

# The Endpoint Problem

*James W. Boyd*

**E**nvironmental scientists, economists, and managers need to focus. As a broad generalization, environmental professionals—conservationists, biologists, managers, ecologists, and environmental economists—are drawn to nature’s complexity and interconnectedness, its sheer comprehensiveness. A butterfly flaps its wings in South America, and a storm forms in the North Atlantic.

Unfortunately, nature’s complexity creates a barrier to cooperation, collaboration, and communication. The scientific community’s descriptions of nature suggest the parable of the elephant and the five blind men: none can agree on what they have found—a tusk, a trunk, a tail—and argument ensues. In environmental science, each sub-discipline touches a different part of the elephant.

## The Public Policy Issue

Why is the lack of coordination a social problem? If what we care about in public policy is the relationship of nature to human well-being—and that is what we should care about—biophysical scientists and social scientists must work, produce results, and communicate in concert. Forty years into the environmental movement, concerted action between ecology and economics is still the exception, rather than the rule. Unlinked descriptions and the perception of conflict they produce confuse the public and our decisionmakers. The cost of confusion is that environmental science still lacks the ability to comprehensively benchmark and communicate the state of nature.

Government has proven to be an ineffective agent when it comes to measuring its own environmental performance. The private sector has no particular reason to take on the role of environmental watchdog and truth teller either. And the challenge is too big for any single environmental group or think tank. So who should society look to if it wants to know what is actually happening to the environment? When

it comes to nature, society depends on scientists to “mind the store.” That may not be the job we all signed up for, but it is a particularly worthy mission.

While not a panacea, the scientific community is our best hope. But what about the blind men and the elephant?

## The Challenge

Consider the following practical, common issue in public policy: should we preserve a piece of land in its natural state? The piece of land could be the Arctic National Wildlife Refuge, a wetland on the side of a highway, or a part of the Everglades. What are the benefits of preservation? Even the simplest analysis of the question requires conservation science. Conservation science tells us *what* will be preserved and *where*. How will the preservation affect habitats, species populations, water and air quality, land cover, water availability, and other biophysical outcomes now and in the future?

Note that conservation science itself is not one discipline, but many. Ecology, biology, hydrology, and atmospheric science are all part of conservation science. Achieving coordination in this realm alone will be a significant challenge.

But the policy problem requires social science as well. Social science really matters in two areas. First, social factors interact with preservation and affect biophysical outcomes. Demography is an obvious consideration. Are communities encroaching on the preservation in a way that has implications for biophysical outcomes? Is the landscape actively managed? If so, what are the results of that management? What if a commercial fishery is harvesting fish at the same time we are protecting fish habitat? The social and economic sides of this—the commercial harvests—are as important to predictions of fish population as the purely biophysical analysis of conservation is.

Note the various disciplines that must be involved: not only conservation science, but conservation management and the field of bioeconomics, which describes linked biophysical

and social systems. And we still haven't fully described the public policy solution.

The second significant role for social science is to take the biophysical outcomes of preservation (the species, land cover, air quality, and water availability) and ask: how important are these factors to society? Most environmental economists focus on this issue. Whenever you hear terms like non-market valuation, contingent valuation, revealed preference, hedonic pricing, or travel cost studies you are hearing economists talking about the ways in which they propose to weight outcomes in nature.

Natural science cut off from social science cannot effectively influence public policy because it cannot make the direct connection to human well-being. Social science cut off from natural science cannot describe outcomes in nature, so it can't influence public policy either. Together we stand; divided we fail.

## Need for a Common Language

When natural and social scientists are not coordinated, the situation manifests itself in something we can call the "endpoint problem." If linked social and natural science is a relay race, endpoints are the baton. The problem is that the baton never gets handed off smoothly.

Economists are often content to apply their methods to simplistic caricatures of nature. An example is the way in which economic "dollar valuations" of environmental goods focus on what can be easily measured, rather than on what may be most important to society. Or the way economic stud-

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ies typically ignore the natural and social landscape when they estimate benefits. Look at an average refereed economic valuation of something in nature and what you'll see is a very narrow view of nature.

Conservation science hasn't done much better. A historic rejection of the relevance of choices, trade-offs, and human-centered measures of success has led the discipline to focus on biophysical outcomes that are themselves narrow and unfortunately disconnected from the cares of nonscientists. For example, the obsession with biodiversity as the sine qua non of scientific conservation studies has led to measures of success and failure that often do not resonate with nonscientists.

*Ecological endpoints are concrete statements, intuitively expressed and commonly understood, about what matters in nature.*

*Technical expressions or descriptions meaningful only to experts are not ecological endpoints.*

The relative success of EPA efforts to translate air quality problems into human health-related social effects is due in large part to the presence of *health endpoints*. These endpoints, while still debated, are a lingua franca understood by disciplines as different as pulmonary medicine and urban economics. This common language had to be developed—and is still being developed. In the old days, health impacts were described in highly technical, medical terms, such as oxygen transfer rates in the lung. Today, epidemiologists count things like asthma attacks, reduced activity days, and reductions in life expectancy. Tell the public about oxygen transfer in the lung, and they won't know what you're talking about. Tell them about asthma attacks, and they will know exactly what you are talking about.

"Common man" descriptions of outcomes are usually a prerequisite to social science. The social sciences tend to rely on the assumption that people are reasonably well informed when they make choices. How can people be well informed if outcomes aren't described in terms that are meaningful to average people?

It is important to emphasize that economists aren't authorized to define endpoints and then turn around and demand that natural science cough up the answers. Rather, the natural and social sciences—with the imprimatur of both science and government—should collectively debate and define these endpoints.

## Consistent Points of Contact

So how do we solve the endpoint problem? This is a central subject of current RFF research. In a set of linked research projects, we have been defining and illustrating measurable,

countable endpoints that can act as consistent “points of contact” between ecological and social science.

Ecological endpoints have several broad characteristics.

- They are purely biophysical.
- They are concrete, tangible, and measurable.
- They are directly connected to human well-being.

While these features sound simple, their application is less so.

For example, what is meant by “purely biophysical?” If you catch a fish, isn’t the fish purely biophysical? No, a fish in the hand is different from a fish in the lake. A fish in the hand is the result of several things, not all of them biophysical: in particular, the rod and reel, the skill, and the time provided by the angler. A fish in the hand is a combination of biophysical and social factors. The ecological endpoint—the thing that is purely biophysical here—is the fish population in the particular lake.

Another important clarification is that “purely biophysical” does not mean “untouched by human hands.” Most things in nature are touched in some way by human action. In this case, the fish population may be reduced by harvests or improved by stocking. Human influence does not rule something out as an ecological endpoint.

Other possible sources of confusion are associated with the second characteristic: endpoints’ concreteness. Economists split environmental benefits into two broad classes: direct and indirect. Indirect benefits are things like the value of species’ existence. I may never come within a thousand miles of a wildebeest, but I still care that it exists. If I’ll never see a wildebeest, how is that concrete? Here, the benefit is intangible, but the physical requirement necessary for the

benefit is absolutely tangible: it’s the existence of wildebeests as a species. That is concrete and can be counted.

Ecology often depicts nature as a collection of interrelated processes and functions; examples include sequestration, predation, and nutrient cycling. Processes and functions are not endpoints. However, understanding ecology as process and function is what allows us to test and depict causality in nature. If a butterfly flaps its wings, what *does* happen, exactly? Ecological process and function are necessary if we are ever to predict changes in nature, particularly changes in endpoints. Endpoints are just that: the tangible, concrete, end results of processes and functions.

Finally, consider the qualification that endpoints must have direct relevance to human well-being. This raises some sticky issues. If human life itself depends on nature and if nature is an integrated whole, aren’t all things in nature directly relevant to our welfare? From a philosophical and ethical perspective, the answer is yes. From a measurement perspective, however, the answer is no. Consider all the things we can count in nature: the number of things and qualities is almost infinite. Focusing on those that are directly relevant to human well-being is, first, a way to make the problem manageable. Second, direct features can be thought of as nature’s end products. Their value will embody all of the indirect products necessary to them.

A set of RFF research papers, listed at [www.rff.org/endpointproblem](http://www.rff.org/endpointproblem), develops these ideas in much greater detail.

## Reasons for Optimism

Among practitioners of environmental assessment, recognition that we have an endpoint problem is growing. This is due partly to the decades-long failure to integrate ecology and economics in a way that effectively contributes to solving the broad public policy problems facing us.

Ecology and economics are growing toward each other. Ecologists increasingly see nature’s broad contributions to economic well-being as a subject for ecological study. Conservationists, too, increasingly see economic arguments as useful to their mission. Likewise, economists have become much more sensitive to and skilled at the analysis of nature’s goods and services, including those that resist traditional economic analysis.

The pursuit of common ecological endpoints will further foster this integration of approaches. In fact, common endpoints are the only way to debate and convey a shared mindset. They will lead to coordination, scientific advance, greater legitimacy in the halls of public debate, and clearer public communication about what in nature is being gained and lost. ■

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