



## ***The State of the Nation's Ecosystems: A Review***

**By Steven F. Hayward**

*The H. John Heinz III Center for Science, Economics and the Environment recently published The State of the Nation's Ecosystems: Measuring the Lands, Waters, and Living Resources of the United States, the culmination of a seven-year project to collect and analyze data on U.S. environmental trends. The ambitious effort provides a thorough checkup on wide-ranging important environmental conditions and moreover identifies the significant gaps in our data that must be filled before an accurate assessment of environmental trends can be made.*

Knowledge of ignorance, Socrates taught us, is the beginning of wisdom. A splendid new study from the H. John Heinz III Center for Science, Economics and the Environment brings the spirit of Socratic skepticism to the problem of understanding environmental conditions in the United States. The Heinz Center's report, *The State of the Nation's Ecosystems: Measuring the Lands, Waters, and Living Resources of the United States*, is the product of a seven-year project, involving more than a hundred prominent environmental researchers, to gather and analyze data on major aspects of environmental quality.<sup>1</sup>

*The State of the Nation's Ecosystems (SONE)* examines 103 environmental indicators for six broad types of ecosystems (coasts and oceans, farmlands, forests, fresh waters, grass- and shrublands, and urban areas). The indicators in the report include soil biological condition, nitrate and phosphorus levels in streams and rivers, at-risk species

counts in different types of habitat, plant and tree growth, nonnative species trends, and carbon storage in various kinds of plant matter.

The report attempts to present "big picture" findings on the condition of ecosystems at the national level, as well as present trends on changes in ecosystem conditions. The report used only high-quality data from consistent sources. Perhaps the most significant aspect of the report is its strictly factual approach. The Heinz Center scrupulously resisted offering sweeping generalizations about whether environmental conditions and trends are good or bad. Despite plenty of troublesome information, SONE is utterly without the alarmist hype usually accompanying reports from environmental groups.

Dispassionate environmental data and trend analysis must replace environmentalism by anecdote. Although the Environmental Protection Agency and other federal departments with environmental responsibilities collect and publish reams of statistics, a consistent, systematic national effort to report on environmental trends has never happened—an astonishing lacuna in a nation where hundreds of billions of dollars are spent annually for environmental protection. The first report of the President's Council on Environmental Quality in 1972 noted the usefulness of such an approach:

The use of a limited number of environmental indices, by aggregating and summarizing available data, could illustrate major trends and highlight the existence of significant environmental conditions. It could also provide the Congress and the American people

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measures of success of Federal, State, local, and private environmental protection activities. An analogy might be drawn with the economic area, where the Consumer Price Index, Wholesale Price Index, and unemployment rates provide a useful indication of economic trends.<sup>2</sup>

Although CEQ published annual reports on the environment from 1972 until the mid-1990s, Paul Portney of Resources for the Future observed that “even in its halcyon days CEQ was never able to muster the resources to present truly comprehensive and consistent environmental data on an annual basis.”<sup>3</sup> The advent of the EPA’s Environmental Indicators Initiative may indicate a change, at last; a draft of the EPA’s first state-of-the-environment report is expected imminently.<sup>4</sup>

Even with the development of environmental indicators at the federal level, private and independent frameworks for understanding environmental trends are necessary because of the variation and complexity of environmental issues across the country and the role of local knowledge in understanding and solving environmental problems. Independent efforts such as the Heinz Center report are free of the political and policy constraints that unavoidably surround any federal effort. Regardless of the quality control on data gathering, many aspects of environmental trend reporting remain controversial. Competition among sets of indicators leads to better-informed policy debates.

## **What Do We Know and What Do We Not Know?**

The Heinz Center report is as important for what it *does not* say as for what it does. Of the 103 indicators selected, only 33 (or one-third) have adequate data on which to base conclusions; another 25 indicators (24 percent) have incomplete data sets. Thirty-one indicators (30 percent) have inadequate data; another 14 indicators (14 percent) need development to be of any use.

The most complete data sets are available for farmlands, forestlands, grass- and shrublands, and urbanized area. Much data for land cover and use come from detailed analysis of satellite imagery, perhaps the fastest-growing area of environmental information science.<sup>5</sup> But even with those data, definitively answering some basic questions about the amount and condition of farmland in the United States is difficult. The amount of farmland has not significantly changed over the past

50 years—contrary to the often-heard theme about vanishing farmland. Other aspects of farmland condition show a mixed picture. The amount of farmland susceptible to wind and water erosion declined by a third over the past two decades. Less than 1 percent of groundwater sites in farmland areas have pesticide levels above the government’s health threshold; however, more than 80 percent of surface streams in farmland areas have pesticide levels above the level considered safe for aquatic life. (The proportion of monitored streams above human health thresholds was only 4 percent, although arguments about human pesticide thresholds rage on.)

The United States contains 747 million acres of the 1 billion acres of forestlands awaiting the first European settlers. The amount of forestland has been rising for more than a century; forest growth has exceeded timber cutting for most of the past 50 years. The most rapid reforestation has taken place in the eastern half of the country, where 65 percent of timberlands are younger than 60 years old and 90 percent are less than 100. Future generations may look forward to expanses of old-growth forests.

One reason for the upward trend in forestland is the fire suppression effort of the past half-century (in the news as part of the controversy about wildfires and federal forest management policy). In 1930, 52 million acres of forestland burned; in recent decades the burned area has fluctuated between 2 and 7 million acres a year. The raw data do not permit us to make judgments about the frequency or intensity of forest fires today, but those assessments are necessary to analyze the impact of forest management policies on the problems of fuel loading and insect infestations. (The Forest Service will soon be releasing a major report on sustainable forestry.)

## **The Urban Land Surprise**

The Heinz Center report does offer one minor bombshell: the amount of urban and suburban land. A prominent aspect of the controversy over urban sprawl concerns the amount and rate of land being developed in the continental United States. Clichés such as “the paving of America” and “running out of farmland” dominate this debate, along with claims that an urban area (such as Las Vegas) is developing at the rate of “an acre an hour.”

Environmentalists were quick to criticize new data from the 2000 U.S. census that the total urban and suburban area of the continental United States accounted for only about 4 percent of the total

land area in the lower forty-eight states. Other estimates, such as the 1997 National Resources Inventory, put the number slightly higher than 5 percent. Moreover, the NRI suggested that the rate of suburban land development had tripled during the 1990s, from about 1 million acres a year in the 1970s and 1980s to 3 million acres a year in the past decade. (The Department of Agriculture subsequently withdrew the NRI from circulation and blamed computer error for the startling results. The department quietly released a reworked NRI, which admitted that its estimates were off by more than 30 percent, in January 2001.)

The Heinz Center report notes the unreliability of both census and NRI data for determining the extent and rate of urban and suburban land development; the center conducted a sophisticated computer analysis of satellite imagery instead. Its finding: urban and suburban areas account for only 1.7 percent of the total land area in the continental United States as of 1992—far lower than any previous estimate.

Two caveats should be noted. First, because of the cautious methodology used by the Heinz Center, the 1.7 percent finding probably understates the amount of developed area in the nation, though not by much.<sup>6</sup> Second, the Heinz Center report had to use 1992 satellite imagery; the U.S. Geological Survey has not finished compiling satellite imagery from 2000, which is necessary to answer the question of how rapidly land is being developed. Until the next round of numbers is available, the issue will remain contentious. In any event the raw statistics on urbanized land area do not change the debate over the tertiary issues of urban sprawl such as traffic congestion, density and design, and public works. Still, the Heinz Center finding that the total amount of urbanized land is substantially less than previously thought represents a major new finding.

## Water

Measuring water quality is more difficult than measuring air quality because of the Heraclitus problem: no one can step into the same river twice. The Heinz Center report grapples with that problem and presents as complete a picture as possible given the limited data available. The countless different aspects to the issue of water quality make summary judgments impossible. Virtually no data on the quality of stream habitats exist, for example. On the one hand high levels of

some pollutants (especially phosphorus) lead to harmful algae growth in about half of America's rivers and lakes; on the other hand waterfowl die-offs appear to be declining.

## Conclusion

Even though SONE is limited to 103 indicators for discrete types of ecosystems, its overwhelming amount of information complicates judgment about whether ecosystem conditions in the United States are improving or worsening. The report's exhaustive technical notes on data sources and methodology of analysis should be required reading for environmental researchers. In many instances SONE is laying a base line; judgments about trends will require future soundings and comparison. In other cases the report frankly admits to major uncertainty even about the kind of data needed to provide a meaningful indicator of some environmental conditions and trends. The most significant general gap in the data concerns measures of land and habitat fragmentation, the heart of the matter for biodiversity. (Sure enough, a growing field known as gap analysis focuses precisely on that problem.)

*The State of the Nation's Ecosystems* provides a road map for future research necessary for policymakers to set sensible priorities, especially for the next generation of water quality measures. The report does not resolve the trade-offs between the human impact on ecosystems and the benefits derived from our use of nature. No data analysis can do so because those questions ultimately turn on our preferences and principles. But the Heinz Center exercise, combined with other serious attempts to develop environmental indicators and trend-line information, can help set more intelligent priorities and assess progress.<sup>7</sup>

## Notes

1. *The State of the Nation's Ecosystems* is available in paperback from Cambridge University Press or online at [www.heinzctr.org/ecosystems/](http://www.heinzctr.org/ecosystems/).
2. (Washington, D.C.: Government Printing Office, 1972).
3. Paul R. Portney, "Reforming Environmental Regulation: Three Modest Proposals," *Columbia Journal of Environmental Law* 13 (201) (1988): 204. Portney proposes a Bureau of Environmental Statistics analogous to the Bureau of Labor Statistics.
4. For updates, see [www.epa.gov/indicate/](http://www.epa.gov/indicate/).

5. Most of the satellite data comes from the National Land Cover Data program of the U.S. Geological Survey.

6. The Heinz Center methodology required that an area be at least 270 acres (less than one-half square mile) to be considered as urban or suburban land cover. Although the method likely captures the overwhelming majority of urbanized areas, the small

areas that escape the method may be statistically significant in aggregate.

7. The Millennium Ecosystem Assessment is a similarly ambitious effort to determine ecosystem conditions and trends on a global scale, although it is not expected to report results until at least 2005. See [www.millenniumassessment.org](http://www.millenniumassessment.org).