

# Ecosystem Services and Government Accountability: The Need for a New Way of Judging Nature's Value

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Ten years ago environmental policy discussions became flooded with the term “sustainability.” Books, articles, conferences, grant competitions, even entire organizations, took sustainability as their focus. No doubt the word took off because it evoked environment-friendly concepts like balance and stewardship. Its success may also have been due to the fact that it could mean almost anything. Now a new term—ecosystem services—threatens to dethrone sustainability as the ultimate environmental buzzword.

Like its predecessor, the term “ecosystem services” is increasingly attached to all manner of public and private environmental endeavors. Recent examples include the UN-sponsored Millennium Assessment, National Research Council reports, and numerous advisory boards to the government and the private sector. As the term gets more and more use, there is a danger it will become a soft, generic label signifying everything, yet nothing.

What follows is a brief guide to what ecosystem services really are, what they are not, and why we need a system of measuring them.

## A definition and a distinction

*Ecosystem services are the end products of nature that yield human well-being.* Three necessary conditions define an ecosystem service. First, and most obvious, the service has to emerge from the natural environment. Second, a service must enhance human well-being. Third, a service is an end product of nature directly used by people. The last two parts of the definition deserve further explanation. Before doing so it is important to emphasize a distinction: ecosystem services are not the same thing as ecosystem functions. Functions are the biological, chemical, and physical interactions associated with ecosystems. These functions are the things described by biology, atmospheric science, hydrology, and so on. Services depend on these functions but are different: they are the aspects of the ecosystem valued by people. For the purposes of our article, we use the word biophysical to define this complex interplay between the inhabitants of the natural world and their environment.

## Services are about human well-being

The term services conveys a basic truth: human welfare is dependent on natural systems. The study and measurement of services tell us about how welfare can be enhanced via stewardship of the environment. It is the emphasis on welfare and human well-being that sets the economic analysis of services apart from purely biophysical analysis.

There are two reasons—one philosophical, one pragmatic—to emphasize nature’s economic characteristics. As a matter of philosophy, economists believe that the objective of social policy is to maximize human well-being. The well-being nature provides can be interpreted quite broadly to include nonmaterial, even spiritual experiences. When we measure ecological conditions alone, it is certainly far better than doing nothing, but it neglects deeper inquiry into what is socially beneficial about ecosystems. The second reason to assess benefits is that it illuminates and disciplines how priorities are set and trade-offs are calculated.

Indicators of pure ecological conditions, such as the presence of a contaminant in a stream, do not help a policymaker forced to choose between conflicting interventions or operate under a tight budget. To say that better ecological conditions are better for society is true, but unhelpful. In practice, policymakers struggle with much more difficult questions, such as *which* ecological conditions are better than others? For economists, measures of social well-being are an effective way to come up with the answers.

It deserves emphasis, however, that all of nature’s benefits can be and should be measured, including nonmaterial, even spiritual, benefits.

### Services are the “end products” of nature

Nature is composed of a swirling multiplicity of processes, functions, and interactions. The oceans affect climate, climate affects plant life, plant life affects habitat, and on and on. All of these linkages are fundamental to life on Earth and thus to human well-being. And all are therefore valuable. But being valuable is not the same thing as being a service.

The metaphor of nature as a factory, although possibly jarring, is powerful and illustrative in this context. To an economist, a factory is nothing more than a set of inputs and a way of combining those inputs to create a set of things people want (the end products). To apply the metaphor, ecosystem services are the things people want from nature, like the beauty of a forest and fish from the sea, not the equally important processes or components on which services depend. These services can be enjoyed directly (such as outdoor recreation) or indirectly, via an additional economic process (such as the fertility of soil, which contributes to the production of food).

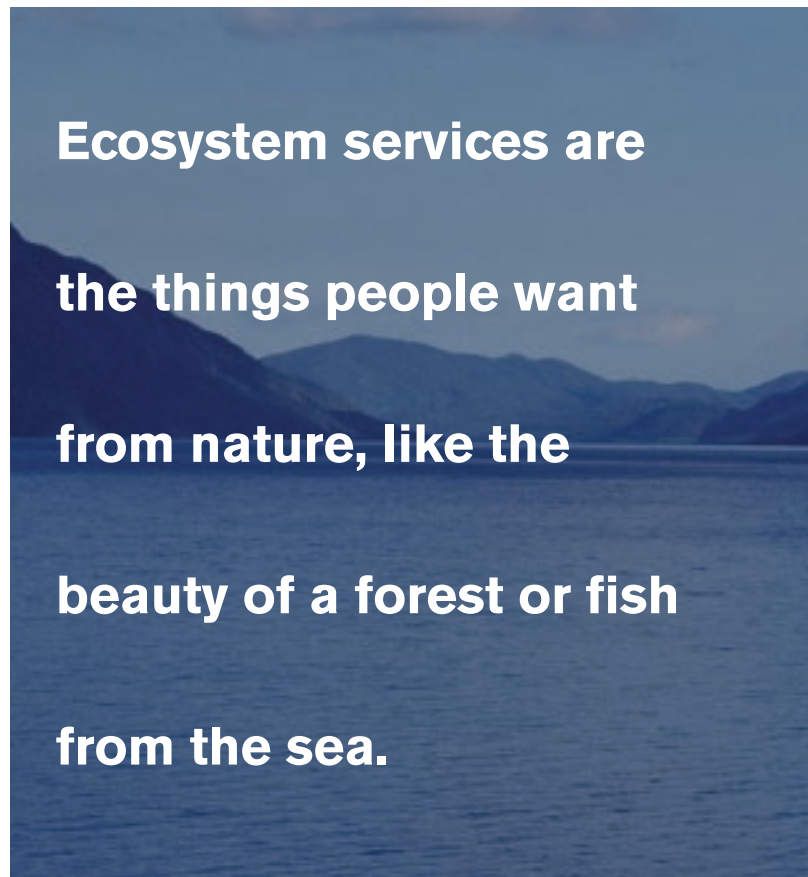
Like a factory, nature represents the processes and components that give rise to these services. To be sure, nature is an extremely complicated factory. While we can inventory the inputs and processes involved with a real factory, depicting the full range of biophysical relationships will occupy

science for centuries to come. But the earth sciences, broadly defined, are already doing this. Another term for this factory is the ecological production function. If you believe in climate change you believe in a biophysical production function.

Confusion between inputs and outputs muddies thinking about ecosystem services. Most inventories of ecosystem services include both the end products people want and the biophysical inputs or processes on which end products depend. For example, inventories of ecosystem services include such things as photosynthesis and nutrient cycling, which are functions, not services. One imperfect test is whether an average person knows what nutrient cycling is (probably not). Nutrient cycling is a valuable ecosystem function because it leads to things people want: clean water, in this case. It is not something people intrinsically value as an end in itself.

### Services are the bridge between economics and ecology

Truly interdisciplinary work between economists and biophysical scientists is the Holy Grail in environmental analysis. Each group can conduct productive academic activities in isolation, but real progress in public decisionmaking demands



integration. Given the definition of services as end products of nature that yield human well-being, the biophysical sciences tell us what kinds of end products we can expect from nature. Take drinking water for example, clearly something from nature that benefits human beings. How much additional clean water can we expect if we apply less pesticide to farms? This is a question for the biophysical sciences. How valuable is that change in clean water? That is a question for economists. The link between the two inquiries—that is, the units nature provides and that enter into consumption or economic production decisions—is the service. But ecologists and economists must agree on the definition of services or their analyses will never effectively integrate.

A corollary to this is that ecologists need to buy into the economic conception of services. To deep ecologists, services' focus on human well-being may be an insuperable hurdle to acceptance. But there are positive reasons for ecologists to embrace the concept, as well as a few misconceptions to clear up. We start with a misconception.

### **Services will usually not be bought and sold**

Proponents of market-oriented environmental policies have seized on the language of ecosystem services because some services can—in principle—be exchanged and priced. This enthusiasm is somewhat unfortunate because it can lead skeptics of market-oriented policies to equate the services mindset with market policies. In reality, a commercial approach to ecosystem services provision is a dim dream for all but a small set of environmental benefits. This is because most ecosystem services are common resources or public goods in economic terminology.

Like the other classic sets of public services—defense and public safety—ecological services tend to benefit large groups of people and resist ownership. A corollary is that people, even if they were somehow allowed to buy ecosystem services, would not buy enough of them. Altruism is not a strong enough motivation for citizens to pay for ecosystem services. We don't even pay for fuel-efficient vehicles and clean fuels and we still apply too much fertilizer and pesticides on our lawns. All of these problems arise for the same reason: our private incentives do not align with the public interest. When it comes to the environment this will always be so because of a fundamental reality: the environment is shared, not owned.

Misplaced excitement over the commercial provision of ecological services arises from one of two mistakes: The belief that private parties will pay for public goods when they clearly don't. Or that someone else—in particular, the gov-

ernment—will pay for them. Theoretically, governments are the solution to public good provision. But it is a misconception to assume that governments know how to provide ecosystem services.

### **Services demand expertise in procurement**

The procurement of public goods is a challenge. Consider public safety and defense. Because private markets do not provide these services we rely on governments to purchase them. Unfortunately, governments are not immune to mispending money. Scandals in defense contracting—such as thousand-dollar toilet seats and armored vehicles that don't perform as they should—provide regular examples of the difference between a government purchase and one where an individual's own money is on the line.

Because ecosystem services are public goods, this problem is inevitable. What it suggests, however, is that governments need a way to measure the quality of services they are buying. With public safety, the public gets some form of feedback on the quality of its investment when the crime rates rise and fall. With ecosystem services, the feedback by which we judge the performance of government in providing these services is much more ambiguous. Was trout fishing better this year than last? Is property better protected from flooding?

### **We should demand quality services**

If the public can be educated about what ecosystem services are, it will be easier to convey the importance of maintaining their quality. There are cars and then there are good cars. The same is true of ecosystem services.

The notion of services prompts two kinds of inquiry into quality. First, what is the environmental quality of the services? Is there more clean water, are there wetlands capable of cycling nutrients, is the visual beauty of the landscape improving? Second, what is the economic quality of these services? Economic quality relates to the degree to which a service creates well-being. For example, the location of ecosystem services can strongly affect their value. The value of flood or hurricane damage prevention, recreation, and aesthetic enjoyment are all strongly dependent on their location.

Economic quality also relates to things like the availability of substitutes. Many ecosystem services have no substitutes. For example, there is no clear substitute for the existence value of wilderness or an endangered species. Other services do have substitutes, however. Consider drinking water. Purchased filtration of unclean water is a partial substitute for

clean water. Are we indifferent between the two? Of course not, because clean drinking water is a signal of many other things: clean rivers and lakes, a sense of personal safety, and trust in institutions delivering the water, to name a few. But there are substitutes for naturally occurring clean drinking water. Mechanically filtered water, for example, is an imperfect substitute for pure natural water. From a procurement standpoint, the substitutability of these services—and their relative cost—should be made a part of public process.

### **The immediate challenge: measure, track, and communicate services**

Measurement of ecosystem services is a first step to their better procurement. Such measurement will require the use of both biophysical and economic data, to capture both the ecological production function and the contribution of services to human welfare. How to go about this is the subject of ongoing research at RFF.

We have been developing a set of tools based on ecological benefit indicators (EBIs), which are quantitative, transparent measures of ecological and social conditions usually gleaned from geospatial information and other public data sets. The depiction of these indicators—both quantitatively and visually—provides a basis for public learning about the ways in which natural systems create well-being. They are also designed to overcome the typical bifurcation of analysis into separate economic and ecological components.

Several products have emerged from this line of thinking. First, for a set of case studies, indicators were collected, displayed, and used to analyze the value of different natural resources. Second, we have been studying the integration of these indicators into a formal index of ecosystem services. Consider an index like the gross domestic product (GDP). We trust such an index because it is constructed transparently and rooted in sound economic science. An index of ecological benefits requires those same properties and one other: it must be based on production function analysis derived from sound biophysical science.

Any such index can be challenged in terms of what it really represents. But a reason to embark on such a project is to begin the development of a rigorous, systematic measurement of ecosystem services. The way we measure GDP has changed over the last 100 years. The way we account for ecosystem benefits will also change over time. But it is important to start. Governments make decisions every day that affect the sources of well-being we derive from nature. The public needs a way to think about, systematize, and track these changes. ■

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