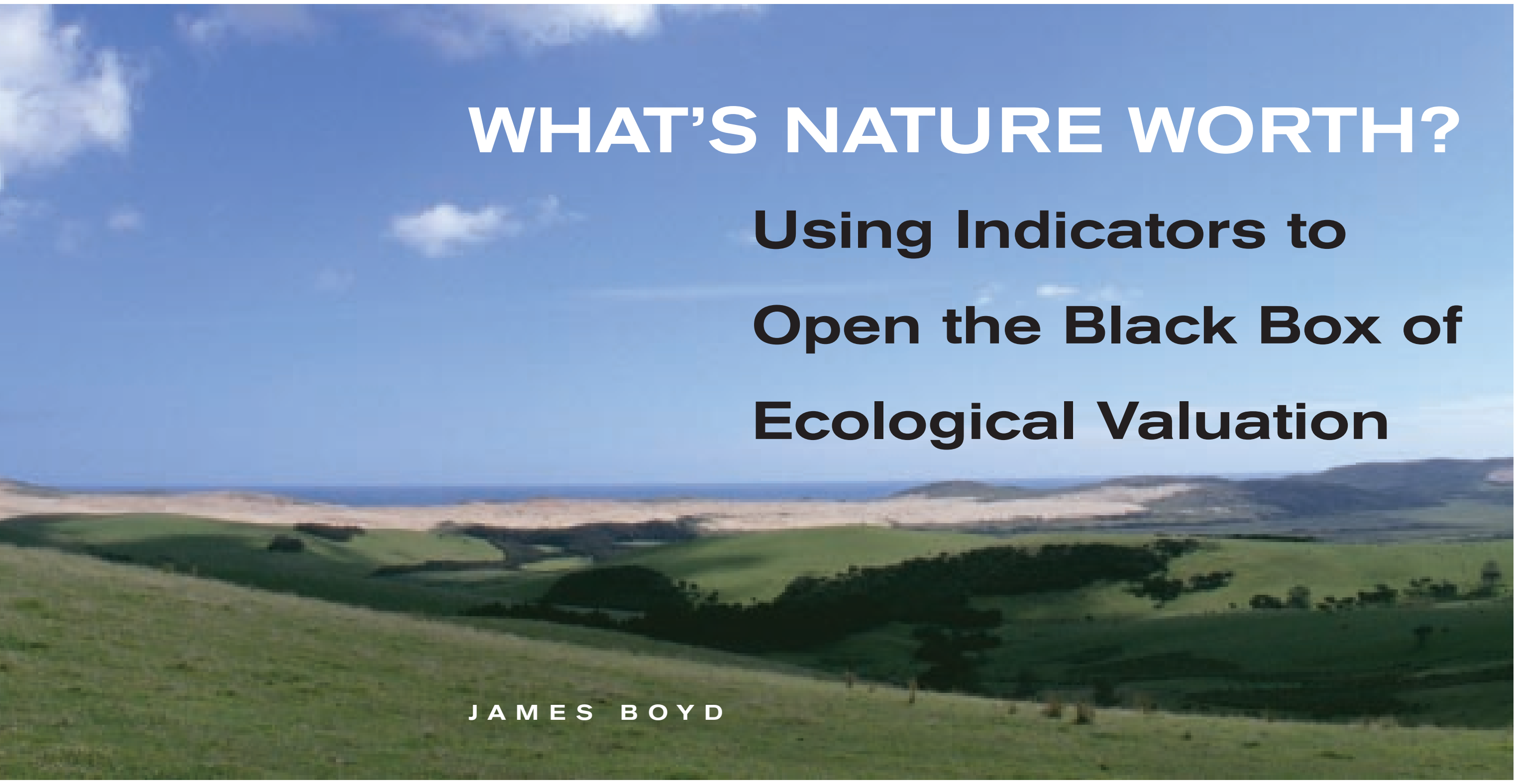


WHAT'S NATURE WORTH?

Using Indicators to Open the Black Box of Ecological Valuation

JAMES BOYD

What is the value of nature? This difficult question has motivated much of the work done at RFF over the last 52 years. If it seems odd that such a question could occupy an institution for half a century, consider both the importance and difficulty of the challenge. Nature and the services it provides are a significant contributor to human well-being, and society makes decisions every day about whether we will have more or less of it. Knowing nature's value helps us make those decisions. The difficulty is that nature never comes with a convenient price tag attached. Ecosystems aren't automobiles, in other words. They are like factories, however. They make beauty, clean air, and clean water, and they feed and house species that are commercially, recreationally, and aesthetically important.

Over the past decades, economic approaches to the "value of nature" question have become ever more sophisticated and accurate. This sophistication has a downside, however: noneconomists rarely understand how estimates are derived and frequently distrust the answers given. To noneconomists, environmental economics presents a set of black boxes, out of which emerges "the value of nature," such as a statement that "beautiful beach provides $1 million in annual recreation benefits" or "wetlands are worth $125 an acre."

How do economists arrive at such conclusions? For one thing, they examine the choices people make in the real world that are related to nature and infer value from those decisions. For instance, how much more do people spend to live in a scenic area as opposed to a less attractive one? How much time and money do they spend getting to a park or beach? The translation of such real-world choices into a dollar benefit estimate is complicated and requires the use of sophisticated statistical techniques and economic theory.

Problems

Economic valuation is met with skepticism in part because of the "black boxes" that are used by environmental economists; "black box" being useful shorthand for statistical or theoretical methods that require math or significant data manipulation, stock and trade for economists and some ecologists.

The technical and opaque nature of economic valuation techniques creates a gulf between environmental economists and decisionmakers that fosters distrust. Such studies can also be quite expensive and demand the expertise of a relatively small number of economists trained in ecological valuation. The complexity of the studies undermines the ability of economists to contribute—as they should—to the analysis of priorities, trade-offs, and effective ecological management.

Another criticism of economic valuation is that values are "created" through political and other social processes and are not something that can be simply measured or derived by "objective" experts. Technical analysis—the black box—fosters this criticism because it produces results that can only be interpreted and evaluated by an elite cadre of experts.

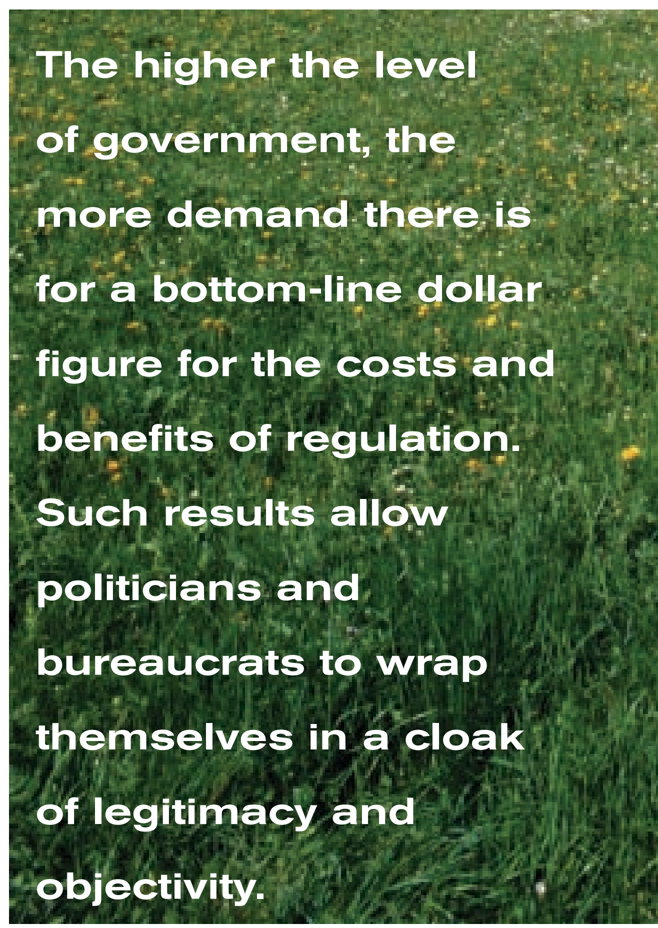
Here I will talk about a method designed to make ecological valuation more intuitive and thereby address some of the criticisms of economic valuation. Working with colleagues at the University of Maryland Center for Environmental Science, we are studying environmental benefit indicators (EBIs), which are a quantitative, but not monetary, approach to the assessment of habitats and land uses. EBIs strip environmental valuation of much of its technical content, but do so to reach a much wider audience and convey economic reasoning as it is applied to nature. Like purely ecological indicators, they summarize and quantify a lot of complex information. And like monetary assessment, they employ the principles of economic analysis. Our argument is that indicators can help noneconomists think about trade-offs.

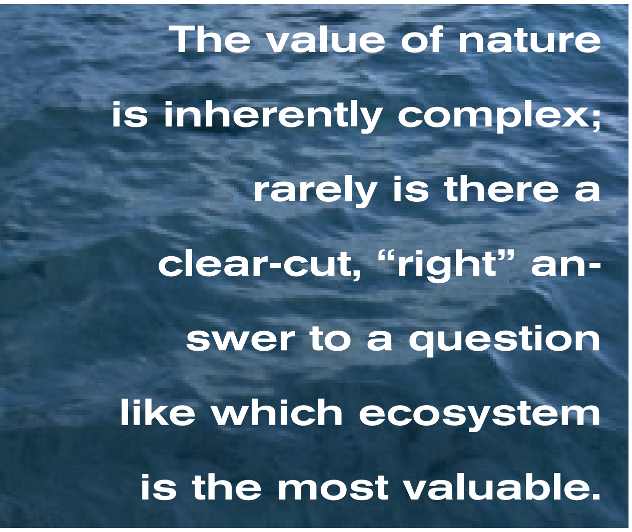
We also believe that indicators can improve the way economists communicate ecological benefits and trade-offs. But it should be emphasized that we do not see indicators as a way to simplify assessment. The value of nature is inherently complex; rarely is there a clear-cut, "right" answer to questions such as which ecosystem is most valuable or which ecosystem service provided by a given habitat is most important.

Opening the black box

RFF's mission is not only to advance the methodology of environmental economics and other disciplines but also to ensure that its technical research affects policymaking. RFF researchers continue to push the scientific frontiers of ecological valuation and always will. But an additional task is increasingly necessary: communicating to decisionmakers what we as economists and scientists already know and agree upon. As a group, environmental economists need to improve the ways in which they communicate the value of nature.

Unfortunately, better communication involves removing (or at least de-emphasizing) much of the technical content of economic methodology. We economists hate doing this. After all, much of the truth may be lost if the discipline of technical economic analysis is removed. But much of the truth is also lost when economists deliver answers that are not trusted or understood by the real-world audiences we must reach.





What are indicators?

At the simplest level, indicators can be the number of individuals in a biological community or species present in a habitat. They may also be a measure of the number of days a piece of land is under water or the presence of nearby invasive species that may threaten an ecosystem. These indicators tell us something about the health of a species or ecosystem.

Organized around basic environmental and economic principles, benefit indicators are a way to illustrate the value of nature. A collection of individual indicators about a given ecosystem can capture the complex relationships among habitats, species, land uses, and human activities, resulting in a more comprehensive picture (see the map on page 21). Regulators could use indicators to identify locations for ecological restoration that will yield large social benefits, and land trusts could use them to identify socially valuable lands for protection. Other applications include evaluation of damages from oil spills or environmental impact studies.

The techniques we are developing will be relatively affordable and easy to use. Dozens of the indicators we have been collecting are readily available in geospatial data formats. States, agencies, and regional planning institutions increasingly have high-resolution, comprehensive data on land cover and land use, built infrastructure, population and demographics, topography, species, and other data useful to the assessment of benefits.

What matters the most?

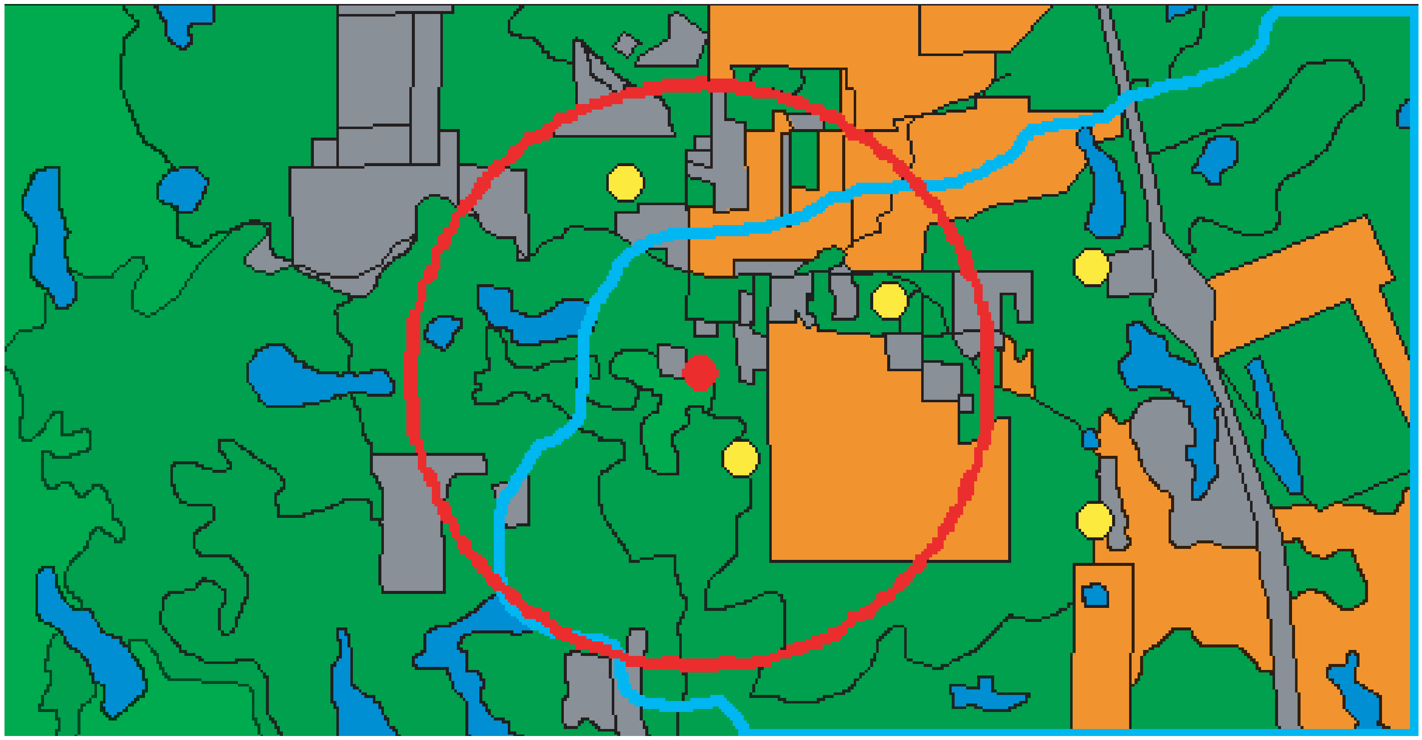
Indicators should act as legitimate proxies for what we really care about: the value of an ecosystem service. For example, wetlands can improve overall water quality by removing pollutants from ground and surface water. This service is valuable but just how valuable? To answer this question we can count a variety of things, such as the number of people who drink from wells attached to the same aquifer as the wetland. The more people who drink the water protected by the wetland, the greater its value.

But other things matter as well. For example, is the wetland the only one providing this service or are others contributing to the aquifer's quality? The more scarce the wetland, the more valuable it will tend to be. There may also be substitutes for wetland water-quality services provided by other land-cover types such as forests or by man-made filtration systems. Mapping and counting the presence of these other features can further refine an understanding of the benefits being provided by a particular wetland. Does mapping and counting these things give us a dollar-based estimate of the wetland's value? No. But it does lead to a more sophisticated, nuanced appreciation of the wetland's value than we would get if we ignored socioeconomic factors and economic principles.

Traditional regulatory and ecological ecosystem assessment techniques typically ignore socioeconomic factors, such as the number of people benefiting from an ecological function. And they never include assessment of concepts like the service's economic scarcity or the presence of substitutes. This highlights the second important function of benefit indicator systems—they can be used to convey basic economic concepts that speak to value.

Ecosystem services and economic principles

Ecologists and economists have identified a wide variety of very important ecological services, including water-quality improvements, flood protection, pollination for fruit trees, recreation, aesthetic enjoyments, and many others. Indicators should be organized around these specific services to help convey a deeper understanding of the service itself.



This map illustrates how a wetland can contribute to drinking water quality. The wetland in question is hydrologically connected to nearby drinking wells. It is also in an area where wetlands are scarce and where water quality may be impaired by agricultural activity.

Also, from both an ecological and economic standpoint, services should be analyzed independently. A typical ecosystem will generate multiple services, but not all services should be assessed using the same data or at the same scale.

The analysis of a service's scarcity and the importance of substitutes are important economic concepts that can be conveyed. Another is the role of complementary assets, which is particularly important to the assessment of recreational benefits. Access via trails, roads, and docks is often a necessary—or complementary—condition to the enjoyment of recreational and aesthetic services. These things can also be counted and relate intuitively to value.

Finally, an indicator system can also feature proxies for risk to an ecosystem service. For example, an ecosystem service may be threatened by an invasive species that can overwhelm more valuable native species, by a rise in sea level if the habitat is in a low-lying area, or by human encroachment if the ecosystem is sensitive to the human footprint. To foster a disciplined communication of results, we are developing indicators for demand, scarcity, substitutes, complementary assets, and risk that are specific to particular services.

How Do Environmental Benefit Indicators Work?

Environmental benefit indicators (EBIs) are a way to illustrate the value of nature in a specific setting. An individual EBI might be the presence of invasive species or the number of acres under active cultivation. A collection of indicators about a given area can portray the complex relationships among habitats, species, land uses, and human activities. EBIs are drawn mainly from geospatial data, including satellite imagery. Data can come from state, county, and regional growth, land-use, or transportation plans; federal and state environmental agencies; private conservancies and nonprofits; and the U.S. Census.

Regulators and planners can use EBIs to address specific questions, such as which wetland site, among many, is the most valuable? Coming up with an effective answer requires looking at many factors: on-site characteristics, such as the type of wetland; off-site characteristics, including the presence of wetlands in the larger area; and socioeconomic indicators, such as the number of people dependent on wells in the area for their drinking water.

The map above graphically portrays how a set of these factors relate to one another in the target area. One of the great virtues of this approach is that unforeseen relationships—such as the amount of A in relation to B—is quickly made apparent.

The importance of landscape and scale

Ecology emphasizes the importance of habitat connectivity and contiguity (or proximity) to the productivity and quality of that habitat. Terms like connectivity and contiguity are inherently spatial and refer to the overall pattern of land uses, surface waters, and topographic characteristics in a given region. Species interdependence and the need for migratory pathways are additional sources of "spatial" phenomena in ecology. The health of an ecosystem cannot be assessed without an understanding of its surroundings.

From an economic standpoint, ecosystem benefits depend on the landscape for an additional reason: because the social and economic landscape affects the value of nature. Where you live, work, travel, and play all affects the value of a particular natural setting. And the consumption of services often occurs over a large scale; examples include recreation and commercial harvests of fish or game, water purification, flood damage reduction, crop pollination, and aesthetic enjoyment.

To ignore, or minimize, the importance of off-site factors misses much that is central to a complete valuation of benefits. How scarce is the service? What complementary assets, such as trails or docks, exist in the surrounding landscape that enhance the value of a service? These questions relate to the overall landscape setting and are, accordingly, spatial in nature.

What the audience wants

Some audiences interested in the value of ecosystems crave the answer typically provided by economists: a dollar value. Government agencies are regularly called upon to demonstrate the social value of programs, plans, and rules they oversee. Generally speaking, the higher the level of government, the more demand there is for a bottom-line dollar figure for the costs and benefits of regulation. Such results allow politicians and high-level bureaucrats to wrap themselves in a cloak of legitimacy and objectivity.

Less cynically, putting things in dollar terms makes it easier to analyze trade-offs. The dollar benefit of program A can be directly compared to the dollar benefit of program B. Assuming the dollar figures are correct, we know which program is better, and this is why economists prefer this approach. Only by expressing benefits in a consistent framework can the apples of ecological protection be compared to the oranges of alternative actions.

Conclusion

Environmental economists need to better communicate trade-offs and the value of nature in a way that educates and confers legitimacy on their own economic arguments. EBIs are an underutilized way to do this. Because indicators avoid technical complexity and the expression of value in dollar terms, however, too many economists reflexively dismiss their value. But the alternative—formal econometric benefit analysis—is unlikely to ever generate results that are holistic enough, transparent enough, credible enough, and cheap enough to get widespread practical use. Scientifically sound, econometric analysis should continue to be conducted, of course. But agencies and planners should know that there are alternatives.

Instead of burying the principles of economics in their methodology, economists need to better communicate those principles in ways that resonate with "normal" people. Benefit indicators can help do this by concretely and quantitatively illustrating the relationships that are important to economic analysis. Communicating even a qualitative understanding of economic principles and relationships would be a huge advance for economic thinking in regulatory decision contexts.

Indicators can also be used to track the performance of environmental programs, regulations, and agencies over time—something that gets surprisingly little attention from environmental agencies or economists. To do so would require consistent and large expenditures of time, money, and expertise. But instead of trying to calculate the dollar benefit of a regulatory program over time, agencies could more easily measure things like the number of people benefiting from ecosystem services protected by their programs. This doesn't yield a dollar benefit, but does yield an intuitive number that conveys valuable information.

Given these benefits, indicators are underutilized in local, regional, and executive-level environmental decisionmaking. We are helping develop tools that are both ecologically and economically sound to address this gap. ■

James Boyd is a senior fellow, whose research interests center on ecological benefit assessment, water quality regulation, and the design of practical regulatory decision tools.