



## Essentials, Section 2 Valuation of Ecosystem Services

*This section defines and explains some important concepts related to how economists approach ecosystem valuation.*

Ecosystem valuation can be a difficult and controversial task, and economists have often been criticized for trying to put a “pricetag” on nature. However, agencies in charge of protecting and managing natural resources must often make difficult spending decisions that involve tradeoffs in allocating resources. These types of decisions are economic decisions, and thus are based, either explicitly or implicitly, on society’s values. Therefore, economic valuation can be useful, by providing a way to justify and set priorities for programs, policies, or actions that protect or restore ecosystems and their services (see The Big Picture for more information).

In order to understand how economists approach ecosystem valuation, it is useful to review some important definitions and concepts.

### **Ecosystem Functions and Services**

Ecosystem functions are the physical, chemical, and biological processes or attributes that contribute to the self-maintenance of an ecosystem; in other words, what the ecosystem does. Some examples of ecosystem functions are provision of wildlife habitat, carbon cycling, or the trapping of nutrients. Thus, ecosystems, such as wetlands, forests, or estuaries, can be characterized by the processes, or functions, that occur within them.

Ecosystem services are the beneficial outcomes, for the natural environment or

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people, that result from ecosystem functions. Some examples of ecosystem services are support of the food chain, harvesting of animals or plants, and the provision of clean water or scenic views. In order for an ecosystem to provide services to humans, some interaction with, or at least some appreciation by, humans is required. Thus, functions of ecosystems are value-neutral, while their services have value to society.

### **Some Factors that Complicate Ecosystem Management Decisions**

Decisions about ecosystem management are complicated by the fact that various types of **market failure** are associated with natural resources and the environment. Market failures occur when markets do not reflect the full social costs or benefits of a good. For example, the price of gasoline does not fully reflect the costs, in terms of pollution, that are imposed on society by burning gasoline. Market failures related to ecosystems include the facts that: (i) many ecosystems provide services that are public goods; (ii) many ecosystem services are affected by externalities; and (iii) property rights related to ecosystems and their services are often not clearly defined.

Ecosystem services are often public goods, which means that they may be enjoyed by any number of people without affecting other peoples' enjoyment. For example, an aesthetic view is a pure public good. No matter how many people enjoy the view, others can also enjoy it. Other services may be quasi-public goods, where at a certain level of use, others' enjoyment may be diminished. For example, a public recreation area may be open to everyone. However, crowding can decrease peoples' enjoyment of the area. The problem with public goods is that, although people value them, no one person has an incentive to pay to maintain the good. Thus, collective action is required in order to produce the most beneficial quantity.

Ecosystem services may be affected by externalities, or uncompensated side effects of human actions. For example, if a stream is polluted by runoff from agricultural land, the people downstream experience a negative externality. The problem with negative externalities is that the people (or ecosystems) they are imposed upon are

generally not compensated for the damages they suffer.

Finally, if property rights for natural resources are not clearly defined, they may be overused, because there is no incentive to conserve them. For example, unregulated fisheries are an open-access resource – anyone who wants to harvest fish can do so. Because no one person or group “owns” the resource, open access can lead to severe over-harvesting and potentially severe declines in fish abundance over time.

#### Definitions

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Ecosystem valuation can help resource managers deal with the effects of market failures, by measuring their costs to society, in terms of lost **economic benefits**. The costs to society can then be imposed, in various ways, on those who are responsible, or can be used to determine the value of actions to reduce or eliminate environmental impacts. For example, in the case of the crowded public recreation area, benefits to the public could be increased by reducing the crowding. This might be done by expanding the area or by limiting the number of visitors. The costs of implementing different options can be compared to the increased economic benefits of reduced crowding.

In the case of a stream polluted by agricultural runoff, the benefits from eliminating the pollution can be compared to costs of actions to reduce the runoff, or can be used to determine the appropriate fines or taxes to be levied on those who are responsible. In the case of open-access fisheries, the benefits from reducing overfishing can be compared to regulatory costs or costs to the commercial fishing industry if access is restricted.

### Ecosystem Values

Ecosystem values are measures of how important ecosystem services are to people – what they are worth. Economists measure the value of ecosystem services to people by estimating the amount people are willing to pay to preserve or enhance the services (see Basic Concepts of Economic Value for more detailed

information). However, this is not always straightforward, for a variety of reasons.

Most importantly, while some services of ecosystems, like fish or lumber, are bought and sold in markets, many ecosystem services, like a day of wildlife viewing or a view of the ocean, are not traded in markets. Thus, people do not pay directly for many ecosystem services. Additionally, because people are not familiar with purchasing such goods, their willingness to pay may not be clearly defined. However, this does not mean that ecosystems or their services have no value, or cannot be valued in dollar terms.

It is not necessary for ecosystem services to be bought and sold in markets in order to measure their value in dollars. What is required is a measure of how much purchasing power (dollars) people are willing to give up to get the service of the ecosystem, or how much people would need to be paid in order to give it up, if they were asked to make a choice similar to one they would make in a market. (Overview of Methods to Estimate Dollar Values gives an overview of, and Dollar-Based Ecosystem Valuation Methods describes in more detail, the methods that economists use to estimate dollar values for ecosystems and their services.)

### **Types of Values**

Economists classify ecosystem values into several types. The two main categories are use values and non-use, or “passive use” values. Whereas use values are based on actual use of the environment, non-use values are values that are not associated with actual use, or even an option to use, an ecosystem or its services.

Thus, use value is defined as the value derived from the actual use of a good or service, such as hunting, fishing, birdwatching, or hiking. Use values may also include indirect uses. For example, an Alaskan wilderness area provides direct use values to the people who visit the area. Other people might enjoy watching a television show about the area and its wildlife, thus receiving indirect use values. People may also receive indirect use values from an input that helps to produce something else that people use directly. For example, the lower organisms on the

aquatic food chain provide indirect use values to recreational anglers who catch the fish that eat them.

Option value is the value that people place on having the option to enjoy something in the future, although they may not currently use it. Thus, it is a type of use value. For example, a person may hope to visit the Alaskan wilderness area sometime in the future, and thus would be willing to pay something to preserve the area in order to maintain that option.

Similarly, bequest value is the value that people place on knowing that future generations will have the option to enjoy something. Thus, bequest value is measured by peoples' willingness to pay to preserve the natural environment for future generations. For example, a person may be willing to pay to protect the Alaskan wilderness area so that future generations will have the opportunity to enjoy it.

Non-use values, also referred to as "passive use" values, are values that are not associated with actual use, or even the option to use a good or service. Existence value is the non-use value that people place on simply knowing that something exists, even if they will never see it or use it. For example, a person might be willing to pay to protect the Alaskan wilderness area, even though he or she never expects or even wants to go there, but simply because he or she values the fact that it exists.

It is clear that a single person may benefit in more than one way from the same ecosystem. Thus, total economic value is the sum of all the relevant use and non-use values for a good or service.



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