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INDEX OF LEADING ENVIRONMENTAL INDICATORS,
NINTH EDITION

BY STEVEN F. HAYWARD

With contributions from Michael De Alessi, Holly Lippke Fretwell, Brent Haglund,
Joel Schwartz, Ryan Stowers, and Sam Thernstrom

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PREFACE TO THE 9TH EDITION

When the *Index of Leading Environmental Indicators* was launched 10 years ago, there were few efforts to develop environmental indicators or report trends in a useful way for the media or the public. This circumstance has changed for the better. The development of environmental indicators has become a growth industry in both the public and private sector, on both the national and local level. As often as not, these efforts reveal to us how much we don't know about environmental conditions and trends, which is one reason why we have too much policy-by-anecdote.

In the fullness of time the competition among various sets of environmental indicators should help fill the gaps in our knowledge and lead to better policy. The increasing interest in indicators allows our report to evolve from its initial format. It has always been the purpose of the *Index* to be expository rather than compendious, so that it could stay within a readable length. Hence it has concentrated on covering the highlights of research and data that are buried in cumbersome government databases or unwieldy reports.

The development of indicator sets is bringing more of this kind of analysis into public use, and as such makes our job easier. The *Index* is becoming a reference work that will shine a light on other worthy efforts at developing environmental trend data, such as last year's *Draft Report on the Environment* from the EPA, or the continuing work of the Heinz Center's *State of the Nation's Ecosystems* report from 2002.

Every year we try out new innovations with the *Index*. This year we include a larger number of case studies of efforts to address water issues that have received little or no media attention. Another new feature that we intend to include regularly in future editions is a comparison of U.S. environmental trends with those in Europe. It is commonly supposed that European environmental policy is more sophisticated and enlightened than U.S. policy. A comparison of actual results will surprise many readers.

As this report is now in its 9th edition, we are beginning to include updates of issues and research that have appeared in past editions. This edition includes new research on wind power (originally discussed in the 7th edition), asthma and air quality (7th and 8th edition), the Bjørn Lomborg controversy (7th edition), dam removal (7th edition), private efforts at habitat protection (8th edition), hormesis (8th edition), and energy technology (6th edition).

Finally, because of the breadth and complexity of the issues covered in the *Index*, this year we have supplemented the work of the *Index*'s main author Steven F. Hayward with contributions from researchers at the American Enterprise Institute, Property and Environment Research Center (PERC), and Reason Public Policy Institute. Their insights will help the *Index* to continue evolving.

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FOREWORD

BY BRENT HAGLUND

The 19th century in the United States can be characterized as that time when, in terms of land use, the axe, plow, and cow claimed the breadth of the land. In the 20th century trees reclaimed many of those acres. Resurgent woodlots and refulgent suburban lots became two of the nation's biggest land-use transformations.

The depopulation of many rural areas is due to the extraordinary increase in the productivity of American farmers. This has an environmental impact on land use. It is not just people who have left farming. Huge expanses of land are no longer under the plow.

Due to ingenuity, technology, and commercial enterprises applied to food production, tens of millions of acres in the United States now grow trees again. More than 25 percent of Wisconsin was abandoned from intensive agriculture during the 80 years which followed World War I. While certain states such as North Carolina have seen limited forest acreage loss in the last decade of the 1900s, in much of the nation farms or portions of farms continue to revert. County by county, state by state across the nation, sets of agricultural information, with land-use implications, have been compiled, reviewed, distributed, and used for decades.

This *Index of Leading Environmental Indicators* reminds me that some sets of environmental data which we should have for our use are weak, unnecessarily contentious, or both. Surface water quality is, in general, poorly documented. Maps of likely floodwater paths often provoke bitter disputes. Some government reports are declared, by combatants in the national environmental arena, to be politically tainted.

My modest suggestion is inspired by concerns raised in this edition of the *Index*. Municipalities and rural areas should encourage their citizens to establish and maintain a community-based "Local Index of Leading Environmental Indicators."

One ultimately fruitful way out of the political maze of land-use conflicts is for citizens to collaboratively, objectively, and routinely measure environmental performance features in their own communities. The process of securing and using sound information can establish a meaningful basis to assess and, over time, improve land use. This is not to say that to do so will be quick or easy.

For Aldo Leopold, the influential conservationist, land use was inextricably linked to democracy. His provocative 1942 "Land Use and Democracy" article in *Audubon Magazine* bears directly

on the need for measures of land use and to make deliberate use of such information. Some highlights of what Leopold had to say then include:

There is lacking only a simple formula by which we, and posterity, may act to make America a permanent institution instead of a trial balloon. The formula is: learn how to tell good land use from bad. Use your own land accordingly, and refuse aid and comfort to those who do not.

This is more to the point than merely voting, petitioning, and writing checks for bigger and better bureaus, in order that our responsibilities may be laid in bigger and better laps. This brings us to the real and indispensable functions of government in conservation.

Government is the tester of fact versus fiction, the umpire of bogus versus genuine. These functions will become real and important as soon as conservation begins to grow from the bottom up, instead of from the top down, as is now the case.

While there is as yet no consensus on how we learn how to tell good land use from bad, we certainly could document some of the discrete consequences which are detrimental to health, public safety, water, property value, fisheries, and the environmental amenities we enjoy in our communities.

It is responsible to grow conservation from the bottom up, as Leopold suggested. It is practical to deploy environmental monitoring locally. It is responsible, practical, and affordable for civic-minded environmentalists to engage with their neighbors to inventory, monitor, and report on consequences of land use in their communities. The basic machinery and personnel for a local index may be close at hand.

The Community Based Conservation Network of Sand County Foundation is all about helping to promote bottom-up conservation by citizens within their own communities. Civic environmentalism and community based natural-resource management can positively affect land use. Accessible monitoring can make land use better. We need to put the central idea of this *Index* to work locally where affordable solutions can be practiced.

Environmental awareness is high. Natural history and, at least, rudimentary scientific study can be practiced by many people. For instance, for a number of years the Izaak Walton League has provided assistance in voluntary stream monitoring. Technology is widely available to support both actual monitoring and dissemination and review of results.

In Pinellas County, Florida, students and teachers report on water quality, with the coordinated support of resource agencies. This example shows how ecological science is accessible, informative, and applicable to land-use decisions.

Private landowners and their neighbors in the Farmington Valley of Connecticut are using voluntary monitoring and reporting about vernal pools to make evident some possible consequences of land uses detrimental to the wildlife and plants. Wallowa County, Oregon has engaged a number of its citizens in stream edge and forestland use studies. Landowner neighbors in the Thunder Basin of Wyoming are sponsoring and coordinating their own monitoring of range condition and wildlife so as to be better prepared to consider effects of land-use changes on imperiled species.

These trends are welcome but much work remains. There are many places in the country where local citizens' ingenuity and enterprise for better land use could become key investments in environmental improvement in the 21st century.

INTRODUCTION: THE YEAR IN REVIEW

BY STEVEN F. HAYWARD WITH SAM THERNSTROM

- Environmental politics in an election year take on an especially furious tone. Activists are busy attacking George Bush's policies, in terms virtually identical to the criticism of Ronald Reagan 20 years ago. But environmental data from the 1980s proves Reagan's critics wrong, as is likely to be the case with the Bush record. Meanwhile, President Bush's environmental poll numbers are very close to those of Bill Clinton for the comparable point in his first term.
- In the past year experts have raised new doubts about climate models. The uncertainty in the range of CO₂ emissions projections is even larger than the uncertainty of the climate models themselves because of flawed economic assumptions.
- There is also controversy from several sources about whether the climate of the 20th century was the warmest on record or whether the period around the 1500s was warmer.

1. Election-Year Environmental Politics

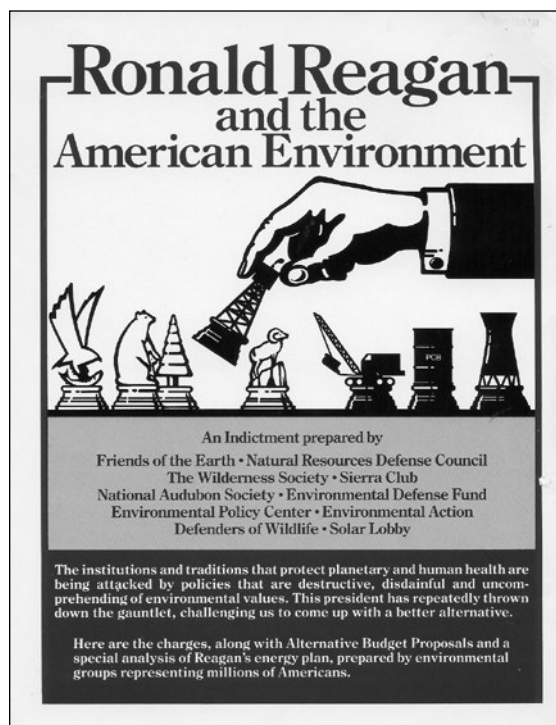
“History isn’t one damn thing after another, it’s the same damn thing over and over again.”

—Attributed to Edna St. Vincent-Millay

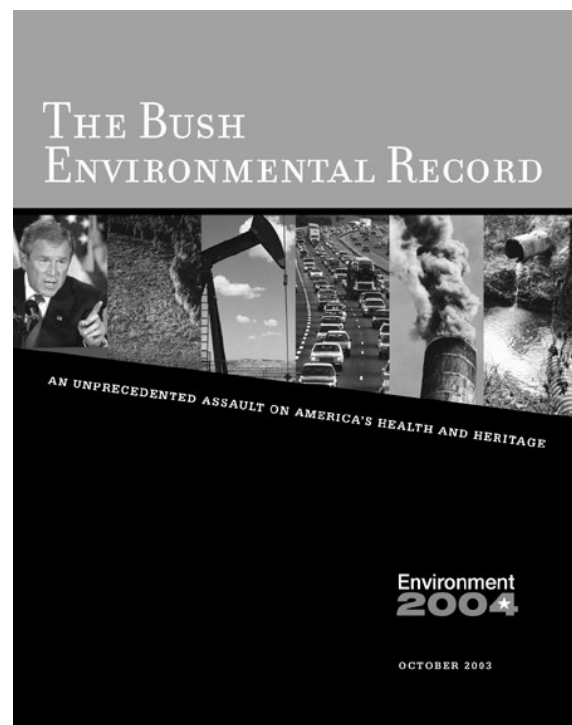
A survey of environmental discourse quickly leads to the conclusion that Edna St. Vincent-Millay’s quip was seldom more aptly applied. The dominant political theme of 2002 and 2003 from the political environmental organizations was that the Bush administration was engaged in an “assault on the environment.” With the turn of the 2004 new year, the news is now official: “George W. Bush will go down in history as America’s worst environmental president.” So sayeth Robert F. Kennedy Jr. in the pages of that pre-eminent environmental journal, *Rolling Stone*.¹

This will come as a relief to Ronald Reagan, the previous undisputed champ of environmental ruin. Consider this excerpt from a report from a consortium of the major environmental groups issued in 1982 on Reagan and the environment:

During his first 14 months in office, he and his appointed officials have simply refused to do the job that the laws require and that Americans



1982 and . . .



. . . 2004: “The same damn thing?”

expect of their government—to protect the public from pollution and to use publicly owned resources and lands for the public good. Instead, the Administration officials are handing over to private use the clean air and water, forests, grasslands, coal and oil that belong to all of us.²

That sounds pretty much like today’s standard complaint about the Bush administration. In fact, you can consider side-by-side the complaints made about Reagan 20 years ago with the complaints made about Bush today, and you can’t tell the difference without an official scorer’s program.³

Since the dominant purpose of this annual report is to bring attention to long-term trends in environmental improvement in the U.S., we thought it would be worth checking the record to tally up just how much environmental ruin the Reaganites were able to achieve during their eight years in office.

Table 1 shows trends in air pollution during the Reagan years. The 1982 critique of Reagan asserted that “*Pollution will increase* because the rules designed to control it and the agencies that enforce the rules are being systematically weakened. The Administration’s attention has focused upon easing the burdens for polluters instead of protecting the public.” That’s just as they are saying about President Bush today. Yet as Table 1 shows, both emissions and ambient levels of all categories of air pollution fell under Reagan.

About public lands, environmentalists said this: “Once again, the Administration is trying to sell off millions of acres of pristine public forests to the logging, mining, and drilling industries.” They said this about Bush last year.⁴ Here’s what they said about Reagan in 1982: “The Administration’s policy is to open the [wilderness] system to oil, gas, and mineral development, and close off major additions of new land.” Easy to see how someone might

**BOTH EMISSIONS AND
AMBIENT LEVELS OF ALL
CATEGORIES OF AIR POLLUTION
FELL UNDER REAGAN.**

TABLE 1: AIR QUALITY TRENDS DURING THE REAGAN ADMINISTRATION, 1981–1989

<u>Pollutant</u>	<u>Emissions</u>	<u>Ambient Level</u>
Sulfur Dioxide	-12.0%	-16.7%
Ozone*	-17.6%	-8.8%
Nitrogen Oxides	-6.3%	0.0%
Carbon Monoxide	-13.4%	-24.4%
Lead	N/A	-85.2%
Particulates*	N/A	-52.0%

Source: EPA Data Tables (www.epa.gov/ttn/chieftrends/trends01/trends2001.pdf)
*Ozone emissions figures are for VOCs (volatile organic compounds); data unavailable for lead emissions; particulate emissions and ambient data are for TSP (total suspended particulates) and PM10; EPA measurements and methodology were changed in 1988.

get confused. Note especially the last clause about Reagan policies: “. . . and close off major additions of new land.”

Table 2 below breaks down the 38 million acres of land the Reagan administration added to the ranks of various protected categories.⁵ It is a mistake, however, to judge land preservation by the single metric of *federal* preservation. The amount of land privately preserved—i.e. through land trusts, conservation easements, and so forth—or preserved by the states, has been growing more rapidly than federal lands. According to one federal report, the total amount of public and private land dedicated to parks and wildlife increased from 98 million acres to 225 million acres between 1978 and 1987.⁶ We shall have more to say about this subject in the section of this report on public lands.

There are serious arguments to be had over the Bush administration’s environmental policy, but the fervency and style of the most publicized arguments suggest something simpler than honest policy disagreement. The real complaint is that a Republican occupies the White House. Many environmentalists were unhappy with the Clinton administration, but did not make a commensurate public fuss.

Last year in this report we observed that “It is hard to escape the impression that many environmental lobby groups (as opposed to research and conservation organizations) have become *de facto* adjuncts to the Democratic Party in the same fashion as the National Rifle Association is to the GOP.” Confirmation of this judgment comes from “Environment2004,” an environmental group founded on the explicit premise that only Democrats can deliver environmental protection.⁷

TABLE 2: MILLIONS OF ACRES OF PROTECTED LAND ADDED DURING REAGAN ADMINISTRATION

<u>Protected Land Category</u>	<u>Million Acres Added</u>
National Parks	3.1
National Wildlife Refuges	19.2
National Forests	4.02
National Wilderness Preservation System	<u>11.75</u>
Total	38.07

Source: Council on Environmental Quality, *1993 Annual Report*, data tables 66, 67, 68, 69

TABLE 3: APPROVAL RATINGS ON HANDLING OF ENVIRONMENTAL ISSUES

	<u>Bush (3/02)</u>	<u>Clinton (7/94)</u>
Approve	53	53
Disapprove	36	34
	<u>Bush (2/03)</u>	<u>Clinton (6/95)</u>
Approve	53	55
Disapprove	37	31

Source: The Gallup Poll

Combining raw partisanship and the normal environmentalist tendency to cry wolf is having little effect. To the amazement of environmentalists and the media, Bush's approval ratings on his handling of the environment have stayed at or above 50 percent, despite the mountain of adverse headlines in the media, the nonstop fury of the political environmental groups, and the huge generic party advantage Democrats have over Republicans as the party best able to protect the environment.

In fact, Bush's environmental poll numbers are very close to President Bill Clinton's poll numbers for the comparable point in his first term. Table 3 displays a comparison between poll ratings for Bush and Clinton.

One reason for this seeming anomaly is that the environment is a tertiary issue for most Americans. While a huge majority of American—typically around 70 or 80 percent—tell pollsters that the environment is “very important,” the issue is always ranked far below other issues such as health care, education, crime, and terrorism when voters are asked an open-ended survey of their priorities. If a president is thought to be performing well on the public's core issues, he tends to get decent ratings on tertiary issues as well. In this regard it is startling to note that Bush's environmental ratings were sometimes higher than his poll ratings on the economy for much of 2002 and 2003.

A deeper reason, though, is found in the results of environmental polls that find a majority of people, while being concerned about “the environment” generally, believe the environment in their local area is okay or has improved. This is one reason why most voters are discounting some of the high decibel complaints from environmentalists.⁸ We are confident that most environmental indicators will show improvement at the end of Bush's presidency, just as they did at the end of Reagan's presidency.

Meanwhile, critics of the Bush administration were noticeably silent when the Office of Management of Budget's Office of Information and Regulatory Affairs (OIRA) released a report to Congress on the costs and benefits of federal regulation. It concluded the benefits of regulation

BUSH'S ENVIRONMENTAL POLL NUMBERS ARE VERY CLOSE TO PRESIDENT BILL CLINTON'S POLL NUMBERS FOR THE COMPARABLE POINT IN HIS FIRST TERM.

Poll shows Bush has growing support for environmental policy

By Jennifer Harper
THE WASHINGTON TIMES

One entrenched idea is beginning to weaken: The public does not consider President Bush the archenemy of the environment, according to a Gallup poll released yesterday. “The environmental movement and sympathetic politicians have painted the administration as anti-environmental. Given the ad-

forts. The hazard was heavily forecast by the United Nations and many pundits in late March.

Meanwhile, the entire environmental debate has changed, according to Mark Pfeifle, spokesman for Interior Secretary Gale A. Norton. He said he is not surprised that public-approval numbers are rising.

“Thirty years ago, there were rivers which caught fire and the bald eagle was dying out.

exceeded the cost by about a three-to-one ratio.⁹ Concerning environmental regulation specifically, OMB's analysis concluded that all the environmental rules adopted over the last 10 years cost between \$23 to \$26 billion, while the benefits were \$120 to \$193 billion.

The head of this OMB unit is John Graham, who previously directed the Harvard Center for Risk Analysis, and whose appointment to head OIRA several environmental groups bitterly opposed. One might have thought this OIRA report would have given the environmentalist critics of the Bush administration at least a talking point, but such is the aversion to cost-benefit analysis among environmentalists that no one thought it noteworthy.

2. Changing Climate on Climate Change

The year 2003 witnessed a major turning point in climate change policy, along with two startling developments in the underlying scientific argument about the nature of the phenomenon. Because climate change has been so badly politicized, what should be sober arguments over scientific substance and genuine uncertainty are freighted with the utmost bitterness.

On the policy front, Russia drove the final stake through the heart of the Kyoto protocol. Russia was widely expected to be the country that would provide the last needed ratification for the Kyoto protocol to go into effect. But in October the Russians shocked the world by saying “nyet.”

Politics Uber Alles

“When I was administrator of the Environmental Protection Agency, one of my first acts was to take a second look at a federal regulation limiting the level of arsenic in drinking water. There was no question the regulation as it then stood would be made more strict. The issue was whether the limit set by the previous administration, which had yet to take effect, had gone too far. I also wanted to make sure the regulation was based on sound science and a thorough cost analysis.

But the outcry from Democrats and the environmental lobby was mind-boggling. It set a tone that made sensible discussion of important questions almost impossible. In the end, after careful study, we allowed the stricter regulation to take effect.

Unfortunately, genuine advances in environmental protection were frequently lost amid extremist rhetoric. When the EPA proposed a rule to reduce pollution from the thousands of unregulated diesel engines—tractors, backhoes, and other equipment—the National Resources Defense Council hailed it as “the most significant public health proposal in decades.”

Within days, however, that changed. Other environmental groups expressed dismay that any environmentalist would say something so positive about the administration. Eventually the council wrote us a letter asking that we stop using that comment because it felt there could have been other environmental proposals that might have been more important to public health.”

—Former EPA administrator Christine Todd Whitman, *New York Times*, January 12, 2004 (<http://www.nytimes.com/2004/01/12/opinion/12WHIT.html?pagewanted=all&position=>)

It had been supposed that Russia, because of a quirk in the treaty, would have been a huge winner of the Kyoto framework, by selling emission credits in a prospective international carbon-trading scheme. Russia may have made the calculation that, as a rising fossil-fuel producer, it may have a more long-term future as an energy exporter than seller of emission credits to Germany and France.

Indeed, its rising oil industry is opposing ratification of Kyoto. Putin's economic minister, Andrei Illarionov, told reporters that "the Kyoto protocol places significant limitations on the economic growth of Russia."

And then there is this from President Vladimir Putin: "Here in Russia you can often hear people say—sometimes jokingly, *sometimes seriously*—that Russia is a northern country, so if it warms up two or three degrees it's not terrible. *It might even be good*—we'd spend less money on fur coats and other warm things."

(Emphasis added.) Separately some Russian scientists have echoed the idea that a cold country might benefit from warming, and they have also expressed doubts about the underlying science of climate change.

**RUSSIA DROVE THE FINAL
STAKE THROUGH THE HEART OF
THE KYOTO PROTOCOL.**

Although Russia left the door to ratification open a tiny crack, behind the scenes many European nations may be breathing a sigh of relief even as they publicly deplore Russia's stance. Europe has confessed that it is struggling to meet its Kyoto emission reduction targets, even with stagnant economies and stable populations. While the European Union is supposed to reduce greenhouse gas emissions by eight percent below 1990 levels by the year 2008 to 2012, the European Environment Agency announced in October that recent trends suggest emissions will only fall by 4.7 percent. Japan is also going to fall far short of its target.

Only two European nations—Britain and Sweden—are likely to make their Kyoto targets. The foot dragging has started. The European Parliament delayed the first reading of the legislation designed to regulate emissions trading. Spain, Portugal, and Greece are demanding that the level of their contributions to developing nations for greenhouse gas emission reduction be reduced. All of these difficulties made the UN's 9th annual Council of Parties conference (COP-9) in Milan in early December a gloomy affair.

While attention of policymakers is slowly turning to long-term substitutes for the Kyoto approach, two new arguments about the underlying science of climate change erupted into full name-calling fury in 2003. While the technical arguments about the design of climate

ONLY TWO EUROPEAN NATIONS—BRITAIN AND SWEDEN—ARE LIKELY TO MAKE THEIR KYOTO TARGETS.

change models grind on, in the background a seemingly small query about carbon dioxide has intruded into the debate.

All of the climate models assume a doubling of CO₂ in the atmosphere over the next several decades. What if this assumption is wrong? Few have thought to inquire about any uncertainties in our projections of rising CO₂ levels, largely because this is thought to be the simple part of the problem. CO₂ emissions are mostly a function of fossil-fuel use, which in turn can be estimated by making assumptions about future world economic growth.

This is where Ian Castles, an Australian statistician, and David Henderson, a British economist, come into the picture.¹⁰

Castles and Henderson argue that the Intergovernmental Panel on Climate Change (IPCC) economic forecasts are based on fundamentally flawed economic assumptions that generate huge overestimates of future CO₂ emissions.¹¹ If Castles and Henderson are correct, the IPCC will need to start from scratch in its CO₂ estimates for its next periodic climate report, which is due next year. Castles's and Henderson's critique is highly technical, but can be simplified as follows.

Jurassic Park Meets The Skeptical Environmentalist

An unusual voice from the literary world, novelist Michael Crichton, weighed in on climate change and environmentalism in a widely-noted speech in September at the Commonwealth Club in San Francisco. It is ironic that the author of blockbuster scientific novels whose frequent theme is human science run amok would turn out to be a voice of deep skepticism about claims of environmental ruin, yet that was the message he delivered. The speech was so strongly worded, in fact, that it was initially suspected of being a hoax.

ENVIRONMENTALISM NEEDS TO BE ABSOLUTELY BASED IN OBJECTIVE AND VERIFIABLE SCIENCE, IT NEEDS TO BE RATIONAL, AND IT NEEDS TO BE FLEXIBLE. AND IT NEEDS TO BE APOLITICAL.

Depicting environmentalism as a religion, Crichton said: "Increasingly it seems facts aren't necessary, because the tenets of environmentalism are all about belief. It's about whether you are going to be a sinner, or saved. Whether you are going to be one of the people on the side of salvation, or on the side of doom. Whether you are going to be one of us, or one of them." He goes on to say:

There are two reasons why I think we all need to get rid of the religion of environmentalism. First, we need an environmental movement, and such a movement is not very effective if it is conducted as a religion. . . . Environmentalism needs to be absolutely based in objective and verifiable science, it needs to be rational, and it needs to be flexible. And it needs to be apolitical. To mix environmental concerns with the frantic fantasies that people have about one political party or another is to

The IPCC's various economic growth scenarios (there are 40 different scenarios in the IPCC report) all rely on estimates of growth in GDP around the world measured in dollar terms. This involves using currency exchange rates to convert the world's disparate economies into a common unit of measurement. This is the wrong way to make economic comparisons, let alone projections, Castles and Henderson argue.

For example, \$20,000 in the United States is not equivalent in purchasing power to \$20,000 converted at currency exchange rates to, say, Swedish kroners or Kenyan shillings. This is why transnational economic comparisons have been using "purchasing power parity" (PPP) for many years now. In fact, PPP is the accepted method the OECD, the UN, the World Bank, and other international economic institutions use for comparing and projecting national economies.

But the IPCC used market exchange rate GDP estimates instead because that is the economic measurement most existing peer-reviewed climate models use, and the IPCC was bound to follow the existing methodology even though some IPCC researchers acknowledge this method may be prone to error. The problem is that measuring and projecting world economic growth by exchange rate GDP estimates leads to overstating future economic growth rates and CO₂ emissions.

MEASURING AND PROJECTING WORLD ECONOMIC GROWTH BY EXCHANGE RATE GDP ESTIMATES LEADS TO OVERSTATING FUTURE ECONOMIC GROWTH RATES AND CO₂ EMISSIONS.

miss the cold truth—that there is very little difference between the parties, except a difference in pandering rhetoric. The effort to promote effective legislation for the environment is not helped by thinking that the Democrats will save us and the Republicans won't. Political history is more complicated than that. Never forget which president started the EPA: Richard Nixon. And never forget which president sold federal oil leases, allowing oil drilling in Santa Barbara: Lyndon Johnson.

WHENEVER YOU HEAR THE CONSENSUS OF SCIENTISTS AGREES ON SOMETHING OR OTHER, REACH FOR YOUR WALLET, BECAUSE YOU'RE BEING HAD.

The second reason to abandon environmental religion is more pressing. Religions think they know it all, but the unhappy truth of the environment is that we are dealing with incredibly complex, evolving systems, and we usually are not certain how best to proceed. Those who are certain are demonstrating their personality type, or their belief system, not the state of their knowledge. Our record in the past, for example managing national parks, is humiliating. Our fifty-year effort at for-

IF ECONOMIES ARE COMPARED ON A PPP BASIS INSTEAD, DEVELOPING NATIONS USE ONLY 1.2 TIMES MORE ENERGY PER DOLLAR OF OUTPUT THAN DEVELOPED NATIONS.

In fact, the GDP approach the IPCC uses assumes much greater economic growth in the developing world than in the developed world throughout this century, and leads to some absurd projections about economic growth—and hence CO₂ emissions—for many emerging nations. Castles and Henderson offer South Africa as a case in point:

The dimensions of the problem can be illustrated by the case of South Africa. In 2000, this country's GDP per head, converted from nominal values using exchange rates, was only 12 percent of the U.S. level. By 2050, the A1 marker scenario projects that the per capita income of South Africans on this basis will have reached more than four times the U.S. level in 2000, and about twice the level that the U.S. will have reached in 2050. And by 2100, this scenario projects that the per capita income of South Africans will be approaching twenty times the U.S. level in 2000, and more than four times the U.S. level at the end of the 21st century. . . The total output of goods and services in South Africa in 2100, according to these downscaled A1 scenario projections, will be comparable to that of the entire world in 1990.

est-fire suppression is a well-intentioned disaster from which our forests will never recover. We need to be humble, deeply humble, in the face of what we are trying to accomplish. We need to be trying various methods of accomplishing things. We need to be open-minded about assessing results of our efforts, and we need to be flexible about balancing needs. Religions are good at none of these things.

(For the complete text of Crichton's Commonwealth Club speech, see www.crichton-official.com/speeches/speeches_quote05.html.)

In a separate speech about the politicization of science given at the California Institute of Technology in January 2003, and fetchingly called "Aliens Caused Global Warming," Crichton took even more direct aim at the notion that policy should bow before scientific "consensus":

I regard consensus science as an extremely pernicious development that ought to be stopped cold in its tracks. Historically, the claim of consensus has been the first refuge of scoundrels; it is a way to avoid debate by claiming that the matter is already settled. Whenever you hear the consensus of scientists agrees on something or other, reach for your wallet, because you're being had.

Among the nations the IPCC projects will have a higher real incomes than the U.S. in 2100 are Libya, Algeria, Argentina, and North Korea. Yes, *North Korea*—that is not a typo. This seems unlikely, to put it mildly.

The nub of the problem is that using the GDP approach inflates CO₂ emissions unrealistically. The World Bank, for example, claims that developing countries use 3.8 times more energy per dollar of GDP than developed nations do. However, Castles and Henderson point out that if economies are compared on a PPP basis instead, developing nations use only 1.2 times more energy per dollar of output than developed nations. This means that CO₂ emissions will not rise as dramatically as developing nations grow.

Castles and Henderson ask: “What are the implications for the projections of emissions of these very high projected rates of growth in economic activity? It is not possible to be precise without undertaking a major reworking of the scenarios. But there is no obvious reason for supposing that the overstatement of prospective growth rates and output levels in developing countries would NOT have led to a significant overstatement of projected emissions.” Even the lowest of the IPCC’s emissions projections is probably too high, which means that the projections of global warming are likely too high as well.

Castles and Henderson note that since the IPCC projections use 1990 as their baseline year, we can already look at a decade’s worth of growth in emissions to see how well it matches up with the projections. The mean IPCC projection for the 1990s was that worldwide CO₂ emissions would increase by about 15 percent. In fact, worldwide CO₂ emissions grew by only about six percent, according to the U.S. Department of Energy. Methane emissions in OECD nations were projected to increase slightly; in fact, early data suggests methane emissions in OECD nations fell about eight percent in the 1990s.

If Castles and Henderson are correct, then even if the climate models are fully accurate in their projections of the linkage between CO₂ and global climate change, the models would need to be rerun from scratch with a more realistic economic forecast of future CO₂ emissions.

Fifteen authors connected with the IPCC published a rejoinder to Castles and Henderson accusing them of bad faith, bias, and “deplorable misinformation.”¹² *The Economist* magazine, which has been following this controversy closely from the start, is unimpressed with this rebuttal, observing that “it fails to answer the case Mr. Castles and Mr. Henderson had laid out—namely, that the IPCC’s low-case scenarios are patently not low-case scenarios, and that the panel has therefore failed to give a true account of the range of possibilities.”¹³

There are sure to be several sequels to this fundamental argument. Meanwhile, there also erupted a two-pronged controversy over one of the central pillars of global warming theory—

THE MEAN IPCC PROJECTION FOR THE 1990s WAS THAT WORLDWIDE CO₂ EMISSIONS WOULD INCREASE BY ABOUT 15 PERCENT. IN FACT, WORLDWIDE CO₂ EMISSIONS GREW BY ONLY ABOUT SIX PERCENT, ACCORDING TO THE U.S. DEPARTMENT OF ENERGY.

Michael Mann's famous "hockey stick" graph. Working from an elaborate reconstruction of climate history for the last 1,000 years, climatologist Mann reported in 1998 that world temperatures in the second half of the 20th century were the highest on record. The graph of temperatures showed a discernable uptick in the shape of a horizontal hockey stick. Mann's graph was prominently displayed by the UN's

influential 2001 report on climate change, and has become perhaps the single-most prominent graphic depiction of global warming.

First, Sally Baliunas and Willie Soon of the Harvard-Smithsonian Center for Astrophysics published an extensive review of more than 200 different studies of climate history, concluding that the weight of these studies present "strong evidence that the climate of the 20th century was not unusual, but fell within the range experienced during the past 1,000 years" during, for instance, a period known as the "Medieval Warm Period."¹⁴ A full-scale ruckus ensued, complete with threats of a boycott against the scientific journal that published Baliunas and Soon (*Climate Research*) and even the resignation of six editors of the journal.¹⁵

If Baliunas and Soon are correct, then Mann's hockey stick must be wrong. While Baliunas and Soon based their work on a survey of existing scientific literature, two Canadian statisticians, Stephen McIntyre and Ross McKittrick, made a close review of the empirical basis of Mann's hockey stick, and also concluded that Mann's calculations are wrong.¹⁶ McIntyre and McKittrick conclude that once data processing errors are corrected, the temperature record shows that the medieval warm period around the 1500s was warmer than the 20th century.

Mann has replied with some bitterness that McIntyre and McKittrick have used an incomplete dataset and are engaged in a "political stunt." McIntyre and McKittrick have reproduced the full e-mail exchanges with Mann and his assistants refuting Mann's claims. An ugly, full-scale scientific dispute looks to be commencing. It will turn on arcane knowledge of advanced statistical techniques that will be hard for the layperson to follow. The defensiveness of Mann's replies, however, suggests something is amiss.

Either his results can be replicated, in time-honored scientific fashion, or they cannot. Already several observers are drawing a parallel to the scandal over historian Michael

Bellesiles's work on guns, wherein a formal inquiry found he had falsified and manipulated data in a fraudulent way. *Nature* magazine, which published Mann's original findings in 1998, is now reported to be reviewing Mann's underlying data.

THE TEMPERATURE RECORD SHOWS THAT THE MEDIEVAL WARM PERIOD AROUND THE 1500s WAS WARMER THAN THE 20TH CENTURY.

Writing in *Technology Review*, U.C. Berkeley physicist Richard Muller sides with McIntyre and McKittrick in concluding that Mann's analysis is unsound.¹⁷ His sobering analysis is worth noting at length:

It was unfortunate that many scientists endorsed the hockey stick before it could be subjected to the tedious review of time. Ironically, it appears that these scientists skipped the vetting precisely because the results were so important.

Let me be clear. My own reading of the literature and study of paleoclimate suggests strongly that carbon dioxide from burning of fossil fuels will prove to be the greatest pollutant of human history. It is likely to have severe and detrimental effects on global climate. I would love to believe that the results of Mann et al. are correct, and that the last few years have been the warmest in a millennium.

Love to believe? My own words make me shudder. They trigger my scientist's instinct for caution. When a conclusion is attractive, I am tempted to lower my standards, to do shoddy work. But that is not the way to truth. When the conclusions are attractive, we must be extra cautious.

The public debate does not make that easy. Political journalists have jumped in, with discussion not only of the science, but also of the political backgrounds of the scientists and their potential biases from funding sources. Scientists themselves are also at fault. Some are finding fame and glory, and even a sense that they are important. (That's remarkably rare in science.) We drift into *ad hominem* counterattacks. Criticize the hockey stick and some colleagues seem to think you have a political agenda—I've discovered this myself. Accept the hockey stick, and others accuse you of uncritical thought.

Stay tuned: the supposed smoking gun of global warming may be loaded with blanks.

3. Hydrogen Energy: Gone with the Wind(power)?

Last year saw the auto industry throw in the towel once and for all on electric cars, once thought to be the future of emission-free autos. General Motors, having spent more than \$1 billion on its electric car program, actually began confiscating its 1,100-car fleet of electric vehicles last year when their leases ran out, to the dismay of electric-car enthusiasts. A group of California electric car owners staged a mock funeral in protest. Toyota, Nissan, Ford, Honda, and DaimlerChrysler have also cancelled their electric car programs.

Throughout California electric-car charging stations in parking lots will stand as a costly memorial to “make-it-so” thinking that regulatory wand-waving can force any technological frontier. Carmakers had pursued electric cars because of a California mandate that 10 percent of all new cars be emission-free by 2003.

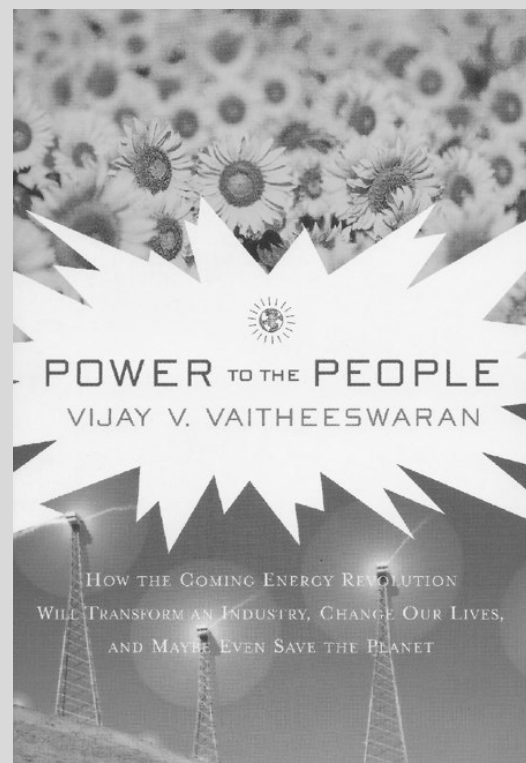
Perhaps those electric charging stations will be replaced with hydrogen fuel stations, as hydrogen is now the hope for next generation emission-free energy. President Bush announced a \$1.5 billion research

WITH CURRENT HYDROGEN TECHNOLOGY, GREENHOUSE GAS EMISSIONS WOULD ACTUALLY INCREASE.

Power to the People

The Economist magazine’s energy and environment correspondent Vijay Vaitheeswaran has produced the most readable survey of the current energy debate in his new book *Power to the People: How the Coming Energy Revolution Will Transform an Industry, Change Our Lives, and Maybe Even Save the Planet* (Farrar, Straus & Giroux, 2003). While the book is light on quantitative analysis of energy and arguably gives too much credence to the quack-boosters of renewable energy such as Amory Lovins, Vaitheeswaran is unafraid to voice several heterodox insights about the energy market.

Among the eyebrow-raising but correct observations, Vaitheeswaran says that Enron was ahead of its time—its problem was old-fashioned fraud, not a chimerical business model—and California’s electricity meltdown was not caused by deregulation but by the fact that “California never really deregulated



program on hydrogen energy in his State of the Union message last year, which he hoped would produce the “Freedom Car.” (The Sierra Club naturally faxed a press release attacking the Bush proposal minutes after the president finished speaking.) Despite the fact that hydrogen is “the most abundant element in the universe,” producing hydrogen in usable form presents immense technological challenges.

Optimists predict the technical challenges will be overcome, and they are probably right, though it will likely take longer and cost more than today’s hydrogen enthusiasts like Amory Lovins think. (Lovins has said that we could make a full transition to a hydrogen-based energy system in 10 years.) Vijay Vaitheeswaran, energy and environment correspondent for *The Economist*, writes in his sprightly new book *Power to the People* that we are on the cusp of nothing less than a revolution in energy, with hydrogen and market liberalization at the core of the transformation. (See sidebar.)

Many of the technical problems of hydrogen may be overcome, but perhaps not without some surprises and tradeoffs along the way. Although hydrogen promises emission-free energy (its only byproduct would be water vapor), it may not be without environmental consequences of its own. *New York Times* reporter Matthew Wald summarized the predicament thus: “But skeptics, and even some hydrogen advocates, say that the use of hydrogen could instead make the air dirtier and the globe warmer.”¹⁸ (See more about Wald’s hydrogen story in the media section of this report.) In the short run this prospect arises because large amounts of energy will be needed to separate hydrogen into useable form, and much of this energy will likely have to come from fossil fuel sources, especially coal. With current hydrogen technology, greenhouse gas emissions would actually increase.

its electricity sector.” “The real problem” Vaitheeswaran added, “is that what California dubbed ‘deregulation’ did very little to unshackle the power sector from the state.” What happened in California was not market failure but regulatory failure. Despite its flaws and debatable themes, *Power to the People* is a highly readable primer on the subject.

WHAT HAPPENED IN CALIFORNIA WAS NOT MARKET FAILURE BUT REGULATORY FAILURE.

Will Hydrogen Clear the Air? Maybe Not, Say Some

Pollution From Producing It May Offset Benefits

By MATTHEW L. WALD

WASHINGTON, Nov. 11 — Widespread hydrogen use has been enthusiastically embraced by major corporations and environmentalists alike as a panacea for global warming and the depletion of fossil fuels, and is a particular favorite of the Bush administration. But skeptics, and even some hydrogen advocates, say that use of hydrogen could instead make the air dirtier and the globe warmer.

work out of a pound of hydrogen.

Intense research is now going on at major companies and universities in North America on the development of a practical fuel cell. Success could have a profound effect on the 200 million motor vehicles in use in the United States, making the streets cleaner and quieter, with hydrogen-powered electric motors. The transition to hydrogen could also wean the country away from gasoline and diesel fuel.

The main source for hydrogen today is natural gas, which is in short supply, is

While this difficulty might be overcome in time, several environmental scientists raised other environmental concerns about hydrogen energy in the pages of *Science* magazine. In July David Keith of Carnegie-Mellon University highlighted the problem of hydrogen leakage; because hydrogen atoms are the smallest of all elements, a significant amount would leak into the atmosphere in a worldwide hydrogen energy system. A second set of authors argued in October that a higher level of hydrogen in the atmosphere might backfire.¹⁹ Although hydrogen is *by itself* a benign element, it could indirectly increase the level of methane—a potent greenhouse gas—in the atmosphere by slowing the natural process of methane uptake.

Might we be seeing the beginnings of the basis for environmental opposition to hydrogen power if it becomes feasible? It should be recalled that once upon a time leading environmental organizations including the Sierra Club supported nuclear power. The famous “Port Huron Statement,” the founding document of the radical 1960s Students for a Democratic Society, contained the sentence, “With nuclear energy whole cities can easily be powered.” A decade later the principal author of the “Port Huron Statement,” Tom Hayden, became one of the leading opponents of nuclear energy.

One look at the current state of wind power is enough to suggest that prospective environmental opposition to hydrogen power is not far-fetched. A *Los Angeles Times* headline from December captures the mood: “GREEN POWER CREATES CANYONS OF DEATH: ECOLOGISTS IN A FLAP ABOUT HIGH BIRD KILL RATE AT CALIFORNIA WINDMILL FARM.”²⁰ Noting that more than 20,000 birds have been killed by windpower operations at Altamont Pass over the last 20 years, a fact noted in this report two years ago, *Times* reporter Rone Tempest observed: “Now, some environmental groups that routinely supported wind power as a clean, alternative source of electric power are opposing the renewal of permits for the wind farm, the largest in the world in number of turbines.”

The *Oakland Tribune* reported in January that the bird kill rate at Altamont may be much higher than previously thought; a study by the National Renewable Energy Laboratory finds that as many as 500 rare birds of prey are killed each year, which probably violates several federal statutes giving birds of prey protected status.²¹ Californians for Renewable Energy and the Center for Biological Diversity have brought a lawsuit to stop the Altamont permit from being renewed. The National Wind Coordinating Committee, a pro-windpower trade group, has said that the controversy over bird kills “has delayed and even significantly contributed to blocking the development of some wind plants in the U.S.”

4. EPA's *Draft Report on the Environment* Released

One of the reasons the *Index of Leading Environmental Indicators* was launched 10 years ago was the lack of reader-friendly analysis of environmental trend information. While the EPA and other federal agencies produce copious reports on individual aspects of the environment that are helpful to specialists, there is no effort analogous to the *Index of Leading Economic Indicators* from the Department of Commerce, or even the Bureau of Labor Statistics. Proposals to found a Bureau of Environmental Statistics within the EPA have met with little enthusiasm from environmentalists, oddly enough. The last time the EPA attempted to produce even a brief composite report on general environmental trends was 1989, at the end of the Reagan administration.

Last year the EPA produced its first ever national composite picture of the U.S. environment, the *Draft Report on the Environment*.²² The *Draft Report* is everything that this annual *Index* has hoped for in such a report, with trend information on many of the same categories this *Index* has always covered: air, water, land condition, toxic chemicals, and human health. Together with the Heinz Center's *State of the Nation's Ecosystems* (profiled in last year's *Index*), the release of the *Draft Report* is another sign that the effort to develop meaningful environmental indicators is gaining traction.

If the EPA's effort to develop and report consistent indicators is continued, it might render this annual report obsolete. However, this looks unlikely at the moment. An 11th-hour textbook, inside-the-Beltway, 6-4-3 double-play (disgruntled

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**REPORT BY E.P.A.
LEAVES OUT DATA
ON CLIMATE CHANGE**

EDITING BY WHITE HOUSE

**Members of Agency Staff Say
They Made Cuts in Draft to
Avoid a Partisan Tone**

By **ANDREW C. REVKIN**
with **KATHARINE Q. SEELYE**

The Environmental Protection Agency is preparing to publish a draft report next week on the state of the environment, but after editing by the White House, a long section describing risks from rising global temperatures has been whittled to a few noncommittal paragraphs.

The report, commissioned in 2001



bureaucrat-to-reporter-to-the-public) cast an undeserved shadow over the *Draft Report*. Days before the *Draft Report* was scheduled for release, the *New York Times* broke a story on the front page charging that the White House had pressured the EPA to change the report's findings about climate change.²³ Ultimately EPA decided to leave out substantive discussion of climate change, which prompted some disgruntled EPA staffers to run to the *Times* with a purposely embarrassing leak. Broadcast media sensationalized the story further.

CNBC led with the plug “What the White House doesn't want you to know about global warming.” Editorial writers lambasted the administration's “censorship” and “revisionist history” conducted by “know-nothing underlings” covering up “inconvenient truths.” And the *Palm Beach Post's* cartoonist showed readers the EPA *Draft Report* before (“As for global warming, the news isn't good when it comes to the future for you and your family”) and “after it was edited by the Bushies” (“Global warming... is good... for you and your family”).

This contrived controversy had the effect of causing the media to ignore the core indicators in the *Draft Report* that were intended to be the main focus. Instead the entire report has been described as “tainted,” even though no one inside or outside EPA has criticized any of the published data

Update: Lomborg Vindicated

Since we first commented at length about the controversy over Bjørn Lomborg's book *The Skeptical Environmentalist* in the 7th edition of this report (2002), there have been several dramatic developments. The most consequential was the finding early last year from something called the Danish Committees on Scientific Dishonesty (DCSD) that Lomborg's book constituted “scientific dishonesty.” As this bizarrely-named committee was an official body of the Danish government, the critical finding received wide publicity and was cited by environmentalists as proof that Lomborg's perspective was discredited.

A GROUP OF 300 EUROPEAN SCIENTISTS SIGNED A PETITION CONDEMNING THE DCSD'S CENSURE OF LOMBERG.

However, the Danish Committees on Scientific Dishonesty gave no evidence nor a single example of “dishonesty” on Lomborg's part, leading *The Economist* to call the panel's ruling “incompetent and shameful.”²⁵ A group of 300 European scientists signed a petition condemning the DCSD's censure of Lomborg. Denmark's Ministry of Science, Technology and Innovation decided to review the matter, and in December issued its own ruling that rebuked the DCSD for its shoddiness and overturned the DCSD's finding against Lomborg. Most of the media outlets that had jumped all over the initial story a year ago ignored the reversal.

The Washington Post's environmental writer Eric Pianin, who wrote about the initial DCSD report, did not file a story about the DCSD's reversal. About the only exception was the *New York Times* science and environmental writer Andrew Revkin, whose original story about the DCSD in January 2003 fairly noted the weaknesses of the case against Lomborg.²⁶

or analysis on the core indicators. It is far from clear, however, that *global* climate change should be included in a report about *national* environmental conditions in the first place.

Regardless of how climate change is judged, there are no obvious indicators for climate change trends on the national level. Indeed, the disputed section on climate change was not a data survey but rather a tug-of-war over what general assessments of the global dimensions of the issue should be included in the *Draft Report*.²⁴ The normal inter-agency disputes about environmental reporting that accompanied the production of the *Draft Report* were difficult enough; in light of the political disaster that attended the release of the *Draft Report* it is doubtful EPA will want to continue the exercise. This would be a shame, as the process promises to be helpful in focusing policy as well as informing the public.

Notes

1 Robert F. Kennedy Jr., “Crimes Against Nature,” *Rolling Stone*, December 11, 2003, available at www.rollingstone.com/features/nationalaffairs/featuregen.asp?pid=2154.

2 From *Ronald Reagan and the Environment*, which is described as “an indictment prepared by Friends of the Earth, Natural Resources Defense Council, The Wilderness Society, Sierra Club, National Audubon Society, Environmental Defense Fund, Environmental Policy Center, Environmental Action, Defenders of Wildlife, and Solar Lobby.”

3 For a more extensive discussion, see Steven F. Hayward, “Eco-Hysteria Then and Now,” *AEI Environmental Policy Outlook*, June 2003, available at www.aei.org/publications/pubID.17658/pub_detail.asp.

4 Statement by Greenpeace; www.greenpeaceusa.org/, accessed May 29, 2003.

5 The Reagan Administration also added 3,619 miles to the National Wild And Scenic Rivers program, and over 1,300 square miles to the National Estuarine Reserves.

6 A.B. Daugherty, *Major Uses of Land in the United States, 1987* (Washington, DC: USDA, 1991).

7 See www.environment2004.org. The website declares that the organization exists to “serve as a resource for Democratic candidates and the media.” Other declarations on the website include: “we believe that Democratic candidates will do a better job of protecting our environment and natural resources. . .”

8 For a recent perspective from the conventional environmental point of view, see Robert J. Duffy, *The Green Agenda in American Politics: New Strategies for the Twenty-First Century* (Lawrence, KS: University Press of Kansas, 2003).

9 *Informing Regulatory Decisions: 2003 Report to Congress on the Costs and Benefits of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities* (Washington, DC: Office of Management and Budget, Office of Information and Regulatory Affairs, 2003).

10 Castles and Henderson bring impressive credentials to this debate. Castles is the former head of Australia’s national office of statistics, and Henderson is a former chief economist of the OECD.

- 11 A complete set of the papers outlining Castles's and Henderson's argument can be found at: www.lavoiser.com.au/papers/articles/IPPCissues.html. *The Economist* offered a cogent summary in the February 13, 2003 edition of the magazine, entitled "Hot Potato: The Intergovernmental Panel on Climate Change Had Better Check Its Calculations."
- 12 Nebojsa Nakicenovic, et al., "IPCC SRES Revisited: A Response," *Energy & Environment*, Vol. 14, nos. 2 & 3, abstract available www.multi-science.co.uk/ee.htm. For a separate rebuttal of the Castles-Henderson critique, see Alan S. Manne and Richard G. Richels, "Market Exchange Rates or Purchasing Power Parity: Does the Choice Make a Difference to the Climate Debate," AEI-Brookings Joint Center for Regulatory Studies, Working Paper 03-11, September 2003, available www.aei-brookings.org/publications/index.php?tab=topics&rtopicid=22.
- 13 "Hot Potato Revisited," *The Economist*, November 6, 2003.
- 14 Willie Soon and Sallie Baliunas, "Proxy Climate and Environmental Changes of the Past 1,000 Years," *Climate Research*, 23: pp. 89-110.
- 15 For additional background on the Baliunas-Soon controversy and other aspects of the climate science-policy debate, see Samuel Thernstrom, "'Censorship' and the Uncertain Science of Climate Change," AEI *Environmental Policy Outlook*, October 2003, www.aei.org/publications/pubID.19348/pub_detail.asp.
- 16 McIntyre and McKittrick's paper can be found at: http://www.multi-science.co.uk/ee_openaccess.htm.
- 17 http://www.techreview.com/articles/wo_muller121703.asp?p=2.
- 18 Matthew L. Wald, "Will Hydrogen Clear the Air? Maybe Not, Some Say," *New York Times*, November 3, 2003, p. C-1.
- 19 D.W. Keith and A.E. Farrell, "Rethinking Hydrogen Cars," *Science*, July 18, 2003, p. 315; Martin G. Schultz, Thomas Diehl, Guy Brasseur, and Werner Zittel, "Air Pollution and Climate-Forcing Impacts of a Global Hydrogen Economy," *Science*, October 24, 2003, p. 624.
- 20 *Los Angeles Times*, December 20, 2003, p. A-19. See also Kimberly Edds, "Peril in the Wind Industry: Turbines That Produce Clean Energy Also Kill Migrating Birds," *Washington Post*, December 24, 2003, p. A-2.
- 21 Matt Carter, "Wind Farms More Lethal to Birds Than First Thought," *Oakland Tribune*, January 30, 2004.
- 22 The report and corollary materials can be found at www.epa.gov/indicators.
- 23 Andrew C. Revkin and Katharine Q. Seelye, "Report by EPA Leaves Out Data on Climate Change," *New York Times*, June 19, 2003, p. A-1.
- 24 For an in-depth analysis of this episode, see Samuel Thernstrom, "'Censorship' and the Uncertain Science of Climate Change," AEI *Environmental Policy Outlook*, Sept-Oct. 2003, available at www.aei.org/publications/pubID.19348/pub_detail.asp.
- 25 See "Lomborg Gets the Galileo Treatment, or, 'Shut up,' they explained", AEI *Environmental Policy Outlook*, January/February 2003, www.aei.org/publications/pubID.15242/pub_detail.asp.
- 26 See Andrew C. Revkin, "Danish Ethics Panel Censured for Critique of Book," *New York Times*, December 23, 2003, p. F-2. See also "The Scourge of the Greens Wins a Round," *The Economist*, December 18, 2003.

BLACK INK, GREEN NEWS: 2003 MEDIA ROUNDUP

BY STEVEN F. HAYWARD

- While many environmental journalists persist in taking a gloomy view of our future, there are a growing number of examples of sound, unbiased reporting. Some of the best pieces focused on the New England fishing crisis, genetically modified crops, hydrogen energy, the Clean Air Act, whaling, and water pollution.
- These best-of-the-best stories appeared in leading newspapers, including the *Atlantic Monthly*, *Boston Globe*, *Los Angeles Times*, *New York Times*, *The New Republic*, *Wall Street Journal*, and *Washington Post*.

“Can you remember a day when you opened your morning newspaper without finding a dramatic and disturbing story about some environmental crisis that’s either here or lurks just around the corner? That would be a rare day.”

—*Jack M. Hollander, The Real Environmental Crisis (University of California Press, 2003)*

Environmental journalism often combines the worst of eco-apocalypticism with the post-Watergate trend of advocacy reporting, and the result is atrocious. Efforts to redress this tendency are moving more slowly than a pre-global-warming glacier, at least if the latest proceedings of the Society for Environmental Journalists (SEJ) are any indication.

The SEJ is dedicated to improving the quality and accuracy of environmental journalism, but as an SEJ board member remarked to us, “It might as well be called the Society of Environmental Doomsayers.” John Charles, formerly of the Environmental Defense Fund and the Oregon Environmental Council, attended last year’s SEJ conference in New Orleans and reported the results recently in *BrainstormNW* magazine.¹ Charles judged that “despite some excellent panels and an honest attempt to present a balanced agenda, environmental pessimism seemed to be the default mode for many journalists.”

A panel on the Bush environmental record brought this sharp blast from Jeff Frischkorn of the *Cleveland News-Herald*: “When I came here and sat through this, quite frankly I kind of thought that I was sitting through a planning session for the DNC [Democratic National Committee] on Bush’s vulnerabilities. It hardly seemed like you guys were presenting objectivity. This was one of the most unfair panels I’ve ever heard in any of my years in covering journalism.”

Diamond in the Rough

We could have filled this report with hundreds of examples of egregious reporting, but chose to limit ourselves to giving just a single raspberry to the worst story of the year, and then highlighting examples more examples of good environmental reporting instead. Competition for the raspberry is fierce, but the winner of this year’s *Index of Leading Environmental Indicators* Media Raspberry Award has to go to Jared Diamond’s 6,800-word article in the June 2003 edition of *Harper’s* magazine entitled “Environmental Collapse and the End of Civilization.”

Diamond is the author of several imaginative and sprightly books on the intersection of nature, technology, and culture, such as *Guns, Germs and Steel* and *The Third Chimpanzee*. But he goes off the deep end in *Harper’s*, invoking the collapse of Mayan civilization as an example

of what may be in store for the modern world unless something is done (what, exactly, is unspecified). Attributing the Mayan collapse primarily to environmental causes is highly controversial among Mayan scholars, but this does not deter Diamond from a cocksure extrapolation of a poor, pre-technological society to modern America. Diamond even deploys Thomas Malthus, which should give pause to environmentalists who bristle at being called “Malthusians.”

A typical gem from the article: “Even the mildest of bad scenarios for our future include a gradual economic decline, as happened to the Roman and British empires. Actually, in case you didn’t notice it, our economic decline is already well under way. Just check the numbers for our national debt, yearly government budget deficit, unemployment statistics, and the value of your investment and pension funds.” This is embarrassing—Diamond should stick to anthropology.

Happily there were a large number of outstanding examples of environmental news features and editorials from 2003 that offer an edifying counterpoint to Diamond and the other cubic zirconia of the media. Herewith our nominees for the best environmental news features that appeared in the print media in 2003.

Gareth Cook and Beth Daley, *Boston Globe*, “Sea Change: The New England Fishing Crisis,” four-part feature series, September 26-29. Cook and Daley present a balanced view of the environmental and commercial tradeoffs of the old fishing industry in New England, and describe in detail both the scientific uncertainty and bureaucratic blunderbuss at the center of the controversy. Decades of over-fishing have depleted the fish stocks in the region, though not beyond the point of recovery if some kind of workable plan is adopted. The series probed doubts about the scientific assessment of the fish stocks as well as the failed efforts to enforce limits on the catch in the industry.

The authors write:

If there is to be a solution that works—one that does not just set new rules but creates a climate in which they will be accepted and obeyed—it can’t come from the government or courts alone, veterans of the conflict agree. The present dilemma is very much the result of a clash of cultures between three very different groups of people—scientists, environmentalists, and fishermen—whose interests and passions have collided time and again at the water’s edge, building a deep well of distrust that has worsened and sustained the crisis.

Our suggestion: see the example of how the Maine lobster fishing industry solved a similar problem in the early 1990s.

David B. Ottaway and Joe Stephens, *Washington Post*, “Big Green: Inside the Nature Conservancy,” May 4-6, with follow ups. The *Washington Post* decided to subject The Nature Conservancy, one of the largest environmental organizations in the nation, to the journalistic equivalent of a colonoscopy. The resulting series was a devastating critique of insider transactions, favoritism, and self-dealing—possibly in violation of tax laws. In fact, the IRS is auditing the Conservancy as a result of the *Post* expose and Congress is holding its own investigation.

While it is good that a major media outlet would devote this kind of critical attention to a well-established environmental group, this series was not without its weaknesses and omissions. The Nature Conservancy specializes in purchasing land for conservation purposes, though, as mentioned in this report last year, occasionally the Conservancy gets into the business of resource extraction on the land it owns or manages, including oil and gas production and logging. On other occasions it deeds over land it acquires to the state or federal government, thus increasing government ownership of land.

These aspects of the Conservancy’s legacy went unmentioned in the *Post* series. Because the Conservancy generally respects property rights and practices mixed-use management of some of its lands, it is not popular with other environmentalists who favor confiscatory regulation and total non-use of land. One wonders how Greenpeace or the Sierra Club would fare if the *Post* devoted a similar level of scrutiny to them, such as was done by Tom Knudson in the *Sacramento Bee* in 2000.

Jonathan Rauch, “Will Frankenfood Save the Planet?,” *Atlantic Monthly*, October. Rauch surveys the controversy over genetically modified (GM) crops, arguing that “over the next half century genetic engineering could feed humanity and solve a raft of environmental ills—if only environmentalists would let it.” The more politicized environmental groups like Greenpeace and the Sierra Club categorically oppose GM crops. Rauch identifies a number of environmental leaders who are cautiously—and quietly—supportive of GM research, especially David Sandalow of the World Wildlife Fund.

Notes Rauch:

Sandalow is unusual. Very few credentialed greens talk the way he does about biotechnology, at least publicly. They would readily agree with him about the huge risks, but they wouldn’t be caught dead speaking of huge potential benefits . . . From an ecological point of view, a very great deal depends on other environmentalists’ coming to think more the way Sandalow does.

Rauch optimistically predicts that within a decade most environmentalists will come around to Sandalow's position. We'll be sure to check back with Jonathan on this.

Matthew Wald, "Will Hydrogen Clean the Air? Maybe Not, Some Say," *New York Times*, November 11. As mentioned in the introduction, there are significant obstacles to the practical development of hydrogen energy, and perhaps some unanticipated environmental tradeoffs. Most reflection on this subject takes place in scientific journals, so kudos to the *Times*'s Matthew Wald for a significant story on the issue that went well beyond the "on-the-one-hand, on-the-other" quotes from opposing points of view.

Wald's story masterfully presented some of the quantitative limitations facing hydrogen energy systems, such as the fact that the average car today produces 374 grams of carbon dioxide per mile, while a hydrogen fuel-cell car would produce 436 grams of carbon dioxide per mile if the cells were generated with power from the current electricity grid. Neither the cheerleaders nor the critics usually bother to do the nitty-gritty arithmetic of the issue; Wald did.

Elizabeth Shogren, "A Clean Air Act 'Success Story': Carbon Monoxide," *Los Angeles Times*, April 24. There are only a handful of news stories each year that convey the substantial improvement in air quality since the first Earth Day in 1970, so it is notable when a major newspaper notes an improving trend as a full-scale "success story." Elizabeth Shogren took note of a National Research Council report on carbon monoxide (CO) that most of the media overlooked entirely. Shogren's lead minced no words in declaring that "the Clean Air Act quietly all but won the war against carbon monoxide."

Katherine Q. Seeyle, "U.S. Report Faults Efforts to Track Water Pollution," *New York Times*, May 27. Nearly every year this report's section on water quality notes the lack of consistent, reliable trend data on the nation's water. There are many different programs that take helpful snapshots, but no national monitoring system that is commensurate with the national monitoring system for air pollution. The EPA and many environmental researchers have been talking about this problem for a long time, and this year the EPA's inspector general detailed the shortcomings of the EPA's water monitoring system for the Clean Water Act. While most media outlets focused on the news that the EPA has supposedly been lax in imposing fines for water quality violations, the *Times*'s Seeyle was one of the only reporters to focus on the lack of a monitoring program as the heart of the problem.

Eric Umansky, “Erin Brockovich’s Weird Science,” *The New Republic*, November 24.

The kind of breathy reporting that connects a “toxic contaminant” to a nearby health problem is a perennial, and the heroine of the genre, Erin Brockovich, became nearly unassailable after the feature film named for her a few years ago. Special kudos, then, belong to Eric Umansky and *The New Republic* for taking a skeptical look at one of Brockovich’s latest toxic crusades. This time she alleged that oil production near Beverly Hills High School is causing disease among the well-heeled students of that institution.

So much for the popular theory that environmental harms are only located near poor people and never in rich neighborhoods. Umansky’s 5,400-word piece debunks the whole thing, concluding not only that Brockovich and her lawyer are engaged in an attempted shakedown (or hoping to drum up interest in making another movie), but also that her previous toxic crusades—including the one dramatized in the film—were equally bogus.

Among the best editorials and opinion columns of 2003 were:

Jim Wooten, “Voice of Sanity Amid Alarmists,” *Atlanta Journal-Constitution*,

December 21. Most newspaper house editorials and columns these days are written to a formula, which can be reduced to: Bush bad—greens good; pollution bad—clean things good; industry bad—environmental lawsuits good, and so forth. Writing by this method makes it easy to get to the track for the last three races of the day’s card. So it is a rare pleasure to see an editorial writer who honestly grapples with the shadings and difficulties of environmental reality.

The *AJC*’s Jim Wooten frankly acknowledges in his column that “My candidate for the most difficult story in America to decipher is anything related to the environment. Because the issues are complex, because the science often relies on models and assumptions and because the debate occurs at the extremes, it is virtually impossible to know the truth.” There follows a splendid takedown of the thoroughly distorted reporting of the recently announced EPA policy on mercury (to be discussed in the air-quality section), along with some reflections placing the hazards of mercury in context (such as the fact that mercury used by industry has fallen more than 70 percent over the last 30 years).

Nicholas D. Kristof, “Whale on the Table,” *New York Times*, September 17.

Columnist Kristof can be maddeningly inconsistent, sometimes within the paragraphs of a single article, but he occasionally breaks ranks with environmental correctness. Last year we noted

in this space that he thought the snowmobile ban in Yellowstone was wrong, the opposite position from the *Times* editorial page. In 2003 he broke ranks on the subject of whales, noting that we allow whale hunting by Eskimos in Alaska while opposing any whaling by other cultures where it is also traditional.

Says Kristof: “Sure, whales are magnificent. But so are dogs, which end up on dinner plates in Asia. By insisting on the rights of our own natives to pursue the Eskimo diet while denying similar rights to other whaling nations, I’m afraid we in the U.S. aren’t taking the moral high ground; we’re just being hypocritical.”

Jonathan H. Adler, “Bad for Your Land, Bad for the Critters,” *Wall Street Journal*, December 28. Adler, professor of law at Case Western University, remarks on the defects of the Endangered Species Act on the 30th anniversary of its enactment. “The ultimate measure of the ESA’s success is the extent to which it is effective at recovering species from endangered status. By this measure, the law is an abject failure. In the past 30 years, fewer than 30 of the over 1,000 domestic species have been taken off the endangered and threatened species lists.”

The biggest problem with the ESA, Adler argues, is its perverse incentives:

In the simplest terms, the ESA turns ownership of endangered species habitat from an asset into a liability. . . A study in December’s *Conservation Biology* reports that just as many landowners responded to the listing of Preble’s meadow jumping mouse by destroying potential habitat as undertook new conservation efforts. And a majority of landowners would not allow biologists on their land to assess mouse populations out of fear that land-use restrictions would follow the discovery of a Preble’s meadow jumping mouse on their land.

Miscellaneous: The “Well, Duh!” File. The Associated Press’s Karen Testa reported on December 3 that, well, let’s let the headline speak for itself: REDUCED PESTICIDE USE MEANS MORE BUGS ON FOOD.” It seems consumers of fruit and vegetables grown with fewer pesticides are noticing nasty things like black widow spiders (found in three different stores in Boston). . .

What happens when an endangered species doesn’t observe the law? *Los Angeles Times* reporter Deborah Schoch ponders this problem in a November 28 story headlined “Golden Eagles Could Die to Save Threatened Foxes.” Golden eagles, which are protected by federal law, have recently decimated the population of several endangered species of small foxes on the

Channel Islands off the California coast. In order for the foxes to survive, wildlife biologists think, it may be necessary to kill some eagles. Can't wait to see the lawsuits on this one.

Finally, CNN reported on October 3 that we really don't have to worry about global warming after all because oil and gas are going to start running out in less than 10 years. Apparently they missed this same story the previous 50 times it has been published over the last 30 years. At least they are practicing recycling.

Notes

1 John A. Charles, "Shading the Truth Green: An Inside Report on Bias from the Society of Environmental Journalists Conference," *BrainstormNW*, January 2003, available at www.brainstormnw.com.

AIR QUALITY

BY STEVEN F. HAYWARD AND JOEL SCHWARTZ

- Average vehicle emissions are dropping about 10 percent per year as the fleet turns over to inherently cleaner vehicles, including modern SUVs.
- Since 1985, nitrogen oxides (NO_x) emissions from cars have dropped 56 percent and volatile organic compounds (VOCs) are down 67 percent, according to the most recent EPA data.
- Stories touting an uptick in ozone pollution are based largely on the “weekend effect,” a paradoxical situation in which the weekend drop in NO_x emissions, from 10 to 40 percent, causes an increase in ozone levels.
- Asthma rates in children under the age of five rose more than 160 percent between 1980 and 1994, while air pollution rates fell from 25 to 80 percent.

Introduction: Losing Ground, or Unintended Consequences of Success?

Was 2003 the year we started losing the battle against ozone smog? That is what you would think if you read the media headlines. “Smog Woes Back on Horizon,” trumpeted an above-the-fold *Los Angeles Times* headline in mid-July.¹ “It’s One Smoggy Summer,” declared the Associated Press. And *USA Today* joined the chorus in October with “Smoggy Skies Persist Despite Decade of Work.”²

Unfortunately, a reader of these articles will learn very little about what is behind the recent uptick in ozone levels. To the contrary, most media stories convey loads of misinformation. The *USA Today* story, for example, offers this explanation of stubborn ozone levels: “One likely reason why the smog isn’t lifting: Americans are driving more miles than they did in the 1980s. *And they’re driving vehicles that give off more pollution than the cars they drove in the ’80s*” (emphasis added). *USA Today* needs a better fact-checking department.

EVEN WITH INCREASED MILES DRIVEN, TOTAL NITROGEN OXIDES (NO_x) EMISSIONS FROM CARS ARE DOWN 56 PERCENT SINCE 1985, ACCORDING TO THE MOST RECENT EPA DATA, AND EMISSIONS OF VOLATILE ORGANIC COMPOUNDS (VOCs) FROM CARS ARE DOWN A WHOPPING 67 PERCENT.

Late-model cars and light trucks (including SUVs) are much less polluting than models sold in the mid- and late-1980s. Even with increased miles driven, total nitrogen oxides (NO_x) emissions from cars are down 56 percent since 1985, according to the most recent EPA data, and emissions of volatile organic compounds (VOCs) from cars are down a whopping 67 percent.

As shown in Figure 1, SUVs have had about the same VOC emissions as cars since the 1996 model-year, and the difference in NO_x emissions disappeared with the 2001 model-year.³ On-road measurements around the country show that average vehicle emissions are dropping about 10 percent per year as the fleet turns over to inherently cleaner vehicles, including modern SUVs.⁴ But total driving is increasing only about one to three percent each year, giving net annual emissions declines of about seven to nine percent. Figure 2 shows rapid, net declines in vehicle emissions, even after accounting for growth in SUVs and driving.⁵ *USA Today*’s reporting on automobile emissions is not merely wrong, but represents the polar opposite of reality.

Nor will you learn much about the whole story from the environmental lobbies, who are no doubt getting ready to say, “I told you so!” Having complained that President Bush’s

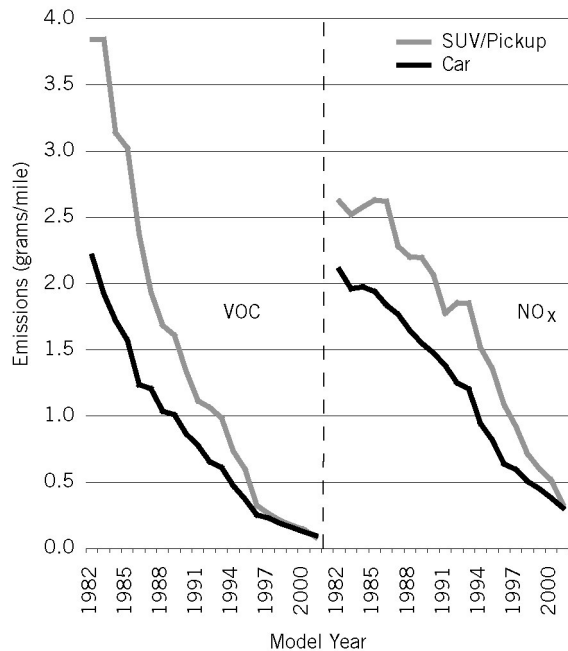
changes to New Source Review (NSR) would increase pollution, the uptick in ozone in some areas looks like vindication. In fact, the changes to NSR have nothing to do with the recent trends in ozone.⁶ Surprisingly, a large story is being overlooked, one that can be posed in the following general question: if emissions of ozone precursors from cars and other sources are falling so quickly, why aren't ambient levels of ozone dropping as well?

ON-ROAD MEASUREMENTS AROUND THE COUNTRY SHOW THAT AVERAGE VEHICLE EMISSIONS ARE DROPPING ABOUT 10 PERCENT PER YEAR AS THE FLEET TURNS OVER TO INHERENTLY CLEANER VEHICLES, INCLUDING MODERN SUVs.

The “Weekend Effect”

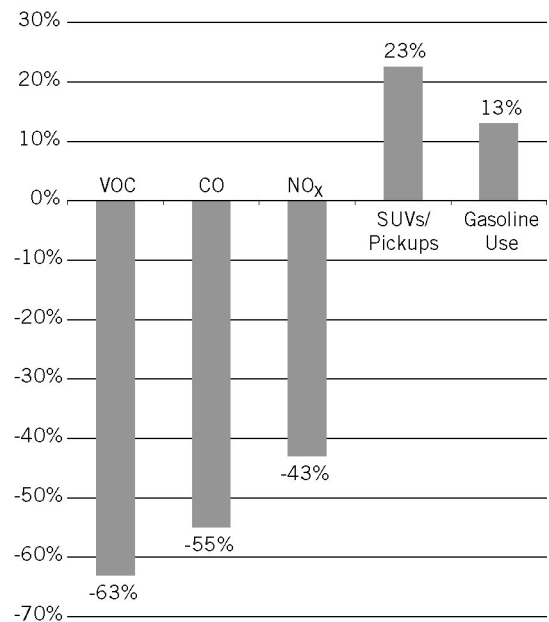
The key to this underreported story can be found in a curious anomaly in the smog statistics: a disproportionate number of exceedences of the ozone standard are occurring on weekends, when emissions of ozone-forming chemicals—especially NO_x—are down anywhere from 10 to 40 per-

FIGURE 1: CAR AND LIGHT TRUCK EMISSIONS BY MODEL YEAR



Source: Based on IM240 text data collected in 2002. Data provided by Tom Wenzel, Lawrence Berkeley Laboratory.

FIGURE 2: NET CHANGE IN AUTOMOBILE EMISSIONS IN CALIFORNIA, 1994–2001



Source: A.J. Kean, et al., “Trends in Exhaust Emissions from In-Use California Light-Duty Vehicles, 1994–2001” (Warrendale, Pennsylvania: Society of Automotive Engineers, 2002).

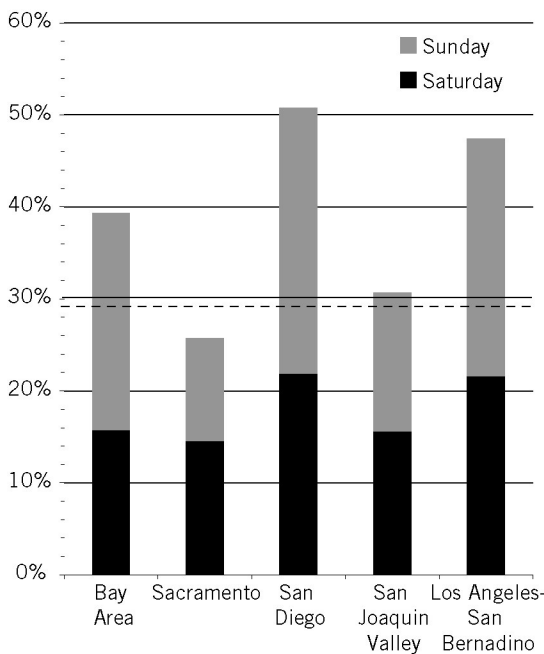
A DISPROPORTIONATE NUMBER OF EXCEEDANCES OF THE OZONE STANDARD ARE OCCURRING ON WEEKENDS, WHEN EMISSIONS OF OZONE-FORMING CHEMICALS—ESPECIAL- LY NO_x— ARE DOWN ANYWHERE FROM 10 TO 40 PERCENT.

cent. (The reduction in NO_x emissions comes chiefly from the sharp decline in diesel truck traffic on weekends.) Figure 3 displays the proportion of ozone exceedances in California air basins that occurred on Saturdays and Sundays between the years 1997 and 2001; the dotted line in Figure 3 indicates the proportion of exceedances that would be expected if exceedances were distributed equally among all

seven days of the week. Figure 3 may actually understate the phenomenon.

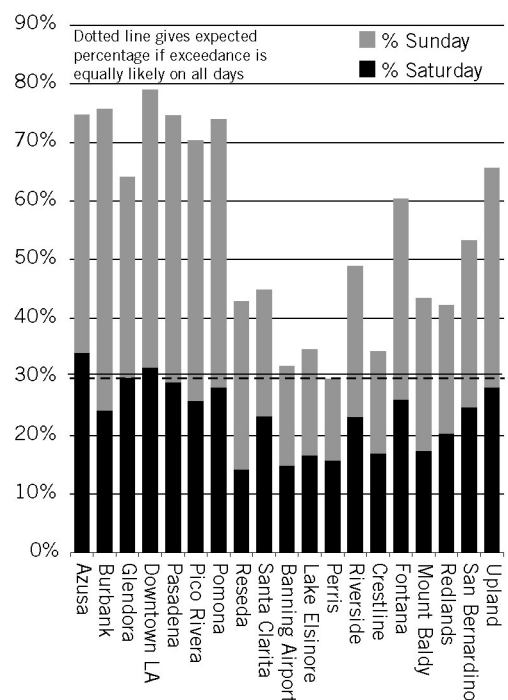
At some monitoring locations in the Los Angeles area, weekend exceedances account for nearly 80 percent of total exceedances. (See figure 4.) And recall once again that these ozone increases are occurring in spite of large declines in NO_x. Although the “weekend effect” is most pronounced in California, it is becoming increasingly prevalent in other cities across the

FIGURE 3: PERCENTAGE OF 8-HOUR OZONE EXCEEDANCES OCCURRING ON A WEEKEND, 1997–2001



Source: Authors' calculations based on CARB data

FIGURE 4: PERCENTAGE OF 8-HOUR OZONE EXCEEDANCES OCCURRING ON A WEEK- END, 1997–2001, LOS ANGELES AIR BASIN



Source: Authors' calculations based on CARB data

HIGHER EMISSIONS OF NO_x ON WEEKDAYS HAVE THE PARADOXICAL EFFECT OF INHIBITING OZONE FORMATION.

nation, including Denver, Chicago, Philadelphia, and New York. Not only are there more ozone exceedences occurring on weekends, but ozone levels are often higher on weekends as well.

Although the news media and many environmental activists are oblivious to the weekend effect, the phenomenon is well known to air-quality scientists, who have been giving the matter increasing scrutiny over the last several years. The California Air Resources Board (CARB) established a “Weekend Effect Working Group” in 1999, and the U.S. Department of Energy’s National Renewable Energy Laboratory has also been actively engaged in studying the issue.⁷ The findings of these efforts are startling.

The chief cause of the weekend effect appears ironically to be lower emissions of NO_x. The formation of ozone from its main precursors (NO_x and VOCs) does not proceed in a linear manner. Ozone formation depends on the ratio of VOC to NO_x and different ratios of VOC/NO_x lead to very different outcomes. When the VOC/NO_x ratio is high—greater than about 10 to one—ozone formation is limited by the availability of NO_x, and VOC reductions have no effect on

The Core Air Quality Indicators

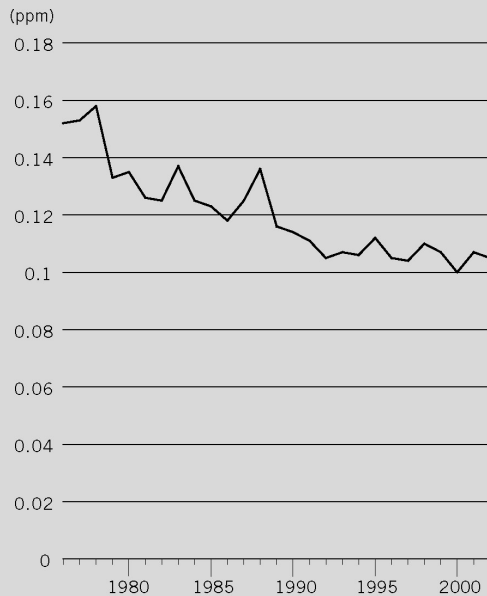
TABLE 4: AMBIENT AIR POLLUTION LEVELS IN THE U.S., 1976–2002

Ozone	-31%
Sulfur Dioxides	-70%
Nitrogen Dioxide	-41%
Carbon Monoxide	-75%
Particulates (PM ₁₀)*	-28%
Lead	-98%

Ozone

As discussed in the introduction to this section, ozone is proving to be a stubborn category of air pollution. Nonetheless, the long-term data show a 31-percent reduction in average national ozone levels on a nationwide basis. This figure, however, understates the improvement in the worst ozone areas such as California, where reductions from peak ozone levels of 30 years ago have been as much as 60 to 70 percent.

FIGURE 5: AMBIENT OZONE, 1976–2002 (ARITHMETIC MEAN, 2ND MAX. 1-HOUR MEASUREMENT)



Source: EPA

IN THE LONG TERM, REDUCTIONS IN VOCs AND NO_x WILL LEAD TO LOWER OZONE LEVELS; IN THE SHORT TERM, HOWEVER, OZONE LEVELS WILL GET WORSE IN MANY AREAS.

ozone levels. But when the VOC/NO_x ratio falls below 10 to one, VOC reductions begin to reduce ozone. The rub is that under VOC sensitive conditions, reducing NO_x increases ozone. Urban areas tend to have the lowest VOC/NO_x ratios and are therefore the most VOC sensitive. During the last few decades the VOC/NO_x ratio has been declining in most areas, increasing the weekend effect.

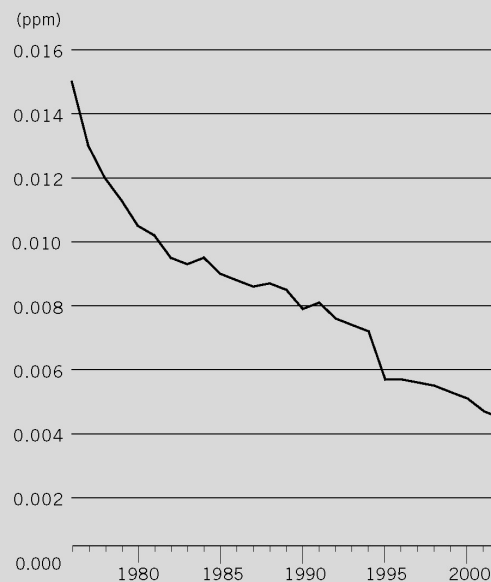
To state this confusing matter in inverse terms, higher emissions of NO_x on weekdays have the paradoxical effect of inhibiting ozone formation. This runs exactly counter to what a common-sense layman would believe to be the case: If there is less pollution coming out of tailpipes and smokestacks, there should be less pollution in the air we breathe. While this is true for most air pollution, it is not always true for ozone.

There are many complicating factors and caveats about the weekend effect, and scientists disagree, as usual, about some of the fine points. But if the foregoing analysis is correct in its essentials, then it raises a startling problem for air-pollution policy. Current regulatory policy aims at large reductions in NO_x emissions over the next

Sulfur Dioxide

The national ambient sulfur dioxide (SO₂) level fell 2.9 percent in 2001, and has now fallen 70 percent since 1976.

FIGURE 6: AMBIENT SULFUR DIOXIDE, 1976–2002 (ARITHMETIC MEAN)



Source: EPA

Nitrogen Oxides (NO_x)

The ambient level of nitrogen dioxide (the most prevalent form of NO_x) has declined 41 percent since 1976, as shown in Figure 7.

Particulates (PM₁₀/PM_{2.5})

The national average ambient level of particulates 10 microns in size (PM₁₀) have declined by 28 percent since 1988 (when a new measurement network went into effect), and by about one percent in 2001. The EPA is starting to implement a new particulate standard of 2.5 microns, and has begun monitoring for the new standard. We will begin reporting and charting the new standard next year, at which point the EPA will have five years of monitoring data

few years. What will happen in a few years when weekday NO_x emissions fall to today's level of weekend NO_x emissions? According to several air quality models, weekday ozone levels would increase roughly to where weekend ozone levels are today.⁸ In other words, regulatory policy is likely to backfire and make ozone worse, at least over the next several years.

Modeling studies suggest that NO_x reductions of up to about 50 percent would increase ozone levels in many major metropolitan areas, including New York, Chicago, Philadelphia, southern California, and the San Francisco Bay area. Beyond about 50 percent, the VOC/NO_x ratio would become high enough that further NO_x reductions would reduce ozone.⁹ In contrast, VOC reductions would reduce ozone at least to some extent almost everywhere and would prove highly effective in some urban areas. However, to attain EPA's stringent eight-hour ozone standard, VOC reductions alone might be insufficient, and NO_x reductions on the order of 70 to 90 percent would ultimately be necessary in most metropolitan areas.

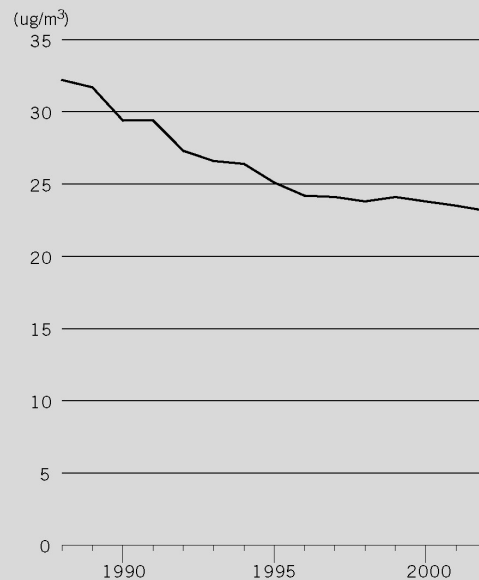
Such large NO_x reductions are unattainable during the next five to 10 years—the amount of time allotted for non-attainment areas to meet an eight-hour standard. This calls into question whether attaining the eight-hour standard is even feasible.

FIGURE 7: AMBIENT NITROGEN OXIDES, 1976–2002 (ARITHMETIC MEAN)



Source: EPA

FIGURE 8: AMBIENT PARTICULATES, 1988–2002 (ANNUAL ARITHMETIC MEAN)



Source: EPA

Backlash to the Backfire

Regulators have been stoutly resisting the implications of the findings about the weekend effect. Admitting that NO_x reductions have become detrimental to ozone control would be a major embarrassment for both EPA and CARB. Both agencies have promulgated stringent regulations that will eliminate most NO_x emissions from automobiles and diesel trucks during the next 20 to 30 years, as the fleet turns over to vehicles built to the tougher standards. EPA is also requiring a 60-percent reduction in NO_x from coal-fired power plants starting this year.

CARB especially has been vigorously resisting the conclusions of independent researchers and offering other hypotheses to explain the weekend effect, including a change in the timing of emissions on weekends or carryover of pollution from increased driving on Friday and Saturday evenings.¹⁰ Most of these explanations are not persuasive, or they merely obfuscate the debate. In fact, CARB's views have failed to pass the rigors of scientific peer review. The July 2003 issue of the *Journal of the Air & Waste Management Association* (JAWMA) devoted a special section to studies of the weekend effect, several of which are cited here. The journal's reviewers rejected CARB's submission.

EPA has similarly resisted the implications of the weekend effect. The technical

[THERE IS] IMPROVEMENT IN THE WORST OZONE AREAS SUCH AS CALIFORNIA, WHERE REDUCTIONS FROM PEAK OZONE LEVELS OF 30 YEARS AGO HAVE BEEN AS MUCH AS 60 TO 70 PERCENT.

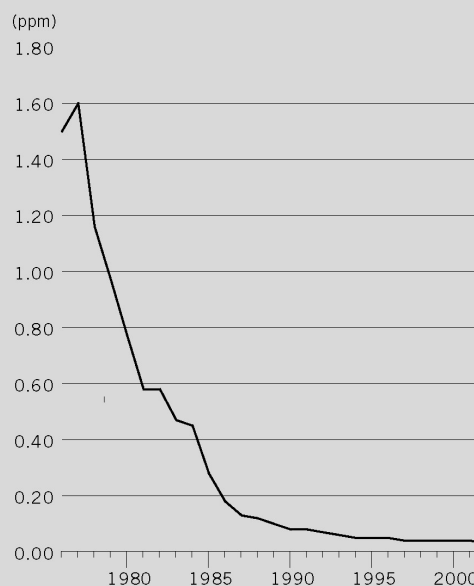
available. The first four years of PM_{2.5} data, from 1999 through 2002, show a seven-percent decline in average national ambient levels.

Lead

The decline in the ambient level of airborne lead is the single greatest success story of air quality in the U.S. Ambient lead levels have fallen steeply and rapidly—98 percent since 1976 (see Figure 9).

The principal measure generating this reduction was the phase-out of leaded gasoline, much of which occurred under rules and regulations promulgated by the Reagan administration, an administration that is seldom given any credit

FIGURE 9: AMBIENT LEAD TREND, 1976–2002



Source: EPA

documentation for EPA's proposed off-road diesel rule, released last May, approvingly cites the CARB paper that was later rejected by JAWMA.¹¹ Therein lies another irony: when EPA in 1999 promulgated a rule requiring a 90-percent reduction in NO_x emissions from automobiles, the agency's own analysis concluded that the rule would increase ozone in many areas of the country.¹²

Sensible Policy Alternatives

Because of the quirky relationship between NO_x, VOCs, and ozone formation, current regulatory policy is leading to the paradoxical world where emissions will continue to fall rapidly, but ambient levels of ozone may increase along a possible path illustrated in Figure 11. In the long term, reductions in VOCs and NO_x will lead to lower ozone levels; in the short term, however, ozone levels will get worse in many areas.

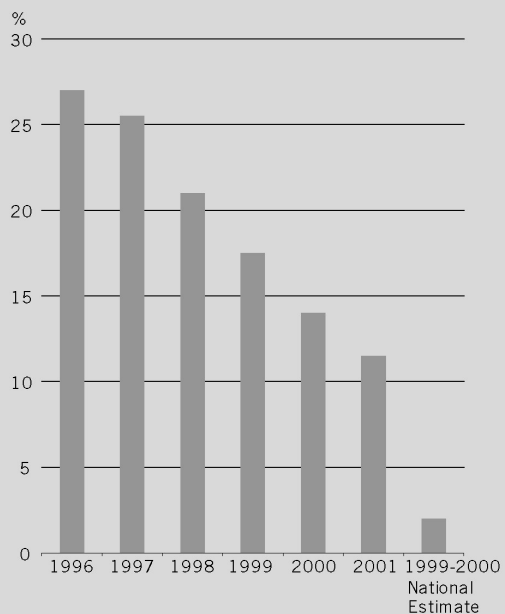
A more sensible strategy for both the short and long term would be for the EPA to seek more rapid reductions in VOCs, and, where possible, delay blanket national NO_x reductions for several years. What makes this strategy appealing is that VOC reductions will reduce ozone in most places, especially places with large populations. Furthermore, atmospheric modeling suggests that the detrimental effects of

AMBIENT LEAD LEVELS HAVE FALLEN STEEPLY AND RAPIDLY —98 PERCENT SINCE 1976.

for environmental progress. Airborne lead emissions from a handful of stationary sources (chiefly metal smelters) remain a problem in a few isolated locations, but as a general matter American children no longer face significant health risks from airborne lead.

The main health risk from lead today comes from lead paint in older housing stock, especially in eastern cities. There are signs that aggressive efforts to target lead-based paint in older housing stock are starting to show results. Figure 10 displays the sharp decline in elevated blood-lead levels among children screened by the Chicago Department of Public Health.

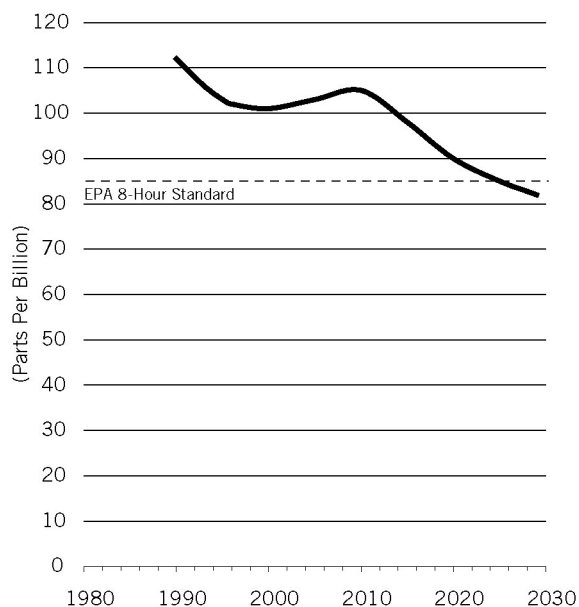
FIGURE 10: PERCENTAGE OF CHICAGO CHILDREN WITH BLOOD-LEAD LEVEL ABOVE 10 UG/DL, 1996–2001



Source: Chicago Department of Public Health

A MORE SENSIBLE STRATEGY FOR BOTH THE SHORT AND LONG TERM WOULD BE FOR THE EPA TO SEEK MORE RAPID REDUCTIONS IN VOCs, AND, WHERE POSSIBLE, DELAY BLANKET NATIONAL NO_x REDUCTIONS FOR SEVERAL YEARS.

FIGURE 11: POSSIBLE TRAJECTORY OF AMBIENT URBAN OZONE LEVELS UNDER CURRENT REGULATORY POLICY



Source: EPA

NO_x reductions can be somewhat mitigated by front-loading VOC reductions to keep ahead of declines in NO_x.

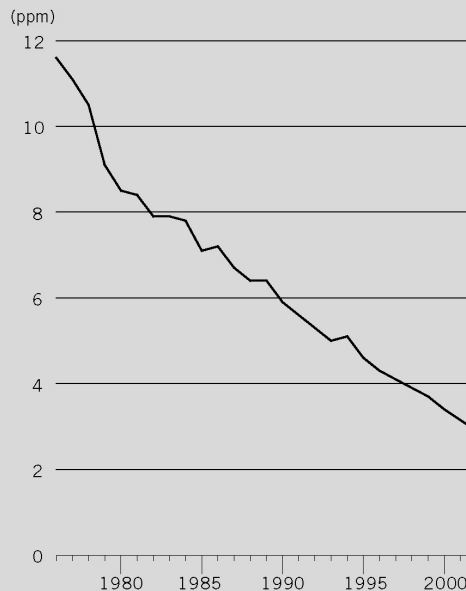
After substantial near-term VOC reductions, later NO_x reductions would achieve eight-hour ozone attainment in the long term, but with less harm in the interim. In addition, this change would give each non-attainment area flexibility to tailor its ozone reduction strategy based on the specifics of local emissions and air chemistry.

NEXT TO LEAD, CARBON MONOXIDE (CO) IS THE LARGEST SUCCESS STORY IN AIR POLLUTION REDUCTION, WITH A DECLINE OF 75 PERCENT SINCE 1976.

Carbon Monoxide

Next to lead, carbon monoxide (CO) is the largest success story in air pollution reduction, with a decline of 75 percent since 1976. In 2002, according to the EPA, “CO levels were the lowest recorded during the past 20 years.”

FIGURE 12: AMBIENT CARBON MONOXIDE TREND, 1976–2002



Source: EPA

More rapid near-term VOC reductions are readily available. Automobiles contribute 50 to 75 percent of all VOC emissions, and the worst five percent of cars account for half the automobile contribution. These cars can be identified on the road with remote sensing and their owners required to repair or voluntarily scrap their cars for a cash incentive. There is no other means to more substantial, more rapid, or less expensive improvements in air quality.

A Guide to Air Pollutants and their Sources

Ozone

Ground-level ozone is the primary contributor to urban smog, although sulfur, nitrogen, carbon, and fine particulate matter contribute to smog's formation as well. Ozone is not emitted directly into the air but forms when volatile organic compounds (VOCs) combine in sunlight with various nitrogen oxides (NO_x), dependent upon weather-related factors. This makes it difficult to predict changes in ozone levels accurately due to reductions in VOCs and NO_x . VOCs evaporate into the atmosphere from motor vehicles, chemical plants, refineries, factories, consumer and commercial products such as lighter fluid, perfume, and other industrial sources. VOCs also occur naturally as a result of photosynthesis.

The December 1991 National Academy of Sciences report on ozone revealed that much of the variation in ozone comes from "natural fluctuations in the weather," not from "year-to-year changes in emissions." Therefore, it concluded that current ozone reduction strategies may be ineffective because they do not account for naturally occurring VOCs.

Sulfur Dioxide

Sulfur dioxide (SO_2) is a colorless gas that forms from the burning of fuel containing sulfur, mainly coal and oil, as well as from industrial and manufacturing processes, particularly the generation of electrical power. Environmental factors such as temperature inversion, wind speed, and wind concentration also affect SO_2 levels.

Nitrogen Oxides

Nitrogen oxides (NO_x) form naturally when nitrogen and oxygen combine through bacterial action in soil, lightning, volcanic activity, and forest fires. Nitrogen oxides also result from human activities including high-temperature combustion of fossil fuels by automobiles, power plants, industry, and the use of home heaters and gas stoves. Environmental agencies particularly track the light brown gas nitrogen dioxide (NO_2)

because in combination with volatile organic compounds (VOCs) in the presence of sunlight it helps form ground-level ozone.

Particulates

Particulate matter is the general term for a mixture of solid particles, including pieces of dust, soot, dirt, ash, smoke, and liquid droplets or vapor directly emitted into the air, where they are suspended for long periods of time. Particulates can affect breathing, damage paints, and reduce visibility. These particles derive from stationary, mobile, and natural sources. Such sources include forest fires and volcanic ash; emissions from power plants, motor vehicles, wood stoves, and waste incineration; and dust from mining, paved and unpaved roads, and wind erosion. Indeed, the highest PM₁₀ level in the nation, in Inyo County, California, is caused not by man-made sources, but from wind-blown dust from a dry lake bed.

Lead

Lead is a soft, dense, bluish-gray metal used in piping, batteries, weights, gunshot, and crystal. Of the six criteria pollutants, lead is the most toxic. When ingested through food, water, soil, dust, or inhaled through the air, lead can accumulate in the body's tissues and is not readily excreted. Excessive exposure to lead can cause anemia, kidney disease, reproductive disorders, and neurological impairments such as seizures, mental retardation, and behavioral disorders.

Carbon Monoxide

When fuel and other substances containing carbon burn without sufficient oxygen, they produce carbon monoxide (CO), a colorless, odorless, and at high levels, poisonous gas. Although trace amounts of CO occur naturally in the atmosphere, transportation sources account for 79 percent of the nation's total emissions. In cities, automobile exhaust may be responsible for as much as 95 percent of all CO emissions. Industrial processes, non-transportation fuel combustion, and natural sources such as wildfires are other sources of CO emissions.

Update: What's Up With Asthma?

Many environmentalists like to attribute sharply rising asthma rates in the U.S. to air pollution, though as we have noted in this report previously, this is mysterious since air pollution levels have consistently declined while asthma rates have been increasing. In the United States alone more than 17 million people have asthma, and it kills 5,000 people a year. Asthma rates in children under the age of five rose more than 160 percent between 1980 and 1994—a period when air pollution rates fell from 25 to 80 percent, depending on the pollutant. (The latest trend data is displayed in Figure 13.)

In last year's edition, we noted the inverse relationship that exists in international health data, with the lowest asthma rates occurring in

ASTHMA RATES IN CHILDREN UNDER THE AGE OF FIVE ROSE MORE THAN 160 PERCENT BETWEEN 1980 AND 1994—A PERIOD WHEN AIR POLLUTION RATES FELL FROM 25 TO 80 PERCENT, DEPENDING ON THE POLLUTANT.

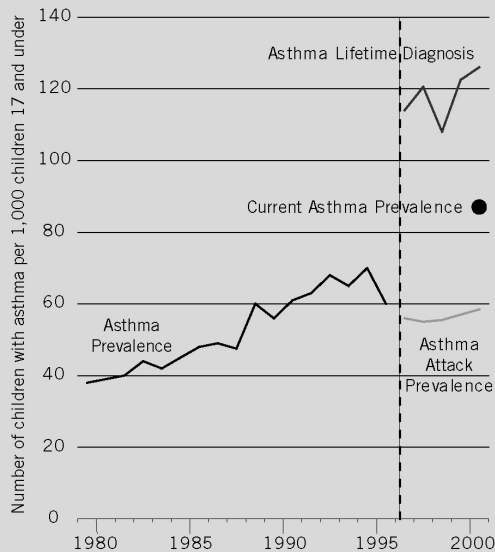
nations with the worst current levels of air pollution such as China and India, while the highest rates exist in nations with low air pollution such as New Zealand and England. While air pollution may trigger asthma attacks in people with the disease, it is doubtful that air pollution can be said to be a cause of the disease in the first place.

Several new studies in the past year have deepened the mystery but mostly exonerate air pollution as a primary cause of asthma. WebMD reported on research in Europe that identified higher rates of asthma among people who are frequent swimmers in indoor pools, suggesting that some of the chlorine compounds used to keep pools clean might be a contributing factor,

though the moist air of indoor pools could be a factor as well. But even if this causal factor is borne out in further research, it cannot explain the overall rise in childhood asthma rates in the U.S. among the large number of children who never see an indoor pool.

In June Reuters reported on research in the U.S. that has identified a potential genetic trigger for asthma—a cluster of 291 genes that seem to correlate with the incidence of asthma.¹³ While this research promises to help guide the development of effective asthma treatments, it still does not explain the increasing rates of asthma in developed countries.

FIGURE 13: ASTHMA PREVALENCE, 1980–1996; ASTHMA LIFETIME DIAGNOSIS; CURRENT ASTHMA; AND ASTHMA ATTACK PREVALENCE 1997–2001, IN CHILDREN



Note: Methodology for asthma tracking was changed in 1997; pre-1997 data cannot be directly compared to post-1997 data.
 Source: Based on and updated from L.J. Akimbami and K.C. Schoendorf, Trends in Childhood Asthma: Prevalence, Health Care Utilization and Mortality, and CDC National Center for Health Statistics

Next Up: Mercury

The newest frontier in air-quality regulation is going to be mercury. The EPA announced plans in the fall to begin regulating mercury emissions, chiefly from coal-fired power plants, through a regional tradable emissions program that is a precursor to the national tradable emissions program proposed in the Bush administration's Clear Skies Initiative. (Clear Skies and the related controversy over changes to New Source Review were analyzed at length in last year's edition of the *Index*.) This development comes almost simultaneously with news from the EPA that the number of newborn babies with potentially dangerous levels of mercury could exceed 600,000, which is double the previous estimate.

However, most of this mercury exposure probably comes from eating fish (especially tuna) with high mercury levels, but it is not clear that fish absorb mercury primarily from power plant air pollution. Although mercury emissions from power plants are estimated to be about 48 tons per year (by contrast, power plants emit about 10 million tons of sulfur dioxide), volcanic activity and forest fires can be significant sources of airborne mercury, while runoff of soil laden with trace amounts of mercury (often from fertilizers that used mercury) also contributes to fish contamination. At present, 41 states have warnings to anglers to limit wild fish consumption because of mercury risk. This is an ideal illustration of unfashionable tradeoffs, as nutritionists exhort us to eat more fish, especially salmon, to lower heart risk.¹⁴

Industrial use of mercury has already dropped 75 percent between 1988 and 1997. These reductions in mercury use may already be showing up in lower levels in wildlife, as shown in Figure 14 below, which displays mercury levels in Bald Eagle feathers as tracked by Michigan's Department of Environmental Quality.

Science magazine offered these incisive comments on mercury in January:

“Rhetoric aside, much of the underlying science [on mercury] is still uncertain. Recent studies do suggest that in some locations cutting emissions can help wildlife—and thus presumably human health—within years. But how general these results are, or what the magnitude of benefit from the new regulations is, remains unclear. ‘There’s a fundamental disagreement about what the overall benefits will be,’ says geo-

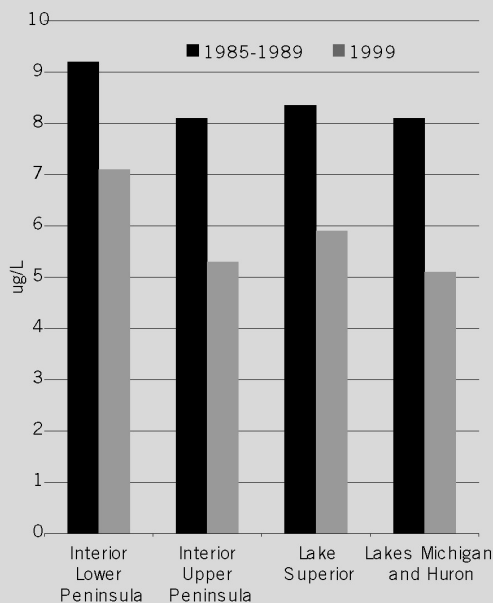
chemist David Krabbenhoft of the U.S. Geological Survey. . .

“The net result is hard to quantify because of a lack of long-term monitoring. But findings released in November are encouraging. This 10-year study of the Florida Everglades showed that mercury levels have declined by as much as 75 percent in fish and wading birds at half the sample sites.

“Scientists are uncertain about important details, from the idiosyncratic chemistry of coal combustion to the myriad reactions that determine when mercury falls from the sky and how toxic it becomes.”¹⁵

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BECAUSE OF MERCURY RISK.**

FIGURE 14: MEAN MERCURY LEVELS IN NESTING BALD EAGLE FEATHERS



Source: Michigan Department of Environmental Quality

Notes

- 1 Gary Polakovic, "Smog Woes Back on Horizon; After decades of improvement, ozone levels are up in the L.A. Basin, fed by growing traffic and a lack of new pollution controls," *Los Angeles Times*, July 15, 2003, p. 1.
- 2 Traci Watson, "Smoggy Skies Persist Despite Decade of Work," *USA Today*, October 16, 2003, p. 1.
- 3 The data in the chart come from Denver's vehicle inspection program and were collected in 2002.
- 4 For more information on declining auto emissions, see Joel Schwartz, *No Way Back: Why Air Pollution Will Continue to Decline* (Washington, DC: AEI Press, 2003), www.aei.org/publications/filer.economic,bookID.428/book_detail.asp.
- 5 The data were collected each year in the Caldecott Tunnel in California from 1994-2001 and are reported in A. J. Kean and R. F. Harley, "Trends in Exhaust Emissions from In-Use California Light-Duty Vehicles, 1994-2001" (Warrendale, Pennsylvania: Society of Automotive Engineers, 2002).
- 6 For background on the New Source Review controversy, see Steven F. Hayward, "Making Sense of New Source Review," *AEI Environmental Policy Outlook*, July 2003, www.aei.org/publications/pubID.18961/pub_detail.asp, and Joel Schwartz, "New Source of Confusion," *TechCentralStation.com*, August 27, 2003, <http://www.techcentralstation.com/082703A.html>.
- 7 For a non-technical, but detailed account, see especially D. R. Lawson, "The Weekend Effect—the Weekly Ambient Emissions Control Experiment," *Environmental Manager* (July 2003), pp. 17–25.
- 8 NREL scientist Doug Lawson succinctly states the problem thus: "The projected 2010 weekday emissions estimates are not greatly different from current weekend ROG [VOC] and NO_x emission inventories. . . Using CARB's emissions projections, calculations suggest that weekday ambient O₃ levels in the SoCAB [South Coast Air Basin (i.e., Southern California)] in 2010 might be similar to weekend O₃ concentrations." *Ibid*, pp. 23, 25.
- 9 E. M. Fujita, et al. "Evolution of the Magnitude and Spatial Extent of the Weekend Ozone Effect in California's South Coast Air Basin, 1981-2000," *Journal of the Air & Waste Management Association*, 53, (2003): pp. 864-875; S. Reynolds, et al. "Understanding the Effectiveness of Precursor Reductions in Lowering 8-Hr Ozone Concentrations," *Journal of the Air & Waste Management Association*, 53, (2003): pp. 195–205.
- 10 See B. E. Croes, et al. "The O₃ 'Weekend Effect' and NO_x Control Strategies: Scientific and Public Health Findings and Their Regulatory Implications," *Environmental Manager*, (July 2003): pp. 27–35.
- 11 EPA, "Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines. Chapter 2. Air Quality, Health, and Welfare Effects," (Washington, DC: 2003), www.epa.gov/otaq/diesel.htm.
- 12 Abt Associates, "Tier II Proposed Rule: Air Quality Estimation, Selected Health and Welfare Benefits Methods, and Benefit Analysis Results," (Research Triangle Park, NC: EPA, 1999).
- 13 "Cluster of Genes Linked with Asthma," Reuters wire-service story, June 16, 2003.
- 14 For additional background on mercury, see Randall Lutter and Elizabeth Irwin, "Mercury in the Environment: A Volatile Problem," *Environment*, November 2002, pp. 24-40.
- 15 Erik Stokstad, "Uncertain Science Underlies New Mercury Standards," *Science*, Vol. 303 (January 2, 2004), p. 34.

AIR QUALITY: THE U.S. AND EUROPE COMPARED

BY STEVEN F. HAYWARD WITH RYAN STOWERS

- The 15 E.U. nations have ambient air quality targets that are stricter than the U.S. targets; however, E.U. policy sets a much less ambitious target for the number of exceedances of the target that are allowed, making comparisons with U.S. air quality complex.
- Measures of emissions intensity show the U.S. and E.U. have been reducing emissions at roughly the same rate relative to their economic and population growth.

It is often presumed in press commentary and public discourse that European environmental policy is more sophisticated and enlightened than the United States. One way of testing this impression is a head-to-head comparison of environmental performance between European nations and the U.S. This is surprisingly difficult to do because the European Union (E.U.)¹ has different environmental standards than the U.S. and, moreover, the E.U. measures environmental performance very differently than the U.S. does.

The E.U., for example, measures air pollution concentration in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) while the U.S. measures in parts per million (ppm). This is probably one reason why there are so few direct comparisons available; our literature search found none, in fact. This edition of the *Index* will compare European and American performance on air quality; future editions will examine other common areas such as water quality and forest health.

As Table 5 shows, the 15 E.U. nations have ambient air quality targets that are stricter than the U.S. targets (only the carbon monoxide target is the same as the U.S. target); however, E.U. policy sets a much less ambitious target for the number of exceedences of the target that are allowed. This makes it difficult to judge whether the U.S. or the E.U. has the tougher air quality standard.

The U.S. ozone standard, with a target of less than one exceedence a year, is likely more difficult to reach than the E.U. ozone target of holding ozone exceedences below 26 a year; an out-of-compliance area in the U.S. might have lower ozone exposure than a European region that is in compliance with E.U. targets. The E.U. target on sulfur dioxide (SO_2) appears stricter than the U.S.; on the other hand, the E.U. has no standard for fine particulates ($\text{PM}_{2.5}$) while the U.S. has adopted an aggressive standard. The standards for lead cannot be compared at all, as the E.U. and U.S. measurements are wholly incompatible. The E.U. appears to have a tougher target than the U.S., but lead levels in the U.S. have fallen so low that we would easily make the E.U. target no matter how it was measured.

Like the United States, European nations have made substantial progress in improving air quality. It is difficult to say exactly how much progress, or how it compares to the U.S., because European air quality monitoring efforts have significantly lagged monitoring efforts in the U.S.

In the case of ozone, comprehensive monitoring was not in place until 1994, whereas the U.S. has been systematically monitoring ozone since the mid-1970s. “Current data,” the European Environment Agency (EEA) reports, “do not yet allow a systematic assessment of exceedences of the new threshold values,” though the EEA also says that “ozone concentrations in Europe commonly exceed the threshold set for protection of human health.”

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Systematic monitoring for particulates (PM₁₀) in the EU was only achieved in 1997, while the U.S. has been systematically monitoring PM₁₀ since 1988 and has been monitoring the new PM_{2.5} standard since 1999. The EEA does not report ambient levels of air pollution in the same way the U.S. does, and because the EEA uses different standards than the U.S. the exceedence rate cannot be compared either.

Hence it is impossible to make simple head-to-head comparisons of ambient air quality conditions between the U.S. and the E.U. However, the E.U. does have emissions data going back to the early 1980s that can be compared with U.S. emissions data. EU data are available from 1980 to 1998; data from 1999 to 2001 are inconsistent with data from earlier periods probably on account of changes to emissions models the EEA has adopted. There are no data available for E.U. lead or particulate emissions.

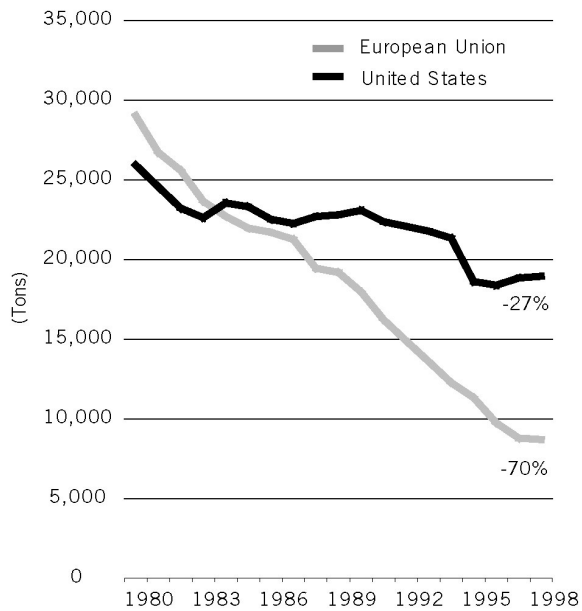
Figures 15–18 compare U.S. and E.U. trends in emissions of sulfur dioxide (SO₂), VOCs, carbon monoxide (CO), and nitrogen oxides (NO_x). At first glance the comparative trends suggest that the E.U. had lower emissions than the U.S. to begin with (with the exception of SO₂—see Figure 15) and has achieved larger emission reductions than the U.S. with the exception of VOCs. Table 6 summarizes the relative emissions reductions of the U.S. and E.U. (In the case of

TABLE 5: EUROPEAN AND U.S. AIR QUALITY STANDARDS COMPARED

	Standard		Exceedence Target	
	<u>E.U.</u>	<u>U.S.</u>	<u>E.U.</u>	<u>U.S.</u>
Ozone (8-hr)	120 ug/m ³	157ug/m ³	<26 days/year	<1 day/year
PM ₁₀ (24-hr)	50ug/m ³	150ug/m ³	<35 days/year	<1 day/year
PM _{2.5} (ann. avg.)	No std.	15 ug/m ³	n/a	<1 day/year
SO ₂ (24-hr)	125 ug/m ³	365 ug/m ³	<4 days/year	<1 day/year
NO ₂ (ann. avg).	40 ug/m ³	100 ug/m ³	None	<1 day/year
NO ₂ (1-hr)	200ug/m ³	No 1 hr std	<20 days/year	n/a
CO (8-hr)	10 mg/m ³	10 mg/m ³	None	<1 day/year

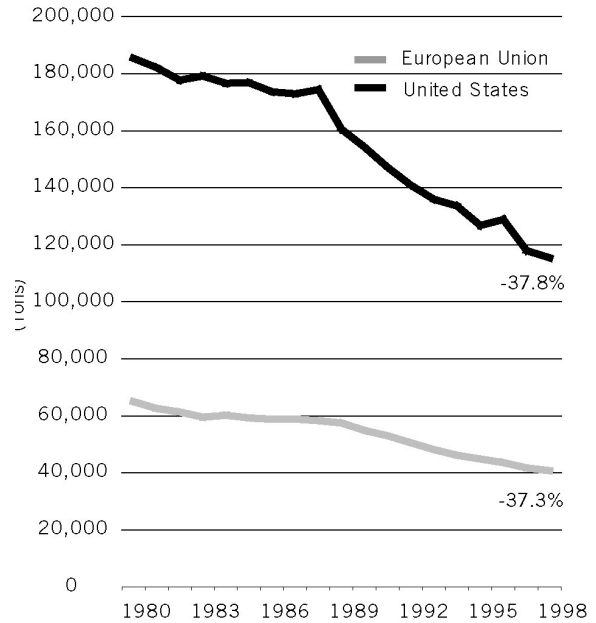
Source: EPA and European Environment Agency (EEA)

FIGURE 15: SULPHUR DIOXIDE (SO₂) EMISSION TRENDS, 1980–1998



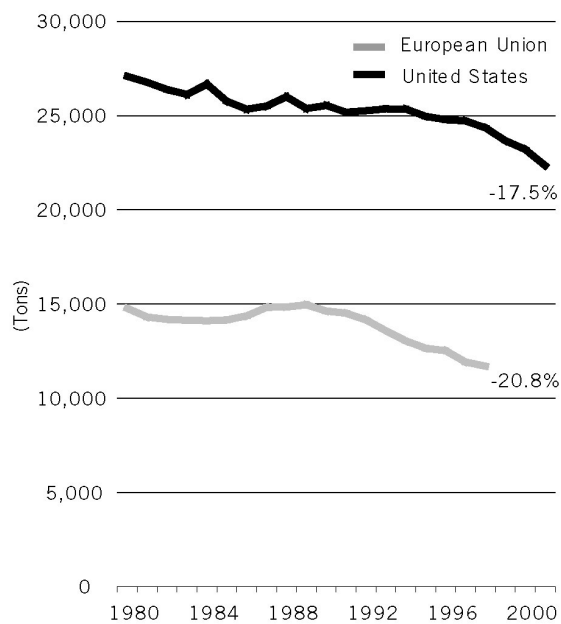
Source: EPA and European Environment Agency (EEA)

FIGURE 16: CARBON MONOXIDE (CO) EMISSION TRENDS, 1980–1998



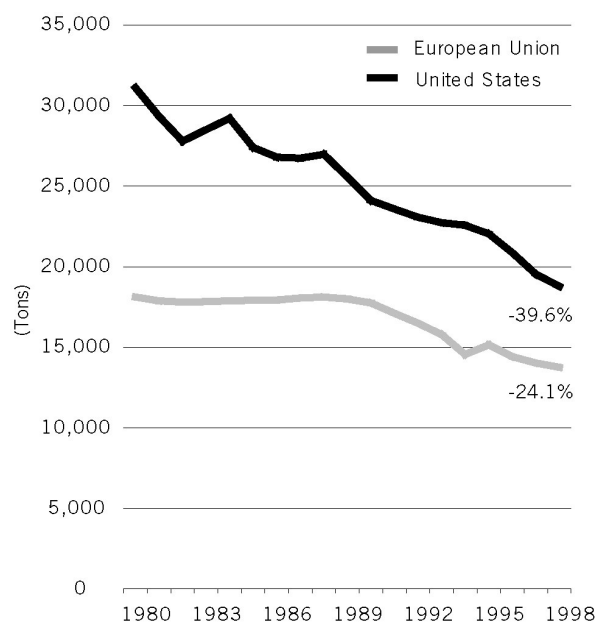
Source: EPA and European Environment Agency (EEA)

FIGURE 17: NITROGEN OXIDES (NO_x) EMISSION TRENDS, 1980–2001



Source: EPA and European Environment Agency (EEA)

FIGURE 18: VOLATILE ORGANIC COMPOUNDS (VOC) EMISSION TRENDS, 1980–1998



Source: EPA and European Environment Agency (EEA)

TABLE 6: U.S. AND E.U. EMISSIONS REDUCTIONS COMPARED, 1980–1998

	<u>U.S.</u>	<u>E.U.</u>
SO ₂	-26.9%	-70.0%
VOCs	-39.6%	-24.1%
NO _x	-10.1%	-20.8%
CO	-37.8%	-37.3%

Source: EPA and European Environment Agency (EEA)

TABLE 7: PER-CAPITA U.S. AND E.U. EMISSIONS REDUCTIONS COMPARED, 1982–1998

	<u>U.S.</u>	<u>E.U.</u>
SO ₂	-67.6%	-31.4%
VOCs	-43.2%	-26.4%
NO _x	-22.4%	-21.4%
CO	-45.4%	-36.7%

Source: EPA and European Environment Agency (EEA)

NO_x and SO₂, we have added more recent data for the U.S., as a new tier of emissions targets that took effect in 1999 show an increase in the rate of emission reduction in the last three years.) On the surface, at least, the European experience may be said to indicate that larger reductions can be expected in the U.S.

Several qualifying factors should be considered when evaluating these comparisons, however. Some of the obvious differences between the economic and energy profiles of the U.S. and the E.U. come to mind, such as the much higher proportion of electricity generation from emission-free nuclear power, as much as 70 percent of the total in France, for example, versus less than 20 percent in the U.S. As most air pollution is a byproduct of combustion to produce energy, Europe’s high fuel and energy taxes suppress energy consumption far below the rate of the U.S.

Population growth in the U.S. has been substantially higher during this period: the E.U.’s population grew by about five percent, while the U.S. population grew 20 percent. The economies of the two regions grew at about the same pace during the last two decades and are roughly the same size, but the E.U.’s larger population means that U.S. per-capita income is nearly 40-percent higher than the E.U.

THESE MEASURES OF EMISSIONS INTENSITY SHOW THAT THE U.S. AND THE E.U. HAVE BEEN REDUCING EMISSIONS AT ROUGHLY THE SAME RATE RELATIVE TO THEIR ECONOMIC AND POPULATION GROWTH.

TABLE 8: U.S. AND E.U. EMISSIONS REDUCTIONS PER DOLLAR OF GDP, 1982-1998

	<u>U.S.</u>	<u>E.U.</u>
SO ₂	-69.8%	-88.1%
VOCs	-75.0%	-73.0%
NO _x	-65.8%	-71.1%
CO	-76.8%	-76.0%

Source: EPA and European Environment Agency (EEA)

One way of equalizing the population and economic differences of the two spheres is to compare emissions reductions on a per-capita basis and on the basis of emissions per dollar of Gross Domestic Product (GDP). Table 7 displays emissions reductions on a per-capita basis, and Table 8 compares emissions per dollar of GDP. (E.U. GDP information was only available back to 1982 from the U.N. Economic Commission for Europe.) These measures of emissions intensity show that the U.S. and the E.U have been reducing emissions at roughly the same rate relative to their economic and population growth.

Notes

¹ The 15 members of the European Union are: Austria, Belgium, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Sweden. The European Environmental Agency (EEA) collects some data on non-E.U. nations, but we have not included these here because of their incompleteness.

WATER QUALITY

BY STEVEN F. HAYWARD

- The EPA reports that the percentage of the U.S. population served by water systems that have reported no violations of any health-based standards has risen from 79 percent in 1993 to 94 percent in 2002.
- While water quality monitoring is much less reliable than that of air quality, there have been improvements in recent years. Indiana, Maryland, and at least 17 other states are developing statistical sampling systems that promise to produce more useful trend data.
- Private efforts such as Ducks Unlimited have been enormously successful in conserving habitat for waterfowl and other wildlife, and private water trusts have also helped further conservation efforts in a number of states.

A lack of consistent, comprehensive trend data for water quality in the U.S. remains one of the largest frustrations in the development of meaningful environmental indicators—a circumstance we have commented upon in past editions. The EPA’s *Draft Report on the Environment* last year also noted this problem: “At this time there is not sufficient information to provide a national answer to this question [of water quality] with confidence and scientific credibility.”

It is certain that water quality has improved in many ways since the passage of the Clean Water Act in 1972, but there are no data-sets or measures that are commensurate with our national findings on air quality. And without national benchmarks, it can be difficult to make judg-

THE PERCENT OF THE U.S. POPULATION SERVED BY WATER SYSTEMS THAT HAVE REPORTED NO VIOLATIONS OF ANY HEALTH-BASED STANDARD HAS RISEN FROM 79 PERCENT IN 1993 TO 94 PERCENT IN 2002.

ments about local conditions, assign priorities to clean up efforts, or even to enforce major water pollution statutes.

The primary reason for the tentativeness about water quality trends is that we still are not capable of measuring water quality systematically for the purposes of national reporting in the same way we measure air pollution. The best that can be said is

that the EPA and other government agencies are pressing hard to develop better and more consistent water quality data. The EPA reported last August on the efforts of states to promote the work of regional water quality councils to coordinate and improve monitoring activities.¹

While there is some encouraging progress, state councils still have a long way to go, as is made evident by some of the language in the EPA’s evaluation, such as: “What works in one Council may not prove effective for all Councils. This may arise out of variation in the mix of personalities at a Council; the powers granted to a Council at its inception; or the Council’s traditional relationship with state agencies in its area of concern.” In other words, this effort is entirely haphazard.

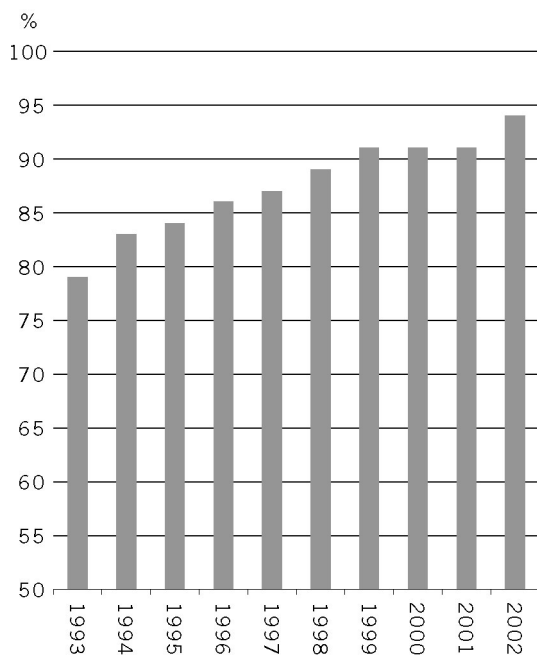
One large dataset that typically gets a lot of media attention is the National Water Quality Inventory (NWQI), which the EPA produces every other year. As this edition of the *Index* goes to press, the 2002 NWQI is not yet available from the EPA (we reported the results of the 2000 NWQI in last year’s edition). This is just as well, for the NWQI is so incomplete and inconsistent that the EPA has always discounted its results and cautioned that it cannot be used for tracking national trends.

The single biggest problem with NWQI data is that it comes from each of the 50 states, whose level of monitoring varies widely. Some states evaluate only a small portion of their rivers, streams, and lakes, while other states use casual sampling methods that generate low-confidence results. But there are signs of gradual progress. Indiana has begun a rotating assessment of 20 per-

cent of its streams and rivers each year, such that over a five-year period 100 percent of its water bodies will be assessed. Maryland has instituted a probability-based survey of its streams according to a few simple measures of biological health; at least 17 other states are developing statistical sampling systems that promise to produce better and more useful trend data.

In the meantime, researchers must pick over the partial sources of data for clues about trends in water quality and availability. Last year in this section we reported on data from the EPA's report on children and the environment showing that the number of

FIGURE 19: PERCENT OF POPULATION SERVED BY COMMUNITY WATER SYSTEMS WITH NO REPORTED VIOLATIONS OF HEALTH-BASED STANDARDS



Source: EPA

Sources of Water Quality Information

While data for a national trend assessment are not yet available, there are several good sources of detailed local information available. The U.S. Geological Survey's National Water Quality Assessment has produced 36 detailed reports on major river basins throughout the nation. The reports are available at <http://water.usgs.gov/nawqa/nawqasum/>.

The U.S.G.S. also operates the National Stream Quality Accounting Network (NASQAN), which monitors water quality in four large river basins (Colorado, Columbia, Mississippi, and the Rio Grande, including the major tributaries of these rivers). This program offers some trend data for these river basins, and can be found at <http://water.usgs.gov/nasqan/>.

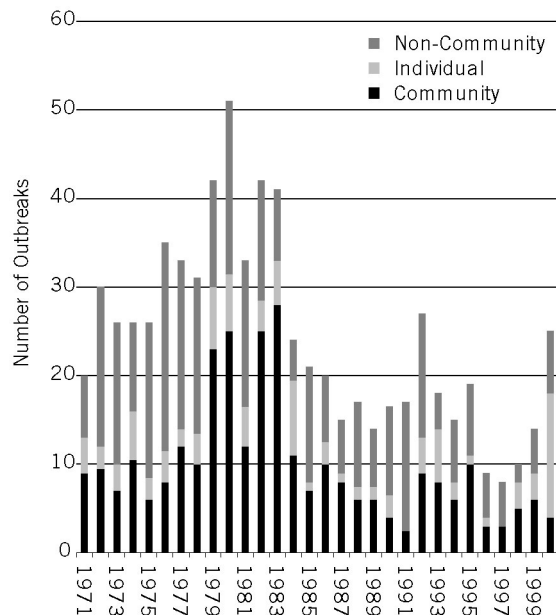
Even with this more detailed data, the Geological Survey, like the EPA, cautions that "Water quality is constantly changing, from season to season and from year to year. Long-term trends are sometimes difficult to distinguish from short-term fluctuations. For many chemicals, it is too early to tell whether conditions are getting better or worse because historical data are insufficient or too inconsistent to measure trends."²

The EPA has upgraded its online water quality data for watersheds, at www.epa.gov/storet/. (This site is cumbersome and requires the user to download special free software to use the data files.) The watershed data on this EPA site concentrate especially on effluent discharge and biological conditions.

Other useful websites include:

- The National Hydrology Dataset (<http://nhd.usgs.gov>) offers spatial images of watersheds, integrating data from the Toxics Release Inventory and tracking water bodies where Total Maximum Daily Load (TMDL) programs are being implemented.
- The Watershed Information Network (www.epa.gov/win/) also offers "geospatial" images of local watersheds, and links to

FIGURE 20: NUMBER OF REPORTED WATER-BORNE DISEASE OUTBREAKS ASSOCIATED WITH DRINKING WATER BY TYPE OF WATER SYSTEMS, 1971–2000



Source: EPA

dozens of state, local, and private water monitoring programs.

- A related EPA site, the Index of Watershed Indicators (www.epa.gov/iwi/), offers data on 18 different indicators of water quality in 2,111 watersheds throughout the U.S. The EPA's 1996 report launching this project acknowledges the gaps and limitations of the currently available data, and provides a roadmap for improvement. This is one of the easier sites for the non-expert citizen to use.
- The North American Lake Management Society operates a remote-sensing water quality program using satellite imagery for lakes in Michigan, Minnesota, and Wisconsin (including the Great Lakes contiguous to these states) at <http://resac.gis.umn.edu/lakeweb/index.htm>.

children living in areas served by public water systems that failed one or more water quality standards had fallen by half over the last decade, from 20 percent in 1993 to eight percent in 1999.

The EPA's *Draft Report on the Environment* last year updated the same data, except that it reversed how it was presented and applied it to all people, not just children. Now, as Figure 19 shows, the percent of the U.S. population served by water systems that have reported no violations of any health-based standard has risen from 79 percent in 1993 to 94 percent in 2002.

The EPA's *Draft Report on the Environment* also contained trend data on waterborne disease outbreaks (WBDO) from 1971-2000, which are displayed in Figure 20 according to type of water system.

Update: More Dams Coming Down

The seventh edition of this report (2002) highlighted the case study of the Sand County Foundation's efforts to remove old, privately-owned dams on the Baraboo River and other rivers in Wisconsin. The trend is spreading (as shown in Figure 21), and the media is starting to take notice. The *Sacramento Bee* reported on the steps Pacific Gas and Electric has taken to remove

WHILE THE ECOLOGICAL DISRUPTION FROM DAMS IS A WELL-KNOWN THEME, THE REMOVAL OF DAMS IS NOT WITHOUT ITS OWN POTENTIAL ECOLOGICAL EFFECTS THAT NEED TO BE UNDERSTOOD.

old dams in the Sierra Nevada foothills, while the *New York Times* editorial page commented on a coalition of environmental groups and industry that removed two dams on the Penobscot River in Maine.

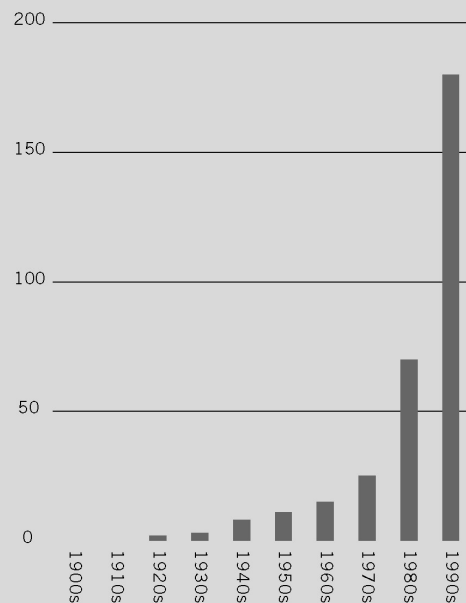
Many questions remain, however, about dam removal, starting with the basic question of how many dams exist in the country. There may be as many as two million small dams in the U.S. according to some estimates; 80,000 dams of six feet or higher have been inventoried. While the ecological disruption from dams is a well-known theme, the removal of dams is not without its own potential ecological effects that need to be understood.

In some cases, stirred-up sediment in rivers following dam removal significantly disrupted fish populations. Dam removals require permits and full environmental reviews in most states, and as incredible as it may seem, in some cases a prospective

dam removal might run afoul of both clean-water laws and the Endangered Species Act because of the sediments that would be released. While some environmentalists advocate the removal of the very large New Deal-era dams on the Columbia and Snake Rivers in the Pacific Northwest, there has been surprisingly little research on the environmental impact of large dam removal.

The most thorough discussion of the issues involved in dam removal comes from the Heinz Center for Science, Economics and the Environment, which has published two major reports on the subject.³ A workshop in September 2003 reviewed progress in developing a research agenda and tracking progress in data gathering. Watch the Heinz Center website (www.heinzctr.org) and its newsletter, *Crossroads*, for updates.

FIGURE 21: DAM REMOVALS IN THE U.S. IN THE 20TH CENTURY



Source: Molly M. Pohl, "American Dam Removal Census," in Graf, ed., *Dam Removal Research*, Heinz Center, 2003

Ducks Unlimited

by Michael De Alessi

Wetlands throughout North America provide diverse and productive habitat for everything from fish to waterfowl to reptiles. They also serve an important hydrologic function by controlling floods, recharging groundwater, and improving water quality through sedimentation and nutrient uptake.

Hunters have long understood the value of wetlands and over the last century, while both federal and state governments subsidized the destruction of wetlands, sportsmen were finding creative ways to protect this valuable habitat. In fact, many properties that are now part of the National Wildlife Refuge system got their start as private hunting reserves. Another notable effort was the formation in 1937 of Ducks Unlimited (DU), an organization with the express purpose of enhancing and protecting waterfowl populations throughout North America by restoring their vital wetland habitat.

Large-scale wetlands destruction began in the United States with the passage of the Swamplands Drainage Acts of 1849, 1850, and 1860, in which Congress transferred 65 million acres of federally owned wetlands to the states on the condition that they use the proceeds from the sale of wetlands to private entities to subsidize drainage on those properties.

With the Flood Control Act of 1928, the federal government began directly draining wetlands. The Flood Control Act of 1944 shifted efforts from flood control to agricultural development, but the result was the same—a drastic loss of wetlands throughout the country, a trend that continued into the 1960s.

According to the U.S. EPA, of the more than 220 million acres of wetlands that existed in the lower 48 states before European colonization, only about 100 million acres of wetlands remain. Thus, more than half of the wetlands in the United States have been drained and converted to other uses. Much of the reason for this decline was the government-subsidized

wetlands destruction that took place from the 1800s well into the 1960s.

The pendulum has now swung in completely the opposite direction, from subsidized destruction of wetlands to protection measures so strict, and often nonsensical, that even the creation of wetlands can be punished. For example, after a winery owner in Northern California created a 90-acre wetland habitat for waterfowl, he actually had to create another 4.5 acres of wetlands to “mitigate” for the damage he did to 1.5 acres of wetlands filled in the process. Far less controversial has been the quiet restoration and protection of millions of acres of wetlands by Ducks Unlimited.

In 2002, Ducks Unlimited celebrated a milestone of 10 million acres of habitat conserved for waterfowl and other wildlife. In the 1930s and 40s, Ducks Unlimited was focused on wetlands in Canada, and quickly made a name for itself as a group of engineers who measured success in terms of acres of water stored. Today, Ducks Unlimited is a large organization with projects throughout North America.

In its 2001 annual report, Ducks Unlimited reported net assets of more than \$60 million, and annual support and revenues of more than \$130 million. Ducks Unlimited has now surpassed 500,000 members and has more than 6,000 wetlands conservation projects in Canada, all 50 states, and Mexico.

Sources: Brian Seasholes, “The Wood Duck,” Center for Private Conservation Case Study, June 1997.

Laura Houseal, “Ten Million Acres & Counting,” *Ducks Unlimited* magazine, May-June 2002.

Water Trusts Offer Answer to Western Water Conflicts

by Michael De Alessi

In the arid west, everything revolves around water supply. And environmentalists, farmers, and urban dwellers all have different ideas about the highest and best use of water. This has led to headline-making conflicts in recent years in places such as the Imperial Valley of California and the Klamath Basin. Mandates to protect endangered species and weakly defined water rights formed the lynchpin of both conflicts, which, left to political arbitration, have produced more acrimony than progress.

Water rights in the West were typically allocated by “first in time, first in right.” Under Western water law, if water is not put to “beneficial use,” the right passes along to the next claimant (also known as “use it or lose it”). State laws determine which uses are beneficial, and in the past did not include allocating water for environmental purposes.

Thus, water had to be “used.” It could not be sold or transferred, nor left instream to protect fish habitat. This is one reason why farmers in California routinely grow monsoon crops in the desert.

The good news is that in recent years a number of Western states have broadened the definitions of beneficial use and freed up water markets so that voluntary, cooperative approaches are possible. Oregon was the first to expand “beneficial use,” to include enhancing water quality and fish habitat, when it passed the Instream Water Rights Act of 1987. To take advantage of this new opportunity, the Oregon Water Trust (OWT) was created in 1993.

The OWT’s mission is “to enhance stream flows by acquiring consumptive water rights to restore flows in rivers and streams in Oregon.”

Working with ranchers and farmers, OWT has improved habitat for coho, chinook, and steelhead salmon, as well as redband, brown, and cutthroat trout in river basins throughout Oregon. In 2003, the OWT was responsible for more than 120 cubic feet per second (cfs) of water kept instream, of which about 10 cfs were permanently acquired.

Other active, privately run water trusts include the Montana Water Trust, the Washington Water Trust, and Trout Unlimited. State water departments are also getting involved. In Idaho, the Department of Water Resources buys and leases water rights to maintain instream flows, and the Texas Parks and Wildlife Department operates the Texas Water Trust. During the 2001 drought in Washington state, the Washington Department of Ecology negotiated 21 leases for 460 acre-feet of water for the four hardest-hit fish habitats.

Private and state-run trusts in Oregon, Washington, Idaho, and Montana are all actively participating in the Columbia Basin Water Transaction Program, a public-private partnership to increase flows for fish in the Columbia River. The program is the result of a federal mandate for the Bonneville Power Authority to mitigate against habitat loss on the Columbia River.

California, which seems to experience the biggest water fights of all, does not currently have any effective water trusts. It does have a state water bank, but most transactions occur within state and federal water projects because the political hang-ups there are easier to navigate.

Stronger water rights and water markets are increasing habitat for fish and wildlife throughout the Western United States. The growth of water trusts is demonstrating how market incentives and property rights can improve fish habitat and promote cooperation between landowners and environmentalists.

Source: Oregon Water Trust, www.owt.org.

Notes

1 *Evaluation of State and Regional Water Quality Monitoring Councils*, EPA, August 2003, available at www.epa.gov/owow/monitoring/reporting.html.

2 <http://water.usgs.gov/pubs/circ/circ1225/html/national.html>.

3 Available at www.heinzctr.org/publications.htm.

TOXIC CHEMICALS

BY STEVEN F. HAYWARD

- There has been a 55-percent decline in toxic releases since 1988, even while total output of the industries covered by this measurement has increased 40 percent. This is a result of productivity gains and technological improvements.
- There has been a 92-percent decline in dioxin over the last two decades. The EPA estimates that more than half of the dioxin in the environment today comes from backyard trash fires.
- *Nature*, *Science*, and *Scientific American* have recently run stories explaining that low doses of some chemical toxins may actually have beneficial effects on organisms, a phenomenon known as hormesis.

The Toxics Release Inventory

The principle source of trend data for toxic chemicals is the EPA's Toxics Release Inventory (TRI), a reporting system for more than 650 chemicals (up from 300 when the TRI began in 1988) used in most major industries, mining operations, and, more recently, federal

THE REDUCTIONS IN THE USE OF CHEMICALS, EVEN AS TOTAL INDUSTRIAL OUTPUT AND ECONOMIC ACTIVITY GROW, IS A SIGN OF THE INCREASING EFFICIENCY OF OUR INDUSTRIAL PLANTS, AND A MEASURE OF WHAT HAS BEEN CALLED THE "DE-MATERIALIZATION" OF THE ECONOMY.

facilities.¹ More than 20,000 individual facilities must provide information for the TRI, requiring more than 80,000 reporting forms.

The EPA emphasizes several important caveats about interpreting TRI data, including gaps in the data and the lack of straight-line applicability of human health risk. The latest TRI, for the year 2001, emphasizes that "TRI reports reflect releases and waste management activities of chemicals, not exposures of the public to those chemicals. Release estimates

alone are not sufficient to determine exposure or to calculate potential adverse effects on human health and the environment" (pp. 1-6).

In addition, "toxic" chemicals are not all created equal, which is why a crude measure of mere "pounds" of toxics "released" is not an especially helpful measure of health or environmental risk. As the EPA notes:

Some high-volume releases of less toxic chemicals may appear to be a more serious problem than lower-volume releases of more toxic chemicals, when just the opposite may be true. For example, phosgene is toxic in smaller quantities than methanol. A comparison between these two chemicals for setting hazard priorities or estimating potential health concerns, solely on the basis of volumes released, may be misleading.²

In an effort to make possible better judgments about the relative risks of different kinds of toxics chemicals, the EPA is developing the Integrated Risk Information System (IRIS) on its website (see www.epa.gov/ncea/iris.htm). IRIS contains the results of ongoing toxicological screens of many of the chemicals on the TRI, along with links to other studies and EPA standards for exposure to the chemical. IRIS is not easy for the non-specialist to use, but it repre-

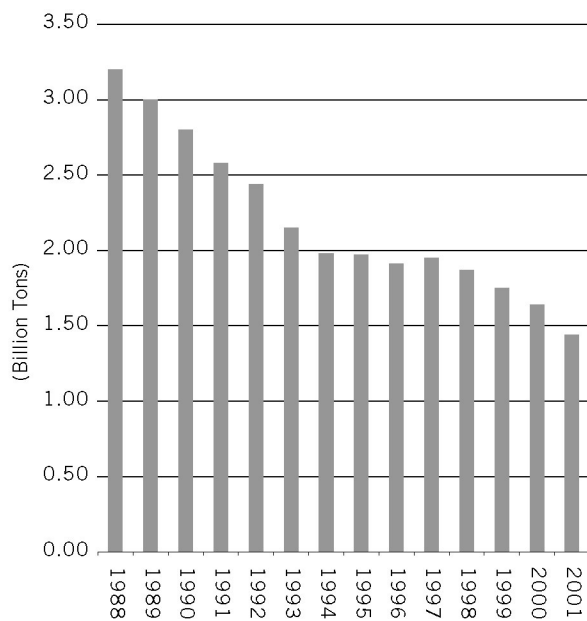
sents a major effort to adapt the massive reporting of the TRI into a useable product for local risk assessment. Another resource is the EPA’s chemical fact sheets, which are available at www.epa.gov/chemfact/.

With all of these caveats and limitations, what does the TRI tell us? While the TRI is limited as a tool for judging environmental or health risks, it is indicative of another trend: the reductions in the use of chemicals, even as total industrial output and economic activity grow, is a sign of the increasing efficiency of our industrial plants, and a measure of what has been called the “de-materialization” of the economy. As such, the TRI can be viewed as a proxy for measuring “sustainable development” or industrial ecology.

THIS MEASURE SHOWS A 55-PERCENT DECLINE IN TOXIC RELEASES SINCE 1988.

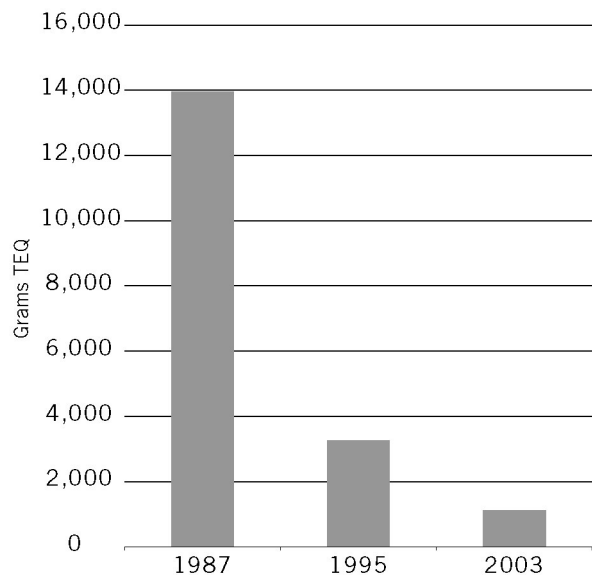
The constant expansion of the number of chemicals and number of facilities included in the TRI data net makes tracking trends difficult. Fortunately, the EPA helpfully breaks out the data against a 1988 baseline that includes only the chemicals included in the original inventory (shown in Figure 22). This measure shows a 55-percent decline in toxic releases since 1988 (and reduction of 12 percent in 2001), a reduction of more than 1.7 billion pounds a year. The

FIGURE 22: TOXICS RELEASE INVENTORY, 1988 BASELINE



Source: EPA

FIGURE 23: DIOXIN EMISSIONS TRENDS, 1987-2003



Source: EPA

chemical industry, not surprisingly, has shown the largest decrease of all industries included in the TRI, with a 60-percent reduction in releases since 1988.

These industry reductions reflect mostly productivity gains and technological improvements; total output of the industries covered under the TRI has increased 40 percent since 1991, even as toxic releases have declined.

The Dioxin Decline

Dioxin has become almost as much of a household term for chemo-dread as arsenic, though, in fact, dioxin is not one chemical but a family of 17 compounds that share certain combinations of chloride. Toxicity levels among these different “dioxin” compounds vary widely, and because dioxin has some significant natural sources, including volcanoes and forest fires, we shall never live in a world without detectable amounts of dioxin. In fact, trace amounts of dioxin have been found in archeological sites.

Most people associate dioxin with chemical dumps, municipal trash incinera-

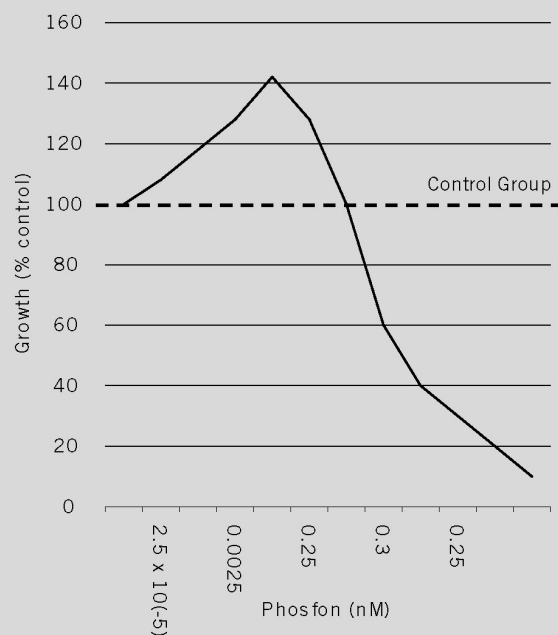
TODAY, HOWEVER, THE EPA ESTIMATES THAT MORE THAN HALF THE DIOXIN IN THE ENVIRONMENT COMES FROM BACKYARD TRASH FIRES.

Update: Hormesis in the Spotlight Again

Last year’s edition of the *Index* reported on the subject of “hormesis”—the counterintuitive idea that small amounts of toxic exposure actually benefit human health by stimulating the body’s immune system, thereby making it more robust. Hormesis, as an article in *Nature* magazine pointed out, calls into question not only the adequacy of our understanding of toxicology, but also our implicit regulatory risk standards that aim theoretically at zero exposure to toxics.⁵ Once banished to the shadows as mere quackery, hormesis is making a comeback within the scientific mainstream.

Science magazine took up the subject of hormesis with a long feature article last October.⁶ “Low doses of chemical toxins,” *Science* magazine’s Jocelyn Kaiser writes, “from cadmium to pesticides to dioxin, appear to have paradoxical and possibly beneficial effects on organisms.” *Scientific American* also took note of the issue in

FIGURE 24: PHOSFON AND PEPPERMINT PLANT GROWTH



Source: Calabrese/*Science* magazine

tors, and other large-scale industrial processes. This was partially accurate in the middle decades of the last century. Today, however, the EPA estimates that more than half the dioxin in the environment comes from backyard trash fires. And although dioxin in the food chain caused dioxin levels in humans to rise substantially in the middle decades of the 20th century, the health risk of this phenomenon is still hotly debated.

In recent years, however, the amount of dioxin in the environment and detected in human tissues has fallen sharply, as efforts to control it have taken effect. Because the toxicity of different dioxin compounds varies by as much as a factor of 10,000, dioxin is not measured by simple volume or weight. Instead, the EPA measures dioxin through a complicated process called “toxic equivalents” or TEQ.

Figure 23 displays the 92-percent decline in dioxin over the last two decades. As has been the case with DDT, the large decline in dioxin in the environment translates to an equally large decline in the amount of dioxin detected in human tissues. Two recent multinational studies conclude that levels of dioxin in human tissues have fallen by more than 90 percent since 1970.³

One of the remaining dioxin controversies concerns the use of sewer sludge as farm fertilizer. After a five-year study, the EPA recently concluded that dioxin levels in sludge used for fertilizer are too low to pose a health risk.⁴

September, in a short piece entitled “Whatever Doesn’t Kill You Might Make You Stronger.” There is even talk of testing some dioxin compounds as potential anti-cancer agents.

The leading advocate of hormesis is Professor Edward Calabrese of the University of Massachusetts. Calabrese first noticed as a graduate student in the 1980s that peppermint plants dosed with small amounts of the herbicide phosfon grew faster than a control group of plants, up to a certain point. Calabrese experimented further, generating the dose-response curve displayed in Figure 24. Nearly 200 studies have found similar hormetic dose-response curves with other toxic substances. *Science* also reports that Canadian researchers are reviewing data on the hormetic effects of low radiation exposure.

More scientists are coming around to Calabrese’s point of view. “Hormesis is on the verge of being a milestone in the evolution of risk assessment,” Professor John Doull of the University of Kansas told *Science*. The EPA is predictably resisting the implications of the hormesis research; the head of the EPA’s risk assessment dismissed hormesis as having been “taken over by rhetoric.”

Meanwhile, the National Academy of Sciences is currently considering a full-scale study of hormesis, and a new scientific journal has been launched that includes on its editorial board both proponents and critics of hormesis, with the typically cumbersome scientific title *Nonlinearity in Biology, Toxicology, and Medicine*. Don’t look for it at your local newsstand, but keep watching for more coverage. Hormesis is likely to become an increasingly hot topic in toxicology.

Notes

1 The TRI can be downloaded from the EPA website at www.epa.gov/tri/. Individual state facts sheets are also available on this site.

2 EPA, 2001 TRI, pp. 1-9.

3 L.L. Aylward and S.M. Hays, "Temporal Trends in Human TCDD Body Burden: Decreases Over Three Decades and Implications for Exposure Levels," *Journal of Exposure Analysis and Environmental Epidemiology*, no. 12 (2002), pp. 319-328; M. Lorber, "A Pharmacokinetic Model for Estimating Exposure of Americans to Dioxin-like Compounds in the Past, Present, and Future," *The Science of the Total Environment*, no. 288 (2002), pp. 81-95.

4 See

<http://yosemite.epa.gov/opa/admpress.nsf/b1ab9f485b098972852562e7004dc686/209dab87e1b0a8b785256dc20050c977?OpenDocument>. For more information, see *Tracking the Dioxin Decline* (Washington, DC: American Legislative Exchange Council, March 2003).

5 See "Time to Rethink Toxicology," *Index of Leading Environmental Indicators*, 8th edition (2003), pp. 57-58.

6 Jocelyn Kaiser, "Sipping from a Poisoned Chalice," *Science*, October 17, 2003, pp. 376-379.

PUBLIC LAND MANAGEMENT

BY HOLLY LIPPKE FRETWELL

- Four federal land management agencies oversee an estate of 614 million acres, an area more than six times the size of California with an estimated value exceeding \$150 billion.
- Despite this wealth of resources, there are serious infrastructure and environmental problems. There are billions of dollars in maintenance backlogs, sewage contamination in Yellowstone, and 90 to 200 million acres of federal land at high risk of catastrophic fire.
- The root of the problem is not a lack of funds but an excess of political management. The solution lies in alternatives such as state trusts to manage specific land tracts and allowing the public to lease land and resources.

Four federal land management agencies—the Bureau of Land Management, Fish and Wildlife Service, Forest Service, and National Park Service—oversee an estate of 614 million acres, an area more than six times the size of California. This acreage is rich in timber, minerals, livestock forage, wildlife habitat, and recreational and scenic resources, with an estimated value exceeding \$150 billion.¹

Despite this wealth of natural resources, however, there is no net return to taxpayers. In fact, the government loses money on its rich resources. Meanwhile, roofs are leaking in Park Service

ALTHOUGH DOLLARS SPENT ON PUBLIC LANDS HAVE GONE UP AND LAND SET ASIDE FOR RECREATION OR CONSERVATION HAS INCREASED, THE QUALITY OF THE LANDS HAS, BY MOST SIGNIFICANT MEASURES, DETERIORATED.

buildings, millions of acres of overly dense forests are charred each year, rangelands are denuded by overgrazing, and many wildlife refuges stand in desperate need of repair.

A review of the federal estate shows trends quite different from the usually positive outlook of the *Index of Leading Environmental Indicators*. Although dollars spent on public lands have gone up and land set aside for recre-

ation or conservation has increased, the quality of the lands has, by most significant measures, deteriorated. It is difficult to discern a favorable trend in public land management.

Management of large tracts of land by the federal government goes back more than a century. At the time, timber resources were being degraded, forests were clear-cut, and mountainsides were mined. So much logging was going on that experts feared a “timber famine.” One reason for this seeming profligacy was the fact that in the nineteenth-century United States, these resources were abundant. Restoring a logged forest held little value. It was more profitable to move to the next hillside or valley.

The growing perception in the Eastern states and especially Washington, D.C., was that the nation’s resources were endangered, and the policy decision was made to stop turning over land to private owners, as the government had been doing since it was founded. This decision in favor of land retention by the federal government makes the western part of the United States totally different from the East, where most land is privately owned. Today, many people are unhappy with the state of the public lands, with good reason.

“Wildlife species are disappearing. Important museum artifacts are not being preserved. Irreplaceable historic structures are crumbling,” says the National Parks Conservation Association, an organization whose mission is to help protect national park resources.²

Indeed, the National Park Service reports a \$6-\$9 billion backlog of unfunded maintenance, acquisition, and resource management projects.³ For example, Yellowstone’s outmoded sewer system spews raw sewage into native trout streams, and the sewage treatment plant at Old Faithful pollutes the groundwater.⁴ Glacier National Park’s popular Going-to-the-Sun Road is frequently closed due to safety concerns,⁵ and prehistoric dwellings in Mesa Verde National Park are disintegrating from a buildup of oils and airborne particles.⁶ In addition, more than one-quarter of the National Park Service’s buildings are in poor or dilapidated condition.⁷ The Forest Service has serious infrastructure problems, too.

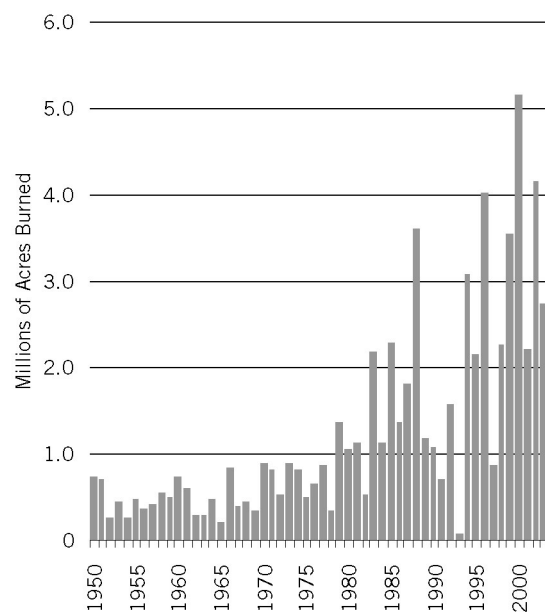
With a road system of 373,000 miles, eight times the interstate highway system, the Forest Service has a road maintenance backlog in excess of \$8.5 billion, with funding adequate to maintain only 40 percent of the roads to planned standards.⁸ According to one source, the agency has a backlog of \$1.7 billion in unfunded recreational maintenance.⁹

The condition of many natural resources on federal lands—especially those of concern to environmentalists—is simply unknown. Although the Park Service has as one of its core missions the protection of cultural and natural resources, there is no inventory of many of these resources. “Most park managers lack sufficient data to determine the overall condition of their park’s natural and cultural resources,” wrote the General Accounting Office in 1995.¹⁰ And then there is fire.

It has been estimated that between 90 and 200 million acres of federal land are at high risk of catastrophic fire.¹¹ Since 2000 more than 22.5 million acres have burned. The rising trend of acreage burned will continue unless weather patterns change or major forest restoration occurs (see Figure 25).

WITH A ROAD SYSTEM OF 373,000 THOUSAND MILES, EIGHT TIMES THE INTERSTATE HIGHWAY SYSTEM, THE FOREST SERVICE HAS A ROAD MAINTENANCE BACKLOG IN EXCESS OF \$8.5 BILLION.

FIGURE 25: WILDFIRE ACRES BURNED IN THE 11 WESTERN STATES



Source: Dennis Simmerman, USDA Forest Service, RMRS FireLab, 2/13/03

Cause of the Problem

Watchdog organizations argue that more money is needed for our public lands. “Congressional funding is key for protection of America’s wildlands,” claims the Wilderness Society.¹²

Insufficient budgets are “resulting in poor administration”; there are “severe funding shortfalls for certain core responsibilities”; there is “a need for more . . . new staff,” says a coalition of environmental groups.¹³ Yet operating budgets for the four federal land agencies have increased

270 percent faster than inflation since 1962.¹⁴

IT HAS BEEN ESTIMATED THAT BETWEEN 90 AND 200 MILLION ACRES OF FEDERAL LAND ARE AT HIGH RISK OF CATASTROPHIC FIRE.

Another way to look at this increase is to consider management costs.

In 1965, management costs per acre were less than \$5. By 2002, in inflation-adjusted terms, costs had more than tripled to \$16 per acre (see Figure 26). Over the last four decades, federal land

holdings increased six percent, and visitation about one percent. Congressional budget appropriations far exceeded this amount. The root of the problem is not a lack of funds but an excess of political management.

Generally, the budgets of the land agencies are appropriated by Congress. To maintain and expand their budgets, managers must satisfy the interests of politicians. The power of Congress is illustrated by an example in Montana. Glacier National Park desperately needed funds to maintain its spectacular but potholed Going-to-the-Sun Highway. Before that happened, the Montana congressional delegation earmarked \$6 million to renovate a system of chalets in the Glacier back country—a system used by fewer than one percent of park visitors.¹⁵

When agencies do receive money from sources other than Congress, those funds tend to tilt the incentives of managers in a particular direction. Decisions are not made on an even playing field. The Forest Service, for example, has an incentive to encourage logging because about half the proceeds from a timber sale can be used by the local Forest Service unit for reforestation and other resource improvements.

Most of the land managed by the Bureau of Land Management (BLM) is grazing land, which ranchers lease from the agency. The BLM retains a portion of the ranchers’ grazing fees for range-

THE ROOT OF THE PROBLEM IS NOT A LACK OF FUNDS BUT AN EXCESS OF POLITICAL MANAGEMENT.

land improvement. This source of revenue gives grazing precedence over other uses, such as recreational land, which receives very few fees. Yet most of the money comes from Congress.

And because of the agencies' reliance on Congress, creating a crisis is the best way for a national park or other agency unit to obtain additional funds.

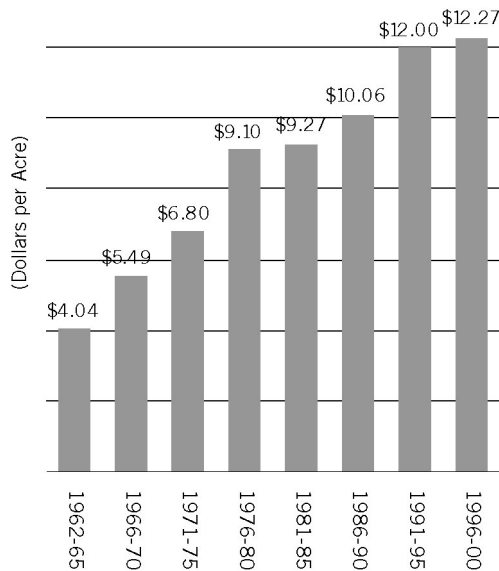
Don Striker, former comptroller at Yellowstone National Park and now Superintendent at Mount Rushmore National Memorial, has pointed out the value of a crisis such as a sewage spill. "Nothing gets attention quicker than two, if not three, ruptures in the antiquated sewer system. Those spills moved us up three notches in the priority system."¹⁶ Yet this is no way to provide the consistent quality of management that our public lands deserve.

A 1999 REPORT COMPLETED DURING THE CLINTON ADMINISTRATION ASSERTS THAT "LAND MANAGEMENT AGENCIES SHOULD IMPROVE THEIR STEWARDSHIP OF THE LANDS THEY ALREADY OWN BEFORE TAKING ON ADDITIONAL MANAGEMENT RESPONSIBILITIES."

The Push for More Preservation

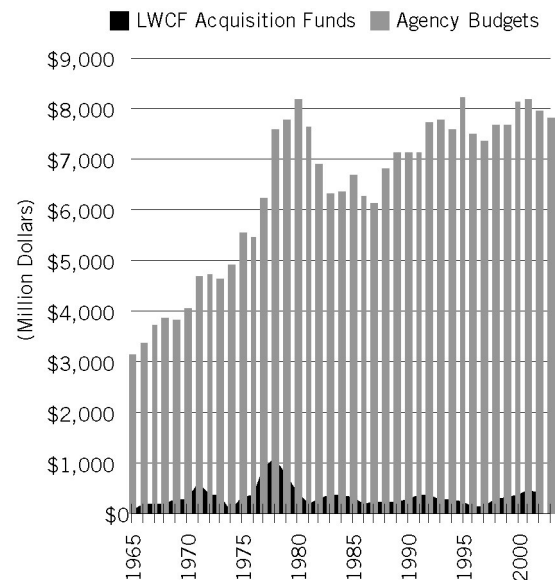
In spite of poor public land management, an area larger than the size of Florida has been added to the federal estate since John F. Kennedy was president. And many politicians and professional

FIGURE 26: FEDERAL LAND MANAGEMENT COSTS ARE RISING



Source: Office of Management and Budget (OMB) Public Budget Database. Cited February 17, 2004, <http://w3.access.gpo.gov/usbudget/fy2004/db.html>

FIGURE 27: THE COST OF MANAGEMENT EXCEEDS THE COST OF ACQUISITION



Source: Office of Management and Budget (OMB) Public Budget Database. Cited February 17, 2004, <http://w3.access.gpo.gov/usbudget/fy2004/db.html>

environmentalists support further expansion.¹⁷ “Responsible land management can be improved in the Forest Service by acquiring sensitive or threatened habitats,” says a report prepared by a group of environmental organizations.¹⁸ The National Parks Conservation Association pleads with Congress to increase funding for the creation of new parks and to expand existing parks.¹⁹

Yet acquiring more land means that there will be more land to manage, and management costs far exceed acquisition costs (see Figure 27). From 1965 to 2002, the Land and Water Conservation Fund, the main source of federal acquisition funds, provided nearly \$12.5 billion for acquisition. Yet the cost of managing all federal lands acquired totaled \$251 billion—about \$8.1 billion in 2002 alone.²⁰

In fact, the Congressional Budget Office has suggested a freeze on federal land acquisitions. A 1999 report completed during the Clinton administration asserts that “land management agencies should improve their stewardship of the lands they already own before taking on additional management responsibilities.” The report goes on to say that “environmental objectives such as habitat protection and access to recreation might be best met by improving management in currently held areas rather than providing minimal management over a larger domain.”²¹

Recommendations for Reform

If federal land management is to be reformed, public land agencies need more independence from political forces (that is, Congress) and from narrow revenue sources that limit their flexibility. Two major approaches would move toward this objective. One is to create trusts to manage specific land tracts. The other is to allow the public, not just narrow interest groups, to lease land and resources.

Trust Management

A trust is a legal assignment of certain powers to one or more persons, called trustees, who manage assets for the benefit of another. The trustees have a legal or fiduciary obligation to manage the assets within the constraints of the trust agreement.²² Most trusts are private and many are charitable organizations. In a number of states, however, lands owned by the state government are managed as trusts, and these offer a model for federal land management.

State trust lands are required to generate revenue for the benefit of the public schools and other endowed organizations such as state universities.²³ These organizations carefully monitor the trust lands to ensure that they meet their mandate of providing income over the long

term. Although state laws regulating land management are generally less burdensome than federal laws,²⁴ better management tends to occur on state trust land because of the mandate to earn revenue.

Because they pursue the specified goal of making money, state managers have more freedom than federal land managers to respond to changing conditions such as the state of the forest, recreation demands, and the growing interest in conservation.²⁵ They have the freedom to consider trade-offs between alternative resource values. This means that the trust can generate revenues from one kind of resource use and use it to improve stewardship in another.

The Paul J. Rainey preserve, a National Audubon Society sanctuary in Louisiana, is a private trust that illustrates how such trade-offs can be beneficial. The preserve is a sanctuary for migratory birds, especially the snowy egret (the symbol of the Audubon Society). Yet the Society allowed 13 natural gas wells to be drilled on-site. The Society was able to put stipulations on drilling that protected the preserve and its wildlife, but still allowed the extraction of natural gas. The first well was drilled around 1950, and production continued until 1999, when gas was no longer economically recoverable. The wells generated about \$25 million for the Audubon Society, money that it used to further its conservation goals.

**BECAUSE THEIR INCENTIVES
MIMIC SUCH PRIVATE INCENTIVES,
STATE LANDS OFTEN ARE MORE
EFFICIENT THAN FEDERAL LANDS.**

Because their incentives mimic such private incentives, state lands often are more efficient than federal lands. Economist Donald Leal found that Montana's state forests earned about \$2 for every dollar spent, while federal forests located in the state (and often right next to the state lands) lost \$0.50 for each dollar spent.²⁶ The state forestlands were also healthier and protected their watersheds better than the federal lands.²⁷ The states offer a model that should be adopted by the federal government.

Resource Leases

One of the tools used by state school trusts is the non-traditional resource or land-use lease. The federal government should adopt such leases, beginning on an experimental basis.

Typically on federal land, agency resources are provided for a single purpose (such as timber, grazing, or minerals) and favor a narrow interest. In contrast, resource leases would allow a broader public to bid for the right to use the trees, grass, or other resources in a non-tradi-

tional way, and that right should be transferable. Resource leases would open up opportunities for additional uses, while giving the successful bidders the right to make trade-offs.

To issue a resource lease, land managers would specify potential uses of a tract of land, as well as any prohibited uses. For example, an area forested with young trees might be leased with a prohibition against timber harvesting, while an area with older trees might be leased for commercial timber harvest. In the first case, the lessee might be a group interested in habitat protection for wildlife; the second, a commercial logging company.

But in either case, the lessee would maintain the right to sublet for alternative uses that fit within the constraints of the lease. On the Audubon's Rainey Preserve, pumping natural gas was permitted, but not during nesting periods, for example. The lessee could make similar stipulations when subletting to other uses.

Resource leases give leaseholders an incentive to carefully weigh the benefits that could come from carefully planned and supervised commodity production, while achieving the specified objectives of the lease. This approach is working in some of the western states, which have land very similar to federally owned tracts.

In Montana, the Nature Conservancy recently obtained a conservation lease on school trust lands. Under such lease arrangements, the conservancy manages the land mostly for wildlife, recreation, and research. The Nature Conservancy is paying the state about \$2,500 per year more than a general grazing lease would.

In Colorado, conservation leases earn the state school trust \$340,000 per year. The state of Wyoming earned more than \$1.2 million by placing a conservation easement that restricts development on state trust properties in Jackson Hole.

Conclusion

Public land management by the federal government is riddled with problems that stem from its political management. By reducing political pressures and providing land managers with new incentives, it is possible to reshape federal land management. Our public lands can be managed for their highest-valued uses without compromising environmental integrity.

For more information, see the website for PERC (the Property and Environment Research Center) at www.perc.org.

Notes

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- 14 See Holly Lippke Fretwell, *Whither the Federal Estate?*, PERC Monograph, forthcoming, 2004.
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20 Office of Management and Budget (OMB), 2003a. *Budget of the United States Government, FY 2003*, Public Budget Database, available www.whitehouse.gov/omb/budget/fy2003/db.html, cited May 20, 2002.

21 Congressional Budget Office, *Maintaining Budgetary Discipline: Spending and Revenue Options*, April 1999, p. 68.

22 See Terry L. Anderson and Holly Lippke Fretwell, *A Trust for Grand Staircase-Escalante*, PERC Policy Series, September 1999, p. 5.

23 See Holly Lippke Fretwell, *The Price We Pay*, PERC Public Land Reports, August 1998.

24 Many western states have adopted state environmental policy acts similar to NEPA. California, Montana, Oregon, and Washington have timber harvest restrictions comparable to national requirements. See also Fretwell (1998).

25 Most western states were provided grants of land upon their creation for the benefit of the public schools and other state institutions. States receiving school trust grant lands are Alaska, Arizona, Arkansas, California, Colorado, Hawaii, Idaho, Louisiana, Minnesota, Mississippi, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, Wisconsin, and Wyoming.

26 See Donald R. Leal, *Turning a Profit on Public Forests*, PERC Policy Series, September 1995, p. 5.

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SPECIES AND HABITAT CONSERVATION

BY STEVEN F. HAYWARD

- Last year marked the 30th anniversary of the Endangered Species Act (ESA), which remains embroiled in controversy. A total of seven species have gone extinct in America and 10 have had full recoveries, four of which predate the ESA.
- In recent years there has been a decline in the number of species added to the ESA, a trend that began under the Clinton administration and is largely the result of protracted litigation surrounding any additional species and habitat designations.
- Private efforts at species conservation, such as the Peregrine Fund, have been very successful, and the new Safe Harbor program is helping remove the disincentives to landowners that had been created by the ESA.

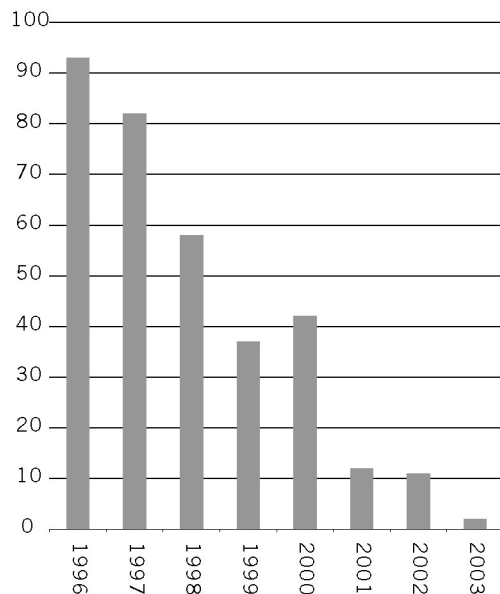
The eye-catching news at the end of the year was a study published in *Nature* magazine that forecast that as much as a third of all species on earth might go extinct by the middle of the 21st century due to global warming. At least that's how most of the media breathlessly reported it.

The actual study was a computer model based a tiny sample (about 1,100 species) which was then extrapolated with the “species area curve” concept that holds the viability of a species is linked to the size of its habitat. While this model has been demonstrated for many species, it is not applicable to all species. Nor can it be firmly established that global warming will result in a net shrinkage of *all* types of habitat.

Writing on *TechCentralStation*, statistician Iain Murray pointed out:

**THE EARTH IS NOT SHRINKING.
THE REDUCTION OF ONE AREA
OF HABITAT DOES NOT MEAN
THAT IT IS REPLACED BY VOID.**

FIGURE 28: NEW SPECIES LISTED UNDER THE ESA, 1996–2003



Source: U.S. Fish and Wildlife Service

There are several reasons this claim should be laughed out of the court of public opinion. First, the research doesn't say what the researchers themselves claim. They have extrapolated to all species a model that looked at only 1,103 species in certain areas (243 of those species were South African proteaceae, a family of evergreen shrubs and trees). For one thing, we don't know how many species there are—estimates vary from two million to 80 million—and have only documented 1.6 million. However, assuming the 14 million figure widely used in the press reports is anywhere near accurate, the sample size is a mere 0.008 percent of the total species population of the planet, with certain species vastly over-represented (there are only 1,000 species of proteaceae on the planet). All the researchers have demonstrated is that, if their model is correct, certain species in certain habitats will run a risk of extinction. Extrapolating to the entire planet from this small, unrepresentative sample is simply invalid. . .

The researchers assume that global warming will reduce habitat. Yet this isn't the case. The earth is not shrinking. The reduction of one area of habitat does not mean that it is replaced by void. Other habitats expand. And so far, all the evidence we have points not to desertification or other changes to less hospitable climates as a result of global warming. Instead, the increase of carbon dioxide in the atmosphere seems to have led to a six-percent increase in the amount of vegetation on the earth. The Amazon rain forests accounted for 42 percent of the growth. To model only reductions in habitats and not expansions accounted for by global warming stacks the deck. The researchers created a model that dictated that global warming will cause extinctions. Surprise, surprise! When they ran the model that's exactly the result they got.¹

Further species alarm comes from the news that U.S. Fish and Wildlife Service listings of endangered species according to the process of the Endangered Species Act continue to decline. This is being

The Peregrine Fund

by Michael De Alessi

Recovering endangered species is a tricky business—just ask the U.S. Fish and Wildlife Service, which is the primary agency responsible for enforcing the Endangered Species Act (ESA). Since the ESA was passed in 1973, few species have gone extinct but, on the other hand, few species have recovered.

To be exact, the tally of American species is seven extinctions and 10 full recoveries. Four of those 10 recoveries were due to bans on whaling and the pesticide DDT that predate the ESA.

The shareholders or funders of a business or non-profit chartered with saving endangered species would not tolerate such a dismal track record even over the near term, let alone over 30 years. Private efforts to recover species have been rare, however, because the land-use restrictions of the ESA put a negative value on endangered species habitat.

For example, a study by economists Dean Lueck and Jeffrey Michael found that owners of forests that would eventually evolve into endangered red-cockaded woodpecker habitat (they prefer old-growth trees) tended to cut their trees ahead of schedule to avoid attracting the birds. Despite these restrictions, one notable non-profit has demonstrated remarkable success—the Peregrine Fund.

Started by a group of ornithologists in the early 1970s, the Peregrine Fund had the well-defined goal of bringing back the Peregrine Falcon from the brink of extinction. Following the failure of a federal captive breeding effort, the Peregrine Fund started its own program, which has since released into the wild more than 4,000 birds. In 1999, the Peregrine Falcon had recovered sufficiently to be removed from the endangered species list.

Since the 1970s the Peregrine Fund has expanded its operations worldwide, but has remained focused on the captive breeding and reintroduction of birdlife, especially birds of prey. Peter Jenny, the vice-president of the Peregrine Fund, credits much of the success of the organization to the fact that it is “run like a business with the expectation of annually achieving clearly defined objectives.”

ESA LISTINGS BEGAN THEIR DECLINE UNDER THE CLINTON ADMINISTRATION, THE RESULT IN PART OF PROTRACTED LITIGATION THAT HAS SEVERELY CONSTRAINED THE FISH AND WILDLIFE SERVICE'S ABILITY TO ADD NEW SPECIES TO THE LIST AND TO MAKE CRITICAL HABITAT DESIGNATIONS.

advertised as more evidence of Bush administration perfidy, though as Figure 28 shows, ESA listings began their decline under the Clinton administration, the result in part of protracted litigation that has severely constrained the Fish and Wildlife Service's ability to add new species to the list and to make critical habitat designations.

Less widely reported are the results of the kind of initiatives discussed in this section's case study, or the news of several species, including the most charismatic of all megafauna—the American bald eagle—that have made a remarkable recovery. The bald eagle is soon to be removed from the endangered species list. Michael Bean, director of wildlife programs for Environmental Defense, told *Nature* magazine in December that “Progress is being made on the ground.”

In August the General Accounting Office (GAO) issued its second report in

Other successes include the Mauritius Kestrel, which was once considered the rarest bird in the world. Working with other non-profits not only to breed the birds in captivity but to improve the habitat available to reintroduced birds (habitat loss and prey availability were the biggest reason for their decline), the species now numbers more than 400.

The last endangered falcon in the United States is the Northern Aplomado Falcon, which the Peregrine Fund began breeding in captivity in 1982. In 1986, however, the bird was added to the endangered species list, which severely dampened the Fund's efforts. After the listing, private landowners in Texas even objected to releasing birds on federal wildlife refuges for fear that the birds might eventually settle on their property. Their fears were borne out when federal regulators proposed prohibiting a popular pesticide in the area to protect released birds.

Land in Texas is 97-percent privately owned, and so as a result of landowner opposition, few Aplomado Falcons were introduced for over 10 years following the listing. To solve this problem, the Peregrine Fund and other groups such as Environmental Defense and the Nature Conservancy worked with U.S. Fish and Wildlife to develop the Safe Harbor program, which indemnifies landowners from ESA restrictions due to reintroduced species.

As a result, the Peregrine Fund has released more than 800 Aplomado Falcons in Texas, and as of May 2003 there was a wild breeding population of at least 39 pairs. The U.S. Fish and Wildlife has established that 60 pairs will be enough to change the status of the bird from endangered to threatened.

The success of the Peregrine Fund underscores the importance of private action to protect endangered species, and the importance of measuring performance.

Sources: Michael Bean, Peter Jenny, and Brian van Eerden, “Safe Harbor Agreements: Carving out a new role for NGOs,” *Conservation Biology in Practice*, vol. 2, no. 2, Spring 2001. The Peregrine Fund, www.peregrinefund.org.

the last two years on the Endangered Species Act, with the most recent study examining the use of science in the controversial program.² While concluding generally that the Fish and Wildlife Service has used the best science in selecting species for protection, “there are concerns over the adequacy of the data used to support critical habitat designations,” which is where the ESA has its most significant impact.

Meanwhile, as the debate over proposed resource extraction activities on public lands such as the Alaska National Wildlife Refuge (ANWR) continues, the GAO released a study finding that oil and gas exploration has taken place on nearly a quarter of all federal wildlife refuges (155 out of 575 refuges) going back to the 1920s.³ Most Americans are probably not aware that resource extraction is so extensive in our wildlife refuges. It is impossible to draw firm general conclusions about the environmental impact of this activity for the usual reason—a lack of information and study. The GAO summarizes:

The Fish and Wildlife Service has not assessed the cumulative environmental effects of oil and gas activities on refuges. Available studies, anecdotal information, and GAO’s observations show that the environmental effects of oil and gas activities vary from negligible, such as from buried pipelines, to substantial, such as from large oil spills or from large-scale infrastructure. These effects also vary from the temporary to the longer term. Some of the most detrimental effects of oil and gas activities have been reduced through environmental laws and improved practices and technology. Moreover, oil and gas operators have taken steps, in some cases voluntarily, to reverse damages resulting from oil and gas activities.

Separately the GAO also reported in September on the converse problem of endangered species, i.e., the problem of too many species that don’t belong, or “invasive species.”⁴ This GAO report dealt mostly with the gaps in the regulatory framework for addressing the problem of invasive species, and did not include any data on the scope of the problem itself.

Notes

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4 *Invasive Species: State and Other Nonfederal Perspectives on Challenges to Managing the Problem*, GAO Report 03-1089r (available at www.gao.gov/cgi-bin/getrpt?GAO-03-1089r).

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