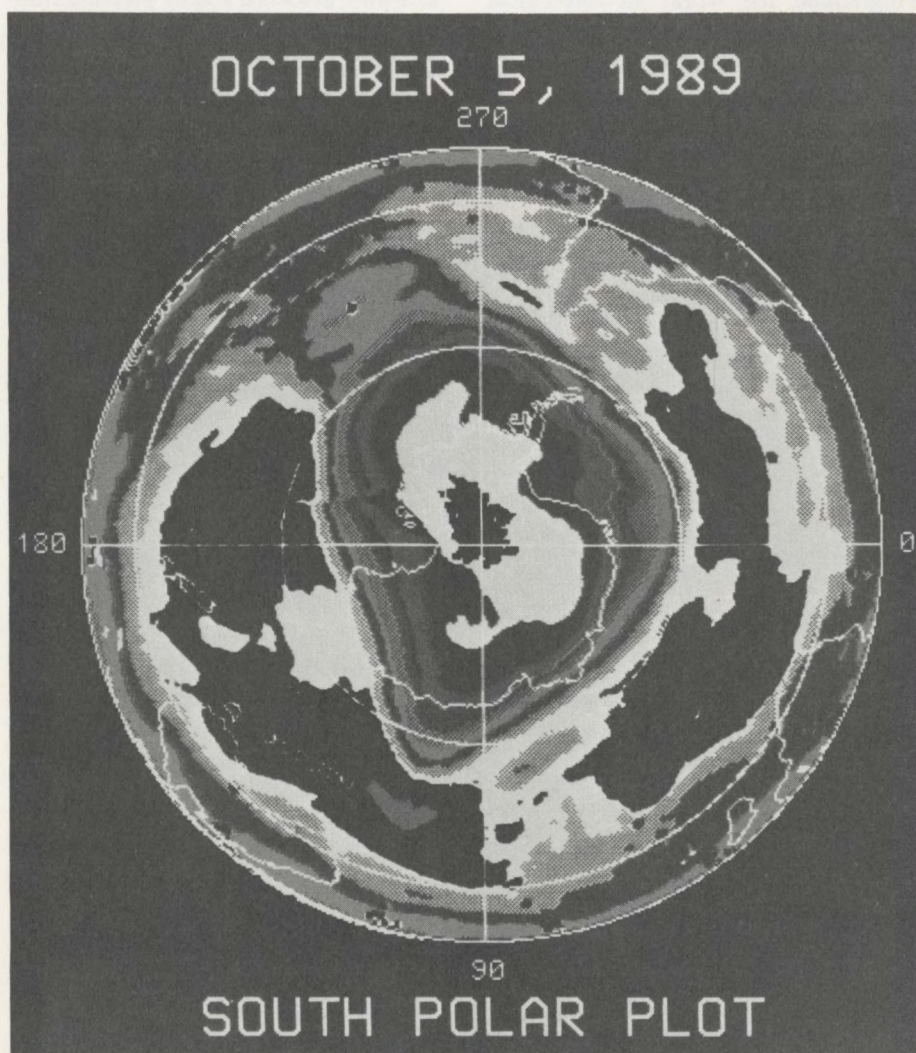


Photo courtesy of NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

This satellite photo shows the ozone hole centered over the South Pole in 1989; ozone depletion was greater around the periphery of the pole in 1988.

ceiving in the popular media—it is not as focused as it was and still is for the ozone depletion issue. This is because the potential impacts of global warming are more uncertain, less tangible, and less immediate than those associated with ozone depletion. Nations, industries, and national and international agencies and organizations disagree on what, if anything, to do about global warming.

There are other ways in which the two issues differ. First, ozone depletion is and will be more manageable than dealing with global warming—a considerably more complicated problem. Reducing carbon dioxide emissions, a major contributor to global warming, will require regulating fossil fuel use, which is central to all economic activities from the local to the global level.

Second, the perception that there may be winners and losers among countries was not an important issue with regard to ozone depletion in the way that it is with respect to global warming. Some countries perceive themselves as potentially benefiting from the changing climatic conditions associated with global warming. Thus assessments of costs and benefits will be a central factor in how individual countries respond in any negotiations on global warming.

And last, the developing countries may be less amenable to measures that slow global warming than they have been to cutting CFC use. It will be much more difficult to gain their approval of an international agreement on global warming as they have a much greater stake in the use of fossil fuels than in CFCs.

Lessons for future negotiations

What lessons does the Montreal Protocol offer for formulating international responses to global warming? Certainly the experience of negotiating and implementing the Montreal Protocol has better prepared us for dealing with global warming and other global environmental problems. In general, the negotiation of the Montreal Protocol demonstrates the necessity of building on past decisions and compromises—such agreements do not happen overnight. Similarly, the international community will have to construct a framework of decisions and actions to

serve as a foundation for substantive international agreements on global warming.

In particular, the negotiation of the Protocol evinces the need to develop a decision-making environment that is conducive to resolving complicated scientific, economic, and political issues that are often barriers to international agreement on global environmental problems. In such an environment, the goals of nations can be integrated with those of the scientific, industrial, and environmental communities. Any international agreements concerning global warming will depend on an integration of these goals.

In addition, the Montreal Protocol suggests the usefulness of formulating very focused agreements. It may be difficult to achieve a broad “law of the atmosphere” in the next ten years, but it may be possible to formulate more specific multilateral and international agreements on global warming research and

monitoring, energy efficiency, technology transfers, or deforestation that could provide the foundation on which to build a broader agreement.

Dealing with global warming presents the international community with an even more difficult task than combating ozone depletion. The scientific, political, and economic uncertainties are greater, and the stakes are higher. While the Montreal Protocol is not an exact model for addressing the global warming issue, it does provide insights on a process for negotiating solutions to global environmental problems. ■

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The federal role in outdoor recreation

Marion Clawson

After World War II, the rate of increase in visits to federal recreation areas began to decrease, until by the 1970s and 1980s it had slowed dramatically as more Americans availed themselves of local and private outdoor recreation facilities. Congress must now consider the role the federal government should play in providing and funding future outdoor recreational opportunities.

The first observance of Earth Day evoked great popular support for environmental measures. To a large degree, this new environmental movement reinforced, and was reinforced by, a continued increase in outdoor recreational activity in the United States. In the

twenty years since the first Earth Day, however, this increase has slowed. In particular, the rate of increase in visits to national parks and other federal recreation areas has diminished in comparison to that of the decades before 1970. This and other trends in outdoor recreation have prompted a reassessment of recreation demand and supply and of the federal government's role in providing future outdoor recreational opportunities.

Over the last twenty years, researchers have observed several fundamental changes in patterns of outdoor recreation. These include a slowdown in the increase of visits to federal and state recreation areas and a more rapid rate of growth in the use of private outdoor recreation areas and facilities.

With respect to attendance at federal recreation sites, visits to national parks increased only 2.5 percent during the 1970s as compared to 5.4 percent in the 1960s, and increased only 2 percent between 1981 and 1986. The rate of increase was much larger at the more accessible national recreation areas, which tend to be located near urban areas, but it was still much lower in the 1970s than the preceding decade—only 5.7 percent as compared to 9.6 percent. The rate of increase in visits to state parks has also slowed since 1970. Growth in visits dropped to 2.3 percent per year in the period from 1971 to 1981, as compared to 6.3 percent between 1961 and 1971.

One explanation for the slowdown is that Americans, as a whole, have reached the limit of their use of the outdoor recreational opportunities provided by the federal and state systems. For a long time park managers and recreation specialists believed that use of such areas would continue to grow more or less at past rates. It now appears that the old assumption of continued growth is wrong and that further increases in per capita attendance at federal recreational areas will be small.

By contrast, there appears to be a greater rate of increase in the use of private outdoor recreation areas and facilities. Data on activities at these sites are usually poor or nonexistent. However, the data that are available on snow skiing, golf, tennis, and other sports suggest that use of private recreational facilities and areas has grown since 1970, although, as in the public sector, the rate of growth overall may have slowed compared to the 1945–1970 period.

Several factors may account for these changes in the use of recreational facilities. The first is a sharp decrease in leisure time. A survey of leisure activity conducted in 1984 revealed that between 1973 and 1984 average leisure time declined from 26 to 18 hours per week. While this change was not accompanied by a decline in reported outdoor recreation activities, there was an apparent shift to recreation close to home and to visits of shorter duration at federal recreation sites. This shift in recreational activity was probably the result of demographic changes, the most important of which have been the rapid aging of the U.S.

population and the growth of participation in the labor force by women since 1965. The latter may account for a major portion of the decline in reported leisure. A second factor affecting recreational activity has been the rise in interest and participation in physical fitness activities such as jogging and bicycling that are generally engaged in close to home. They

The issue of who should fund outdoor recreation is a thorny one.

require neither specialized recreation facilities nor large unimproved land areas such as those characteristic of federal recreation sites.

The increase in participation in physical fitness and decrease in leisure time have affected preferences for recreation sites. The Forest Service's Southeast Experiment Station has recently estimated that use of federal sites accounts for only about 13 percent of total leisure-time activity, while use of local recreation facilities accounts for more than 50 percent. Use of state and privately owned lands accounts for the remainder.

Recreation planning

The federal government's role in providing and funding recreational opportunities has been the major issue in recreation planning since 1958, when the Outdoor Recreation Resources Review Commission (ORRRC) was established. One of the commission's major concerns was the apparent lack of a coherent federal policy regarding outdoor recreation. It observed in a 1962 report that numerous federal agencies provided recreational opportunities as an incidental matter, but not as part of their primary, or even official, responsibilities. It therefore stressed the need for greater federal efforts in providing these opportunities.

The commission led directly to the establishment of the Bureau of Outdoor Recreation in 1963. The bureau was directed to prepare a comprehensive nationwide outdoor recreation plan within five years — a plan that would be revised

and updated every five years thereafter. The initial plan, drafted two years behind schedule, was never released by the White House or transmitted officially to Congress. The attempted suppression of the report was probably due to its recommendation that the federal government play a far larger and more expensive role in providing recreational opportunities than many thought appropriate. Eventually issued by a Senate committee in 1974 as "The Recreation Imperative," the report stressed federal activity in providing local outdoor recreation.

A revised and toned-down report had already been prepared by the Department of the Interior and transmitted to Congress in December 1973. "Outdoor Recreation: A Legacy for America," which constituted the second nationwide recreation plan, did not deviate greatly from the first except for a reduced emphasis on the role of the federal government.

In 1979 the Heritage Conservation and Recreation Service, the successor to the Bureau of Outdoor Recreation, submitted the "Third Nationwide Outdoor Recreation Plan." Based on two comprehensive surveys, one on outdoor recreation participation nationally and the other on urban outdoor recreation, this plan differed from the previous two in that it sought broad public participation both in identifying preliminary issues and in shaping recommendations for decisions.

Each of the three reports considered recreation demand based on population and economic factors and on rates of participation in recreational activities by defined segments of the population. Each considered land and water areas available for outdoor recreation. And each discussed the role of government at various levels—especially the third plan, which called for better data and more research to determine what that role should be. However, none of the reports mention the slowdown in the increase of visits to federal recreation sites, a trend that had become quite noticeable by 1979. In addition, they all carefully skirt the most difficult policy issue: Who is going to pay the bill?

When the Reagan administration assumed office in 1981, it began to cut back substantially on federal funds for outdoor recreation. Payments were still

made into the Land and Water Conservation Fund, out of which money was made available to federal agencies to purchase land or make improvements in it, but appropriations from the fund greatly lagged. Funds for the acquisition of private holdings in national parks and other federal areas were also cut back. At the same time, the Heritage Conservation and Recreation Service was abolished and its functions transferred to the National Park Service. Funds and personnel for the Park Service were also cut back. In short, the federal presence in outdoor recreation was downgraded.

In light of this situation, several conservation and recreation leaders recommended that Congress authorize a new commission to reconsider and update the 1962 report of the Outdoor Recreation Resources Review Commission. The President's Commission on Americans Outdoors was appointed by executive order in 1987. Its report placed more emphasis on private recreational areas than earlier reports had. The commission acknowledged declining growth in the use of federal recreation areas but did not accord that decline prominent attention. In fact, its report rejected the idea that pressure on recreation resources was easing. Instead it noted the increasing interest in outdoor recreational opportunities

A presidential commission recommended dedicating revenues from recreation user fees to recreation uses.

close to home, where available resources and facilities were perceived as already crowded.

Funding debate

As for funding to increase local recreational opportunities, the president's commission recommended greater reliance on recreation participants through the implementation of higher entry fees and equipment taxes. This would amount to an important shift in the funding of public outdoor recreation, which had



Recreation specialists once believed that attendance at federal recreation areas like the Shenandoah National Park would continue to grow steadily.

typically involved substantial payments out of general public revenues. In 1982, per capita recreation expenditures by the federal government were about equal to those by the state governments combined. Together these expenditures were less than half the amount spent by county and city governments. User charges raised about a quarter of the operating costs for state parks and recreation areas and about a sixth for local areas, but much less for federal areas. Park managers have lacked interest in charging entry fees since those collected are not earmarked for recreation but go into the general fund. However, the commission was emphatic that revenues from such fees should be dedicated to recreation uses.

The commission also recognized the importance of private providers of recreational opportunities and recommended the investigation of more effective incentives for private recreation supply. It sought special attention to the problem of increased liability of landowners, which was regarded as a barrier to greater use of private land for recreation.

The commission entered a highly controversial arena in its recommendation of an annual federal appropriation of \$1 billion or more and the creation of an

outdoor recreation trust fund into which money from the Land and Water Conservation Fund and from other federal appropriations would flow. Federal agencies could make expenditures from the trust fund without going through the appropriation process. These funds would then be made available to local and state agencies, perhaps on a matching basis, for expansion of recreation facilities locally. The commission and supporters of these provisions were anxious to establish a reliable and dependable source of annual funds by sidestepping the control of both Congress and the Office of Management and Budget.

It is precisely this freedom from control which leads many, inside and outside Congress, to oppose strongly the creation of such a fund. Increased appropriations in this time of budget stringency are also hard to secure. Bills to implement the commission's recommendations were introduced but have yet to be approved in Congress. Nevertheless, many organizations interested in outdoor recreation strongly endorse the commission's recommendation that an outdoor recreation trust fund be created. They scarcely mention the major role of local government emphasized by the commission.

After reviewing the report of the president's commission, the White House Domestic Policy Council assembled a task force of officials from federal agencies concerned with recreation, which took a more analytical approach than did the commission. Whereas the president's commission, in its report, conveyed a sense of urgency and concern about deteriorating federal efforts for outdoor recreation, the task force report was congratulatory, taking great pride in what it viewed as the superior accomplishments of the Reagan administration. This substantial difference in tone perhaps obscured the extent to which the two studies reached similar conclusions. In view of the slowing growth in use of federal facilities, the task force considered the main federal issue to be the improvement of coordination among federal agencies. It strongly favored greater reliance on user fees at federal recreation sites. Such fees were promoted as rationing devices, revenue raisers, and a means of encouraging the private provision of recreational opportunities by eliminating unfair competition.

Like the president's commission, the task force placed special emphasis on the importance of local organizations and supported the commission's recommendations for the encouragement of local and private provision of recreational opportunities. However, in keeping with the political philosophy of the Reagan administration, there is no mention in the task force report of either the \$1 billion annual appropriation or the trust fund.

Future use and management issues

The recent fundamental changes in patterns of recreation use have prompted a reevaluation of important recreation policy questions such as who is to provide recreational opportunities, who should pay, and in particular what the federal government's role should be. Today local governments remain the most important providers of recreational opportunities in the United States, as measured by visits. It is estimated that more than half of all recreation use takes place at local recreation sites, which mainly support user-based recreation activities

such as athletic competitions that do not depend on particular site attributes. By contrast, the federal government remains the most important provider of resource-based recreational opportunities, offering sites that are unique for their natural wonder or historical significance. State recreation sites typically fall somewhere between user- and resource-based recreation. Recreational opportunities pro-

While continuing to provide outdoor recreation, the federal government is unlikely to add to its recreation estate.

vided by the private sector can run the gamut from user- to resource-based.

There is a certain economic rationale to the federal provision of resource-based recreation. While there remain numerous federal recreational areas that are scarcely distinguishable in their function and attractiveness from state or local sites, most observers agree that the federal government's role in outdoor recreation should be limited to those sites of national interest in the national park system and to the more important wilderness areas. Both the President's Commission on Americans Outdoors and the Domestic Policy Council's task force advocate decentralization of responsibility in the provision of recreation. If the growth in recreation demand is now primarily local, as recent trends suggest, then the best way to meet the demand is through local providers—that is, local governments and private landowners.

One special aspect of the growing interest in decentralization is the effect government actions have on private suppliers of outdoor recreation. Many people agree that it would be desirable for private citizens and organizations to play a greater role in supplying outdoor recreational opportunities. With this in mind, some states have passed laws relieving private property owners of legal liability to recreation users if no fee is charged. Yet such laws may remove financial incentives for resource owners to provide

or allow outdoor recreation on their properties. Moreover, the fact that low or no entrance fees are charged for the use of public areas and public facilities makes it difficult for those private parties, who are trying to make a profit from the provision of outdoor recreational opportunities, to compete.

On the other hand, some states provide subsidies to private landowners to preserve wildlife habitats or to allow recreational uses. However, even in those instances in which the subsidies appear successful it is often difficult to determine whether landowners engage in the desired behavior because of the subsidy or whether they would have taken the action regardless of the subsidy.

No one doubts that the federal government will continue to play a major role in the provision of outdoor recreational opportunities, although major additions to the federal recreation estate are unlikely. A thornier issue is the provision of local recreational opportunities. While there is substantial agreement among interested parties that future additions to recreational capacity will generally be locally owned and operated, that does not necessarily mean that they will be locally financed. The Bush administration is likely to encourage local financing of local recreation, reserving federal funds for making improvements to existing federal sites. But some worry that even these funds might be cut as they were in the Reagan days. User fees at federal recreation sites might replace appropriations not forthcoming from the federal government. However, until such fees are dedicated to recreation uses at the places from which they originated, they are of little value in guaranteeing that future funding will be available where most needed. ■

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Confronting future environmental challenges

Allen V. Kneese

On the twentieth anniversary of Earth Day, the United States—indeed, the world—confronts much greater environmental challenges than it did in 1970. The pollution control problems that preoccupied the public two decades ago tended to be local and regional in scope; today's appear more far-ranging. In retrospect, the environmental problems of 1970 seem rather straightforward; looking ahead, those of 1990 appear much more daunting.

The early 1970s saw the greatest outpouring of legislative initiatives ever on a single issue—the environment. Just a few months after the first Earth Day on April 22, 1970, President Nixon proposed the establishment of the Environmental Protection Agency, which would consolidate federal environmental programs. Earlier that year he signed legislation that established the Council on Environmental Quality and required environmental impact statements for large federal projects. In 1970 Congress also passed the Clean Air amendments, which called for the establishment of national air-quality standards, and the Water Quality Improvement Act, which established liability for oil-spill clean-up costs. Over the next twenty years Congress would enact over twenty other major environmental laws, including the Federal Water Pollution Control Act of 1972 and amendments to the Clean Air, Water Quality Improvement, and Federal Water Pollution Control acts in 1977.

Perhaps more important than these legislative actions, however, has been a fundamental change in the attitude of the American public toward the environment. The environmental concern that began emerging in 1970 has now so thoroughly penetrated American society that even industry has seen the need to cooperate in preserving environmental quality. This

was not always the case, as an incident during the 1970 Earth Day ceremonies at Colorado College illustrates.

Among the speakers at the ceremonies was Charles Wurster, who had recently established the connection between traces of the pesticide DDT in the environment and the thinning of eggshells of carnivorous birds—especially those of the peregrine falcon, which was about to become extinct. The atmosphere became emotionally charged as a Colorado College biology professor walked on stage bearing a falcon on his arm. Still struck by the beauty and majesty of the bird, the audience was now treated to a slide show courtesy of a chemical company representative. The show depicted how herbicides were aiding in the construction of interstate highways. The first slide featured a bulldozer crashing through a magnificent fir forest in the Pacific North-

Despite much legislation and the rise in environmental consciousness, much of the environmental agenda of the 1970s and 1980s remains unfulfilled.

west. The assembled students groaned. The next two slides showed how a particular herbicide controlled foliage on roadbeds by killing plant roots. As each new slide was presented, it was greeted with jeers and catcalls. Then suddenly the humor of the situation dawned on everyone and the rest of the slides were met with gales of laughter. The chemical company representative, who plodded through his entire prepared show, received a tremendous ovation at the end.

Happily the great gulf that has existed between industry and environmentalists

is beginning to diminish. The vice president of Dow Chemical was recently quoted as saying that industry should change its goal from environmental "compliance" to environmental "stewardship." This new attitude is fortunate indeed since the country will need all of industry's technological powers to meet the demand for both environmental protection and economic growth.

Despite the shift in American thinking concerning the environment and the avalanche of environmental legislation since the first Earth Day, much of the environmental agenda of the 1970s and 1980s remains unfulfilled. Automotive and industrial emissions still diminish air quality in many metropolitan areas. Water quality has not improved much in some places. Experts and private citizens still debate how and where to manage both hazardous and household solid wastes.

Efforts to deal with these and emerging environmental problems will be complicated by several factors. First, sources of pollution are widespread and sometimes diffuse. Second, the effects of most kinds of pollution on human health and the environment are uncertain. Along with the first factor, this uncertainty makes the costs and benefits of environmental protection measures difficult to gauge. Third, some environmental problems are global in scope and cannot be managed through domestic efforts alone; international cooperation is required if they are to be effectively controlled.

One or more of these factors apply to each of three environmental issues that are the subject of increasing debate as we commemorate the twentieth anniversary of Earth Day. They are the long-range transport and accumulation of pollutants in environmental media, the effects of agriculture on the environment, and nuclear waste management.

Acid rain, global warming

Before the early 1970s, it was common to think of the sources and manifestations of environmental problems as mostly local or regional in scope. More recently scientists have observed that pollutants, particularly those emitted into the air, can be transported and can accumulate far from the place of origin,



Photo courtesy of the U.S. FISH AND WILDLIFE SERVICE

A peregrine falcon helped raise the environmental consciousness of students at Colorado College on Earth Day 1970.

causing widespread environmental degradation. Two phenomena associated with the long-range transport and accumulation of pollutants in environmental media are acid rain and global warming.

Acid rain occurs when sulfur dioxide (SO_2) and nitrogen dioxide (NO_2), which are emitted in industrial operations such as electricity generation, chemically react in the atmosphere to form sulfuric and nitric acids. These acids can accumulate in soil and bodies of water, retarding plant growth and killing fish. Sulfur dioxide and nitrogen dioxide emissions in the United States are blamed for acid rains that may damage forests as far away as Canada.

This year Congress is considering a major reauthorization of the Clean Air Act, as part of which it is investigating the trading of emissions-allowance permits among electricity generating plants, a major source of SO_2 emissions. Under this approach, a plant that would be required to reduce its SO_2 emissions would have the option of making the reduction

itself or paying other plants to reduce their emissions in excess of their required amounts. Such a purchase would be allowed as long as the total emissions reduction target was met. Emissions-permit trading would be pursued by those plants that find it cheaper to buy emissions reductions than to improve their own emissions control. Economists say that such trading would probably prove a more efficient way of meeting national SO_2 emissions standards than the traditional regulatory approach, perhaps saving billions of dollars.

A more difficult problem, since it will require more than domestic initiatives, is global warming, a phenomenon many scientists believe will result from the accumulation in the atmosphere of carbon dioxide emissions and other so-called greenhouse gases. These gas emissions, some say, will create a blanket around the earth, causing the earth to retain heat. The potential effects of this rise in temperatures worldwide include coastal inundation and erosion, resulting from a

rise in sea levels, and ecological and agricultural changes.

A comparison of global warming with ozone depletion, another atmospheric change phenomenon, is instructive. Ozone depletion was the subject of a recent international agreement calling for a reduction in the production of chloro-fluorocarbons (CFCs), which destroy ozone in the stratosphere. The United States is one of thirty-nine countries that have signed the Montreal Protocol on Substances that Deplete the Ozone Layer, which went into effect in 1989. Whether the agreement in practice will be adequate to prevent further ozone depletion remains uncertain.

As Peter M. Morrisette points out in this issue in "Negotiating Agreements on Global Change," the problem of global warming differs from that of ozone depletion in several significant ways, making an international agreement on global warming much more difficult to achieve. For one thing, there is no consensus in the scientific community about the consequences of global warming. While scientists agree that emissions of CFCs have resulted in ozone depletion, they are in less accord about the effects of carbon dioxide and other greenhouse gases on the earth's lower atmosphere, land, and oceans. Some question whether global warming would cause a rise in sea level as previously thought. According to one theory, precipitation will increase as a result of increased evaporation caused by warmer temperatures. But if that precipitation takes the form of snow on Greenland, and there is cold enough for the snow to stick despite the temperature increase, the rise in sea level would be small or nonexistent. In the face of such uncertainties it may be difficult for nations to decide if they should do anything about global warming. In addition, getting countries to agree to control emissions of greenhouse gases will be more difficult than getting them to agree to control CFC production. CFCs are an important industrial chemical but not one upon which any country's economy hinges. By contrast, reducing fossil fuel use to lower carbon dioxide emissions could come at the cost of economic growth, or economic decline, in some countries.

For the present, it appears prudent to continue monitoring climatic changes and developing more capable models for predicting the consequences of a global rise in temperature. Other well-advised actions would include controlling fossil fuel use, perhaps by taxing it more steeply; using renewable resources better; and designing safer and more dependable nuclear energy technologies (which produce no greenhouse gases) including better technologies for nuclear waste disposal.

Agriculture and the environment

The impact of agricultural activities on the environment was not a major concern of the environmental legislation of the 1970s. For example, in focusing on "point," or direct, sources of water pollution, which are mainly industrial and municipal, the Federal Water Pollution Control Act of 1972 gave little consideration to "non-point," or diffuse, sources of pollution, which are often agricultural. Yet today the major pollutant load on U.S. water courses is from non-point sources, primarily agriculture. Runoff from cultivated land can contaminate water with agricultural chemicals, as well as deplete oxygen in water and add excess nutrients and salt to it. In addition, soil eroded from farm land can silt up reservoirs, destroy fish habitat, and constrict river channels (which leads to increased flooding). It is likely that future water quality improvement will be possible only through further control of non-point sources of pollution. However, controlling these sources presents far more complex regulatory problems than does controlling point sources.

Scientists now recognize that agricultural activities have far reaching impacts on the environment. They even affect the earth's carbon cycle, which in turn affects weather and climate. For instance, the burning of trees to clear land for crop cultivation releases carbon dioxide. This contributes to global warming and may reduce the earth's ability to absorb carbon through the process of photosynthesis. As the effects of agricultural activities on the environment become more clear, the United States and other countries must determine which circumstances are likely to permit both indefinite development of

profitable agriculture and environmental protection. The United States has already begun to examine policies that might better integrate the different objectives of agricultural and environmental programs. For the first time, broad environmental concerns will be a major factor in formulating agricultural policies as Congress debates the 1990 farm bill.

Nuclear waste

Thus far efforts to deal with both civilian and military nuclear wastes in a decisive way have come to nought. For some years the Department of Energy (DOE), which is responsible for nuclear waste disposal in the United States, has been trying to find a place to store the most dangerous of nuclear wastes—those that must be isolated from ecological systems for at least ten thousand years. The search for a geological formation suitable for long-term storage of high-level nuclear waste has come to focus on Yucca Mountain in Nevada. However, political resistance from Nevada plus doubts about the geological integrity of the site have led to a standoff between the state of Nevada and the DOE. Although

No one knows how much it would cost to clean up soil contamination at nuclear weapons facilities, or even whether it is possible to do so for any price.

the federal government has spent more than half a billion dollars studying the mountain's suitability as a nuclear waste storage site, DOE Secretary James D. Watkins recently reported that the site assessment work performed thus far was not of sufficient quality to allow the Nuclear Regulatory Commission to grant the necessary licenses for nuclear waste disposal at Yucca Mountain.

Waste storage is not the only issue. Soil contamination exists at federal nuclear weapons facilities, including Hanford in Washington, Rocky Flats in Colorado, and Savannah River in Georgia. No

one knows how much it would cost to clean up these sites or even whether it is possible to do so for any amount of money. Currently no technological means are available to speed up the degradation of the substances involved. At present the objective of nuclear waste management is to better shield the environment from nuclear waste than it has been shielded in the past. Estimates of the costs of doing this range into the hundreds of billions of dollars.

Sustainable development

Discussion of the new generation of concerns often proceeds under the terminological umbrella of "sustainable development," a concept that spans a range of moral and economic considerations. The general concerns it envelops are continued improvements in the well-being of people in developed countries, improvement in the well-being of people in developing countries, and protection and maintenance of a safe and attractive environment.

These goals cannot be achieved without a better understanding of the natural world than we now possess and a much greater ability to put that understanding into practical use through technology. Thus we have no choice but to make technology serve human interest better than ever before. In this context the conventional distinctions among natural resources, the environment, and human resources blur. Indeed, the central focus becomes human knowledge, skills, and innovative and adventurous behavior, all of which are beyond our present ability to measure and assess, despite their clear importance. What we do know is that education is a prerequisite for most of them. In that connection, on every test of scientific and intellectual attainment our young people rank behind every other industrialized country. That may be our greatest challenge for Earth Day 1990. ■

Allen V. Kneese is a senior fellow in the Quality of the Environment Division at RFF. A former director of that division and of the former Water Resources Program, he joined RFF in 1960.

Applicants sought for leadership program

The National Center for Food and Agricultural Policy at Resources for the Future is now accepting fellowship applications for the sixth annual Leadership Development Program. Applicants must have at least a baccalaureate degree and have completed at least five years' work in a field related to food and agriculture.

The program provides an opportunity for mid-career professionals to obtain four-week public policy fellowships in Washington, D.C. Those selected participate in specially designed seminars and workshops. Areas of study include the policymaking process and policies relating agriculture to food and nutrition, rural development, international trade, and natural resources and the environment.

Those selected also undertake independent policy projects dealing with a food or agricultural policy issue of their choice.

The 1991 program is divided into two two-week segments, separated by a two-week interval. It will run from January 29 to February 13 and March 3 to 16, 1991. Tuition is \$1,900. Limited support is available from the National Center for fellows in special circumstances.

To obtain an application form for the program, write to: 1991 Leadership Development Program, National Center for Food and Agricultural Policy, Resources for the Future, 1616 P Street, N.W., Washington, D.C. 20036. Telephone (202) 328-5117. The deadline for submitting applications is September 14, 1990. ■

New NCFAP senior fellows named

Dale E. Hathaway, a long-time advisor to the National Center for Food and Agricultural Policy at Resources for the Future, has been named a visiting senior fellow at NCFAP. Currently vice president of The Consultants International Group in Washington, D.C., Hathaway will continue to serve in that capacity half time. Prior to joining that firm in 1981, he was the Assistant Secretary and later Under Secretary of Agriculture for

International Affairs and Commodity Programs at the U.S. Department of Agriculture.

Katherine H. Reichelderfer, an agricultural economist with expertise in the area of linkages between agriculture and the environment, has been named a NCFAP senior fellow. She previously held a number of positions at the Economic Research Service of the U.S. Department of Agriculture. ■

Center head named

Michael Gough, an expert on environmental and occupational risks to health, is the new director of the Center for Risk Management at Resources for the Future. Before joining the center as a senior fellow in 1987, Gough worked as a consultant at ENVIRON Corporation, where he directed risk assessments on food additives, hazardous waste sites, and municipal and hazardous waste incinerators. Before that he worked at the congressional Office of Technology Assessment, where he directed studies in environmental and occupational health. ■

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To order discussion papers and reprints, please send a written request, accompanied by a check, to Publications and Communication at the same address.

New books

Public Policies for Environmental Protection, edited by Paul R. Portney

This book evaluates the accomplishments and the costs of environmental regulation since the 1970s. Portney and his coauthors analyze the issues, progress, and problems in five major areas of environmental policy and regulation: air pollution, water pollution, hazardous wastes, toxic substances, and compliance monitoring and enforcement.

In identifying and analyzing trends likely to influence environmental policy in the near future, Portney notes the recent emergence of environmental federalism in which the states take an increasingly active part in environmental regulation and enforcement. He also points to the withering of administrative discretion, which reduces the flexibility of regulatory officials in dealing with environmental problems. In addition, he suggests the importance of the growing awareness of global environmental problems such as greenhouse warming and ozone depletion—problems that transcend domestic regulatory solutions.

April 1990. 323 pp. \$9.95 paper.
ISBN 0-915707-53-5. \$25.00 cloth
ISBN 0-915707-52-7

Readings in Risk, edited by Theodore S. Glickman and Michael Gough

This volume reflects the sharp growth of scholarly inquiry into risk assessment, risk management, and risk communication. It also testifies to the mounting concern on the part of industry, government, and the public about the health and safety hazards posed by environmental contaminants and energy and transportation systems.

Developed for use by undergraduate and graduate students, researchers, policymakers, and interested laypersons, the book is a collection of authoritative yet accessible journal articles about risk. Glickman and Gough have drawn selections from a variety of disciplines,

including the physical and social sciences, engineering, and the law. The articles cover a wide range of public policy, regulatory, and management issues relating to risk and are accompanied by introductory notes, discussion questions, and suggestions for further reading.

June 1990. 288 pp. \$24.95 paper.
ISBN 0-915707-55-1

NCFAP policy review

Agricultural Policies in a New Decade,
edited by Kristen Allen

This volume examines the issues likely to be debated in the reauthorization of agricultural legislation upon the expiration in 1990 of the Food Security Act of 1985. Contributors to the volume explore several alternative proposals for agricultural policy; review policy tools that could be used to implement these proposals; and assess the impacts of various policy approaches on producers, consumers, taxpayers, rural communities, the environment, agribusiness, and other nations.

The book includes an examination of U.S. policy goals, an analysis of the merits of using the Food Security Act of 1985 as the basis of the new farm bill, and an assessment of the pros and cons of providing farmers with income assistance not based on production levels. It also explores the targeting and distribu-

Discussion papers

RFF discussion papers convey the early results of research for the purpose of comment and evaluation. They are available at modest cost, which includes postage and handling. The following discussion papers have recently been released.

Energy and Natural Resources Division

- "The Nation's Water Resources: Past Trends and Current Challenges," by Kenneth D. Frederick. (ENR90-02) \$5.00
- "The Nation's Cropland and Soils: Past Trends and Current Challenges," by Pierre R. Crosson. (ENR90-03) \$5.00
- "Rangelands," by B. Delworth Gardner. (ENR90-04) \$5.00
- "Is Regulation What Regulators Do?" by Charles G. Stalon. (ENR90-05) \$5.00
- "Recent International Developments Impacting United States Forest Products Trade," by A. Clark Wiseman. (ENR90-06) \$5.00
- "The Nation's Forest Resources," by Roger A. Sedjo. (ENR90-07) \$5.00

tion of program benefits, the economics of stabilization policy for food and agricultural markets, the linkages between environmental quality and agricultural support, and U.S. agriculture's emerging role in the global economy. This fifth

Quality of the Environment Division

- "Unintended Impacts of Public Investments on Private Decisions: The Depletion of Forested Wetlands," by Robert N. Stavins and Adam B. Jaffe. (QE90-09) \$2.25
- "Alternative Renewable Resource Strategies: A Simulation of Optimal Use," by Robert N. Stavins. (QE90-10) \$2.25
- "Innovative Policies for Sustainable Development in the 1990s: Economic Incentives for Environmental Protection," by Robert N. Stavins. (QE90-11) \$2.25
- "Environmental Economics: A Survey," by Maureen L. Cropper and Wallace E. Oates. (QE90-12) \$2.25
- "The Effect of Information on Health Risk Valuations," by Alan J. Krupnick and Maureen L. Cropper. (QE90-13) \$2.25

Center for Risk Management

- "Discounting and the Evaluation of Live-saving Programs," by Maureen L. Cropper and Paul R. Portney. (CRM90-02) Free

annual policy review is a companion volume to the 1989 review, *The Political Economy of U.S. Agriculture: Challenges for the 1990s*.

March 1990. 372 pp. \$20.00 paper.
ISBN 0-915707-54-3

Public
Policies for
Environmental
Protection
Paul R. Portney,
editor

New Book!

Public Policies for Environmental Protection

Paul R. Portney, editor

The authors take a new look at the issues, progress, and problems in environmental regulation from the changed perspective of the late 1980s. They rigorously examine environmental policy and regulation, with particular emphasis on the role of economics and the several ways by which the benefits and costs of environmental policy may be measured. Portney and his coauthors discuss air pollution policy, water pollution policy, hazardous wastes, toxic substances, and the monitoring and enforcement of compliance.

From the foreword

"In a word, this is a book for the public as well as the specialist—easily accessible to the general reader, and offering expert analysis and recommendations for the specialist."

—Lee M. Thomas
former administrator, EPA

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