6 Concepts of Ecosystem Value and Valuation Approaches

Executive Summary

- Decision-making concerning ecosystems and their services can be particularly challenging because different disciplines, philosophical views, and schools of thought conceive of the value of ecosystems differently.
- In the utilitarian (anthropocentric) concept of value, ecosystems and the services they provide have value to human societies because people derive utility from their use, either directly or indirectly (use values). People also value ecosystem services that they are not currently using (non-use values).
- Under the utilitarian approach, numerous methodologies have been developed to try to quantify the benefits of different ecosystem services. These are particularly well developed for provisioning services, but recent work has also improved the ability to value regulating, supporting, and cultural services. The choice of valuation technique is dictated by the characteristics of each case and by data availability.
- Non-utilitarian value proceeds from a variety of ethical, cultural, religious, and philosophical bases. These differ in the specific entities that are deemed to have value and in the interpretation of what having non-utilitarian value means. Notable among these are ecological, sociocultural, and intrinsic values. These may complement or counter-balance considerations of utilitarian value. The legal and social consequences for violating laws or regulations based on an entity's intrinsic value may be regarded as a measure of the degree of that value ascribed to them.
- The Millennium Ecosystem Assessment plans to use valuation as a tool that enhances the ability of decision-makers to evaluate trade-offs between alternative ecosystem management regimes and courses of social actions that alter the use of ecosystems and the services they provide. This usually requires assessing the change in the mix of services provided by an ecosystem resulting from a given change in its management.
- Most of the work involved in estimating the change in the value of ecosystem benefits concerns estimating the change in the physical flow of benefits (quantifying biophysical relations) and tracing through and quantifying a chain of causality between changes in ecosystem condition and human well-being. A common problem in valuation is that information is only available on some of the links in the chain, and often in incompatible units.

- Ecosystem values in terms of services provided are only one of the bases on which decisions on ecosystem management are and should be made. Many other factors, including notions of intrinsic value and other objectives that society might have, such as equity among different groups or generations, will also feed into the decision framework.

Introduction

The importance or "value" of ecosystems is viewed and expressed differently by different disciplines, cultural conceptions, philosophical views, and schools of thought (Goulder and Kennedy 1997). One important aim of the Millennium Ecosystem Assessment (MA) is to analyze and as much as possible quantify the importance of ecosystems to human well-being in order to make better decisions regarding the sustainable use and management of ecosystem services.

Understanding the impact of ecosystem management decisions on human well-being is an important objective. But if this information is presented solely as a list of consequences in physical terms—so much less provision of clean water, perhaps, and so much more production of crops—then the classic problem of comparing apples and oranges applies. The purpose of economic valuation is to make the disparate services provided by ecosystems comparable to each other, using a common metric. This is by no means simple, either conceptually or empirically. Society's ability to do so has increased substantially in recent years, however.

Ecosystems have value because they maintain life on Earth and the services needed to satisfy human material and nonmaterial needs. In addition, many people ascribe ecological, sociocultural, or intrinsic values to the existence of ecosystems and species. The MA recognizes these different paradigms, based on various motivations and concepts of value, along with the many valuation methods connected with them.

Ecosystems and the provisioning, regulating, cultural, and supporting services they provide have economic value to human societies because people derive utility from their actual or potential use, either directly or indirectly (known as use values). People also value ecosystem services they are not currently using (non-use values). This paradigm of value is known as the utilitarian (anthropocentric) concept and is based on the principles of humans' preference satisfaction (welfare).

Another set of values placed on ecosystems can be identified as the sociocultural perspective: people value elements in their environment based on different worldviews or conceptions of nature and society that are ethical, religious, cultural, and philosophical. These values are expressed through, for example, designation of sacred species or places, development of social rules concerning ecosystem use (for instance, "taboos"), and inspirational experiences. For many people, sociocultural identity is in part constituted by the ecosystems in which they live and on which they depend—these help determine not only how they live, but who they are. To some extent, this kind of value is captured in the concept of "cultural" ecosystem services. To the extent, however, that ecosystems are tied up with the very identity of a community, the sociocultural value of ecosystems transcends utilitarian preference satisfaction.

A different source of the value of ecosystems has been articulated by natural scientists in reference to causal relationships between parts of a system—for example, the value of a particular tree species to control erosion or the value of one species to the survival of another species or of an entire ecosystem (Farber et al. 2002). At a global scale, different ecosystems and their species play different roles in the maintenance of essential life support processes (such as energy conversion, biogeochemical cycling, and evolution). The magnitude of this ecological value is expressed through indicators such as species diversity, rarity, ecosystem integrity (health), and resilience. With increasing scarcity of space, and with limited financial resources, priorities have to be set regarding the conservation of the remaining biodiversity at all scale levels. The selection of protected areas and the determination of safe minimum standards regarding (sustainable) use of ecosystem services are based in part on these ecological values and criteria. The concept of ecological value is captured largely in the "supporting" aspect of the MA's definition of ecosystem services.

Although the various value paradigms have no common denominator and may lack any basis for comparison, some valuation approaches corresponding to them overlap and interact in various ways. Human preferences for all values can, to some extent, be measured with economic valuation methods, but ecological, sociocultural, and intrinsic value concepts have separate metrics and should be used in the decision-making process in their own right.

This chapter reviews the merits and deficiencies of these different valuation paradigms and how they complement or bound each other in assisting decisions and policy formulation for sustainable management and use of ecosystems. Ecological values are not discussed further here because they are dealt with extensively in Chapter 2.

The Utilitarian Approach and Economic Valuation Methods

The utilitarian paradigm of value is based on the fact that human beings derive utility from ecosystem services either directly or indirectly, whether currently or in the future. Two aspects of this paradigm need to be stressed. First, the use that an individual human being derives from a given ecosystem service depends on that individual's motivations, including, for example, his or her needs and personal preferences. The utilitarian approach, therefore, bases its notion of value on attempts to measure the specific usefulness that individual members of society derive from a given service, and then aggregates across all individuals, usually weighting them all equally.

Second, utility cannot be measured directly. In order to provide a common metric in which to express the benefits of the widely diverse variety of services provided by ecosystems, the utilitarian approach usually attempts to measure all services in monetary terms. This is purely a matter of convenience, however, in that it uses units that are well recognized, saves the effort of having to convert values already expressed in monetary terms into some other unit, and facilitates comparison with other activities that also contribute to well-being, such as spending on education or health. It explicitly does not mean that only services that generate monetary benefits are taken into consideration in the valuation process. On the contrary, the essence of practically all work on economic valuation of environmental and natural resources has been to find ways to measure benefits that do not enter markets and so have no directly observable monetary benefits.

Motivations for Economic Valuation

The most common reasons for undertaking a valuation of ecosystems are:

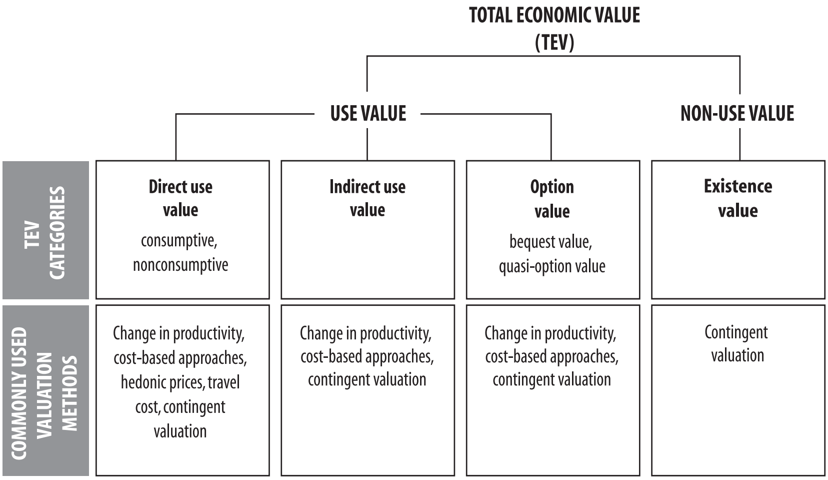
- to assess the overall contribution of ecosystems to social and economic well-being,
- to understand how and why economic actors use ecosystems as they do, and
- to assess the relative impact of alternative actions so as to help guide decision-making.

Numerous studies have assessed the contribution of ecosystems to social and economic well-being (Hartwick 1994; Asheim 1997; Costanza et al. 1997; Pimentel and Wilson 1997; Hamilton and Clemens 1999). Ecosystems form part of the total wealth of nations and contribute flow benefits, including social and cultural. But many ecosystem services are not traded, and hence their values are not captured in the conventional system of national accounts as part of total income. Moreover, in spite of the significant share of natural capital in total national wealth (World Bank 1997), the value of its depletion or appreciation is typically not accounted for.

As a result, conventional measures of wealth give incorrect indications of the state of well-being, leading to misinformed policy actions and ill-advised strategic social choices. For example, liquidation of natural assets to finance current consumption may appear to increase well-being when it does not take into account the corresponding decline in the capacity of the natural system to sustain the flow of economic, ecological, social, and cultural benefits in the future. More appropriate indicators that account for the flow and asset values of ecosystems are crucial for accurate monitoring of the implications of changes in ecosystem conditions for well-being. This is critical for the sustainable use and inter-temporal allocation of natural resources and for intergenerational equity. Valuation can help establish ecosystem values that allow correction of a country's national accounts (sometimes known as "greening") and construction of improved indicators of changes in wealth and well-being. Better valuation of the services provided by a given ecosystem does not guarantee that it will be conserved, as the costs of conservation might still be found to exceed its benefits, but it will almost certainly result in a lower loss of ecosystem services than otherwise.

Understanding why and how humans use ecosystems the way they do—for instance, why they cut natural forests, deplete soils, or pollute water surfaces—is a second reason to undertake a valuation of ecosystems. Markets guide the behavior and choices of individuals and public and private decisions. There is often a divergence, or wedge, between the market prices of goods and services as seen by individual economic agents and the social opportunity cost of using them. In particular, many services provided by ecosystems tend to be underpriced or not priced at all, leading to the inefficient and, often, unsustainable use of resources. By showing the existence and magnitude of differences between these private and social costs and benefits, valuation can help reveal policy and institutional failures (such as open access, public goods and externalities, or missing or incomplete markets), providing useful policy information on alternative intervention options for correcting them, such as creating markets or improving incentives.

FIGURE 6.1 The Total Economic Value Framework



The MA plans to use valuation primarily for the third rationale for undertaking it: assessing the impacts—the gains and losses—of alternative ecosystem management regimes. This provides a tool that enhances the ability of decision-makers to evaluate trade-offs between alternative ecosystem management regimes and courses of social actions that alter the use of ecosystems and the multiple services they provide.

It must be stressed that the ecosystem values in the sense discussed in this section are only one of the bases on which decisions on ecosystem management are and should be made. Many other factors, including notions of intrinsic value, as discussed later in this chapter, and other objectives that society might have, such as equity among different groups or generations, will also feed into the decision-making framework. (See Chapter 8.)

Total Economic Value

The concept of total economic value (TEV) is a widely used framework for looking at the utilitarian value of ecosystems (Pearce and Warford 1993). (See Figure 6.1.) This framework typically disaggregates TEV into two categories: use values and non-use values.

Use value refers to the value of ecosystem services that are used by humans for consumption or production purposes. It includes tangible and intangible services of ecosystems that are either currently used directly or indirectly or that have a potential to provide future use values. The TEV separates use values as follows:

- *Direct use values*. Some ecosystem services are directly used for consumptive (when the quantity of the good available for other users is reduced) or nonconsumptive purposes (no reduction in available quantity). Harvesting of food products, timber for fuel or construction, medicinal products, and hunting of animals for consumption from natural or managed ecosystems are all examples of consumptive use. Nonconsumptive uses of ecosystem services include enjoying recreational and cultural amenities such as wildlife and bird-watching, water sports, and spiritual and social utilities that do not require a harvesting of products. This category of benefits corresponds broadly to the MA description of provisioning and cultural services.
- *Indirect use values*. A wide range of ecosystem services are used as intermediate inputs for production of final goods and services to humans such as water, soil nutrients, and pollination and biological control services for food production. Other ecosystem services contribute indirectly to the enjoyment of other final consumption amenities, such as water purification, waste assimilation, and other regulation services leading to clean air and water supplies and thus reduced health risks. This category of benefits corresponds broadly to the MA notion of regulating and supporting services.
- *Option values*. Despite the fact that people may not currently be deriving any utility from them, many ecosystem services still hold value for preserving the option to use such services in the future either by the individual (option value) or by others or heirs (bequest value). Quasi-option value is a related kind of value: it represents the value of avoiding irreversible decisions until new information reveals whether certain ecosystem services have values that are currently unknown. (Note that some analysts place option value as a subset of non-use value rather than of use value, but they do not otherwise treat it differently.) This category of benefits includes provisioning, regulating, and cultural services to the extent that they are not used now but may be used in the future.

Non-use values are also usually known as existence value (or, sometimes, conservation value or passive use value). Humans ascribe value to knowing that a resource exists, even if they never use that resource directly. This is an area of partial overlap with the non-utilitarian sources of value discussed later in this chapter. The utilitarian paradigm itself has no notion of intrinsic value. However, many people do believe that ecosystems have intrinsic value. To the extent that they do, this would be partially reflected in the existence value they place on that ecosystem, and so would be included in an assessment of its total economic value under the utilitarian approach. This kind of value is the hardest, and the most controversial, to estimate.

Economic Valuation Methods

Under the utilitarian approach, numerous methodologies have been developed to attempt to quantify the benefits of different ecosystem services (Hufschmidt et al. 1983; Braden and Kolstad 1991; Hanemann 1992; Freeman III 1993; Dixon et al. 1994). As in the case of private market goods, a common feature of all methods of economic valuation of ecosystem services is that they are founded in the theoretical axioms and principles of welfare economics. These measures of welfare change are reflected in people's willingness to pay (WTP) or willingness to accept (WTA) compensation for changes in their level of use of a particular good or bundle of goods (Hanemann 1991; Shogren and Hayes 1997). Although WTP and WTA are often treated as interchangeable, there are important conceptual and empirical differences between them. Broadly speaking, WTP is appropriate when beneficiaries do not own the resource providing the service or when service levels are being increased, while WTA is appropriate when beneficiaries own the resource providing the service or when service levels are being reduced. In practice, WTA estimates tend to be substantially higher than WTP estimates. For this reason, WTP estimates are often used, as they are more conservative.

The methods commonly used to estimate the value of various services are shown in Figure 6.1. A number of factors and conditions determine the choice of measurement method. For instance, when an ecosystem service is privately owned and traded in the market, its users have the opportunity to reveal their preferences for such a good compared with other substitutes or complementary commodities through their actual market choices, given relative prices and other economic factors. For such ecosystem services, a demand curve can be directly specified based on observed market behavior. Many ecosystem services are not privately owned or traded, however, and hence their demand curves cannot be directly observed and measured. Alternative methods have been used to derive values in these cases. Different users and authors often classify the various methods of measuring ecosystem services values differently, but the grouping and naming systems converge to a broad classification that basically depends on whether the measures are based on observed or hypothetical behavior.

BOX 6.1 Valuation of Economic Services Through Observed Behavior

- *Direct observed behavior methods.* These methods derive estimates of value from the observed behavior of producers and consumers. They often use market prices and are most often applicable in cases where the ecosystem services are privately owned and traded in functioning markets. This approach is most frequently applicable to consumptive use, where goods are extracted from ecosystems and traded on markets.
- *Indirect observed behavior methods.* This category also uses actual observed behavior data but not on the ecosystem service in question. In the absence of actual market behavior regarding that particular service, these methods use observations on actual behavior in a surrogate market, which is hypothesized to have a direct relationship with the ecosystem service value. Examples in this category include hedonic pricing methods (which use statistical techniques to break down the price paid for a service into the implicit prices for each of its attributes, including environmental attributes such as access to recreation or clean air) and travel cost methods (which use observed costs to travel to a destination to derive demand functions for that destination). This group also includes cost-based methods (such as replacement cost methods, which value services at the cost of replacing, for example, a water purification service provided by an ecosystem with a new water treatment plant) that do not exactly reflect welfare (benefit-based) measures of value. (They sometimes underestimate and sometimes overestimate value.)

The standard valuation approach that uses actual observed behavior data is further divided into direct and indirect observed behavior methods. (See Box 6.1.) When they can be applied, these are generally considered preferable to measures based on hypothetical behavior.

The second valuation approach uses measures of economic value based on hypothetical behavior. In this category of methods, people's responses to direct questions describing hypothetical markets or situations are used to infer value. This group can also be divided into direct hypothetical (such as contingent valuation, in which respondents are asked directly how much they would be willing to pay for specified benefits) and indirect hypothetical measures of WTP or WTA (contingent ranking or conjoint valuation, which ask respondents to rank different bundles of goods).

A final category of approach is known as benefits transfer. This is not a methodology per se but rather the use of estimates obtained (by whatever method) in one context to estimate values in a different context. For example, an estimate of the benefit obtained by tourists viewing wildlife in one park might be used to estimate the benefit obtained from viewing wildlife in a different park. Benefits transfer has been the subject of considerable controversy in the economics literature, as it has often been used inappropriately. A consensus seems to be emerging that benefits transfer can provide valid and reliable estimates under certain conditions. These include that the commodity or service being valued is identical at the site where the estimates were made and the site where they are applied and that the populations affected have identical characteristics. Of course, the original estimates being transferred must themselves be reliable for any attempt at transfer to be meaningful.

Each of these approaches has seen broad use in recent years, and an extensive literature exists on their application. These techniques can and have been applied to a wide range of issues, including the valuation of cultural benefits (Pagiola 1996; Navrud and Ready 2002). In general, more direct measures are preferred to indirect ones. However, the choice of valuation technique in any given instance will be dictated by the characteristics of the case and by data availability.

Several techniques have been specifically developed to cater to the characteristics of particular problems. The travel cost method, for example, was developed to measure the utility derived by visitors to sites such as protected areas. The change in productivity approach, on the other hand, is quite broadly applicable to a wide range of issues. Contingent valuation is potentially applicable to any issue, simply by phrasing the questions appropriately, and as such has become widely used—probably excessively so, as it is easy to misapply and, being based on hypothetical behavior, is inherently less reliable. Data availability is a frequent constraint and often restricts the choice of approach. Hedonic price techniques, for instance, require vast amounts of data, thus limiting their applicability.

Putting Economic Valuation into Practice

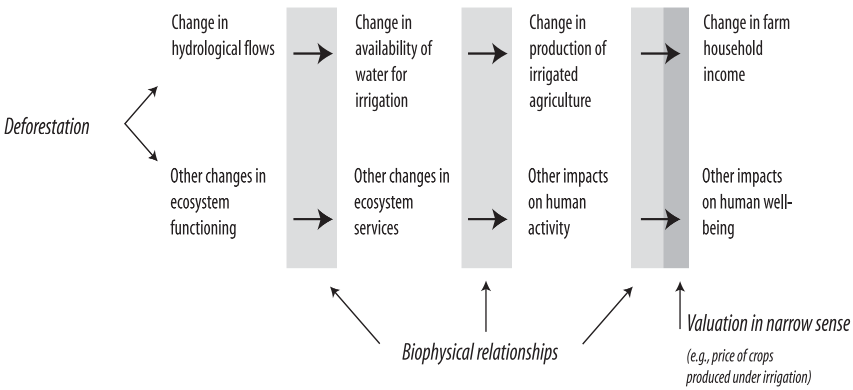
Whichever method is used for valuing a service, the analysis must begin by framing appropriately the question to be answered. In most policy-relevant cases, the concern is over changes in the level and mix of services provided by an ecosystem. At any given time, an ecosystem provides a specific "flow" of services, depending on the type of ecosystem, its condition (the "stock" of the resource), how it is managed, and its socioeconomic context. A change in management (whether negative, such as deforestation, or positive, such as an improvement in logging practices) will change the condition of the ecosystem and hence the flow of benefits it is capable of generating. It is rare for all ecosystem services to be lost entirely; a forested watershed that is logged and converted to agriculture, for example, may still provide a mix of provisioning, regulating, supporting, and cultural services, even though both the mix and the magnitude of specific services will have changed. Consequently, an assessment of the change in the value of services resulting from a given change in ecosystem management typically is most relevant to decision-makers and policy-makers. Where the change does involve the complete elimination of ecosystem services, such as the conversion of an ecosystem through urban expansion or road-building, then the change in value would equal the total economic value of the services provided by the ecosystem. (Measurements of total economic value of the services from a particular ecosystem can also be useful to policy-makers as an economic indicator, just as measures of gross national product or genuine savings provide policy-relevant information on the state of the economy.)

An assessment of the change in value of ecosystem services can be achieved either by explicitly estimating the change in value or by separately estimating the value of ecosystem services under the current and the alternative management regime and then comparing them. If the loss of a given service is irreversible, then the loss of the option value of that service will also be included. (An important caveat here is that the appropriate comparison is between the ecosystem with and without the management change; this is not the same as a comparison of the ecosystem before and after the management change, as many other factors will usually also have changed.) The typical question being asked, then, is whether the total value of the mix of services provided by an ecosystem managed in one way is greater or smaller then the total value of the mix provided by that ecosystem managed in another way.

The actual change in the value of the benefits can be expressed either as a change in the value of the annual flow of benefits, if these flows are relatively constant, or as a change in the present value of all future flows. The latter is equivalent to the change in the capital value of the ecosystem and is particularly useful when future flows are likely to vary substantially over time. (It is important to bear in mind that the capital value of the ecosystem is not separate and additional to the value of the flows of benefits it generates; rather, the two are intimately linked in that the capital value is the present value of all future flows of benefits.)

Estimating the change in the value of the flow of benefits provided by an ecosystem begins by estimating the change in the physical flow of benefits. This is illustrated in Figure 6.2 for a hypothetical case of deforestation that affects the water services provided by a forest ecosystem.

FIGURE 6.2 Valuing the Impact of Ecosystem Change



Source: Adapted from Pagiola et al. in press.

The bulk of the work involved in the exercise actually concerns quantifying the biophysical relationships. In many cases, this requires tracing through and quantifying a chain of causality. Thus, valuing the change in production of irrigated agriculture resulting from deforestation requires estimating the impact of deforestation on hydrological flows, determining how changes in water flows affect the availability of water to irrigation, and then estimating how changes in water availability affects agricultural production. Only at the end of this chain does valuation in the strict sense occur—when putting a value on the change in agricultural production, which in this instance is likely to be quite simple, as it is based on observed prices of crops and agricultural inputs. The change in value resulting from deforestation then requires summing across all the impacts.

Clearly, following through a chain like this requires close collaboration between experts in different disciplines—in this example, between foresters, hydrologists, water engineers, and agronomists as well as economists. It is a common problem in valuation that information is only available on some of the links in the chain, and often in incompatible units. The MA can make a major contribution by helping the various disciplines involved to become more aware of what is needed to ensure that their work can be combined with that of others to allow a full analysis of such problems.

In bringing the various strands of the analysis together, there are many possible pitfalls to be wary of. Inevitably, some types of value will prove impossible to estimate using any of the available techniques, either because of lack of data or because of the difficulty of extracting the desired information from them. To this extent, estimates of value will be underestimates. Conversely, there is an opposite danger that benefits (even if accurately measured) might be double-counted.

As needed, the analysis can be carried out either from the perspective of society as a whole ("social" analysis) or from that of individual groups within society ("private" analysis). Focusing on a particular group usually requires focusing on a subset of the benefits provided by an ecosystem, as that group may receive some benefits but not others. (Groups located within an ecosystem, for example, typically receive most of the direct use benefits but few of the indirect use benefits, whereas the opposite applies to downstream users.) It will often also require using estimates of value specific to that group; the value of additional water, for example, will be different depending on whether it is used for human consumption or for irrigation. The analysis can thus allow distributional impacts and equity considerations to be taken into account, as well as overall welfare impacts on society as a whole. This type of disaggregation is also useful in understanding the incentives that particular groups face in making their ecosystem management decisions. Many ecosystems are mismanaged, from a social perspective, precisely because most groups that make decisions about management perceive only a subset of the benefits the ecosystem provides.

Similarly, estimating the impact of changes in management on future flows of benefits allows for intergenerational considerations to be taken into account. Here, too, the bulk of the work involved concerns predicting the change in future physical flows; the actual valuation in the narrow sense forms only a small part of the work. Predicting the value that future generations will place on a given service is obviously difficult. Technical, cultural, or other changes could result in the value currently placed on a service either increasing or decreasing. Often, the best that can be done is to simply assume that current values will remain unchanged. If trends suggest that a particular change in values will occur, that can be easily included in the analysis. Such predictions are notoriously unreliable, however.

Non-utilitarian Value

From the perspective of many ethical, religious, and cultural points of view, ecosystems are valued even if they do not contribute directly to human well-being. Some ecosystems may be vital to a people's identity as a distinct society or culture. Thus preserving the health of such ecosystems may be a necessary condition for measuring changes in the collective welfare of those societies and cultures. Further, to the extent that a society's or a culture's ecocentric philosophical and ethical views recognize the intrinsic value of nonhuman species and ecosystems, sociocultural value also reaches beyond human welfare considerations.

Sociocultural Values

For many people, ecosystems are closely associated with deeply held historical, national, ethical, religious, and spiritual values. A particular mountain, forest, or watershed may, for example, have been the site of an important event in their past, the home or shrine of a deity, the place of a moment of moral transformation, or the embodiment of national ideals. These are some of the kind of values that the MA recognizes as the cultural services of ecosystems. And to some extent they are captured by utilitarian methods of valuation. But to the extent that some ecosystems are essential to a peoples' very identity, they are not fully captured by such techniques.

These values fall between the utilitarian and intrinsic value paradigms. They might be elicited by using, for example, techniques of participatory assessment (Campell and Luckert 2002) or group valuation (Jacobs 1997; Wilson and Howarth 2002). This evolving set of techniques is founded on the assumption that the valuation of ecological goods and services should result from a process of open public deliberation, not from the aggregation of separately measured individual preferences. Using this approach, small groups of citizens are brought together in a moderated forum to deliberate about the economic value of ecosystem goods or services (Wilson and Howarth 2002). The end result is a deliberative or "group" contingent valuation (CV) process (Jacobs 1997; Sagoff 1998). With a group CV, the explicit goal is to derive an economic value for the ecological good or service in question. The valuation exercise is conducted in a manner very similar to a conventional CV survey—using hypothetical scenarios and payment vehicles—with the key difference being that value elicitation is not done through private questioning but through group discussion and consensus building.

The Intrinsic Value Paradigm

Although the notion that nature has intrinsic value is a familiar one in many religions and cultures, it is unfamiliar in the context of modern rational choice theory and economic valuation. Yet analysts do have a well-established and familiar metric for assessing the intrinsic value of human beings and their various aspects. This valuation method and its metric may then be extended to some nonhuman natural entities, including ecosystems.

The notion that ecosystems have intrinsic value is based on a variety of points of view. Intrinsic value is a basic and general concept that is founded upon many and diverse cultural and religious worldviews. Among these are indigenous North and South American, African, and Australian cultural worldviews, as well as the major religious traditions of Europe, the Middle East, and Asia.

In the Judeo-Christian-Islamic tradition of religions, human beings are alleged to be created in the image of God. On that basis, humans are attributed intrinsic value. The Bible also represents God as having created plant and animal species, and declares the things thus created to be "good." Some commentators have argued that in doing so, God attributes intrinsic value to them, and thus that plant and animal species and the other aspects of nature that God also declared to be good have intrinsic value by an act of divine fiat (Barr 1972; Zaidi 1981; Ehrenfeld and Bently 1985).

In some American Indian cultural worldviews, animals, plants, and other aspects of nature are conceived as relatives, born of one universal Mother Earth and Father Sky (Hughes 1983). Thus they have the same value as human relatives: intrinsic value—if not in name, then at least in pragmatic effect. You may not sell your mother at any price; even performing a hypothetical economic valuation of your mother is questionable. And so, some American Indian elders have argued, neither should humans sell Mother Earth—that is, their tribal lands—or even compromise the intrinsic value of Earth by carrying out an economic valuation of tribal lands (Gill 1987).

Examples of other religious worldviews supporting the concept of intrinsic value in nature abound. Basic to Hindu religious belief is the essential oneness of all being, Brahman, which lies at the core of all natural things. The presence of Brahman in all natural things is the Hindu basis of intrinsic value (Deutch 1970). Closely related to this idea is the moral imperative of *ahimsa,* non-injury, extended to all living beings. The concept of *ahimsa* is also central to the Jain environmental ethic (Chapple 1986). Buddhism incorporates *ahimsa* as a central moral imperative as well (Chapple 1986). Also central to Buddhism is the overcoming of suffering by the cessation of desire. Absent desire, the natural world ceases to be referenced to a person as a pool of resources existing to satisfy desires or preferences (Kalupahana 1985). The enlightened Buddhist is thus able to appreciate the intrinsic value of nature.

Taoism, a major philosophical and religious tradition of China, posits the *Tao* or Way of nature as a norm of human action (Tu 1985). Taoism regards human economies as a subset of the economy of nature. In the Japanese Shinto religious tradition, the *kami* (gods), are closely associated with various aspects of nature (Odin 1991). As the *kami* have a greater-than-human dignity, the aspects of nature with which they are associated are also thought to have intrinsic value. In the Dreamtime narratives of the peoples indigenous to Australia, various features of the landscape are the places where the totemic Ancestors performed "terraforming" deeds (Stanner 1979). Such places are sacred and, in effect, have intrinsic value.

These are but a few of the bases for intrinsic value in non-western religious and cultural worldviews (for a comprehensive summary, see Callicott 1994). It is important for decision-makers to assess empirically the actual ecosystem-oriented values—intrinsic, sociocultural, and ecological, as well as utilitarian—of those affected by ecosystem-oriented policy and decisions.

The two main traditions of modern secular ethics in western culture are utilitarianism and Kantianism. In classical utilitarianism, aggregate "happiness," understood as a greater balance of pleasure over pain, was the putative goal of social policy. Contemporary economics is derived from utilitarianism and posits "preference satisfaction" as the goal of rational choice (Sen 1987). If aggregate preference satisfaction is, correspondingly, the goal of social policy, this may sometimes be maximized at the cost of overriding the interests of a comparatively few individuals (Rawls 1971). The potential injustices of unbridled utilitarianism are checked by the assertion of individual rights—most basically to life, liberty, and property.

Economic valuation of ecosystem services has been variously criticized by different commentators (e.g., Bromley 1990; Costanza 2000; Heal 2000a; Heal 2000b; Ludwig 2000; Pritchard et al. 2000). Further, reducing all values to preferences has been contested (Sagoff 1988). A person may prefer chocolate to vanilla ice cream, but some find it demeaning to the intrinsic value of human life and human liberty to say that as a society humans collectively prefer not to stage gladiator shows or own slaves or that, as an individual, a person merely prefers honesty over perfidy or justice over treachery.

The counter-utilitarian idea that there is a difference between preferences and values and that considerations of individual rights tempers calculations of aggregate utility was most clearly and powerfully expressed by Kant, who wrote, "Everything has either a *price* or a *dignity*. Whatever has a price can be replaced by something else as its equivalent; on the other hand, whatever is above all price, and therefore admits of no equivalent, has a dignity. But that which constitutes the condition under which alone something can be an end in itself does not have mere relative worth, i.e., a price, but an intrinsic worth, i.e., a dignity" (Kant 1959 [1785]:53, italics in original).

Because human rights, based on the dignity and intrinsic value of human beings, has traditionally been used to check the excesses and potential injustices of calculations of aggregate utility, many non-anthropocentric ethical theorists have largely adopted the intrinsic value paradigm. They first extended it to cover various nonhuman animals (Regan 1983). Some have attempted to push this line of argument further, to argue that all organisms have interests, goods of their own, natural goals, developments, and fulfillments and so should be accorded intrinsic value (Taylor 1986). Based on the seminal work of Aldo Leopold (1949), others have argued that transorganismic levels of biological organization (species, biotic communities, ecosystems) also have intrinsic value (Callicott 1989; Rolston III 1994). On whatever basis, intrinsic value has been attributed to various aspects of nature (genes, organisms, populations, species, evolutionarily significant units, biotic communities, ecosystems) and to nature as a whole (the biosphere).

The basis on which intrinsic value is attributed to various entities may limit which ones can have intrinsic value. For example, if being rational is the property required for something to have intrinsic value, then only rational beings (effectively, only human beings) are recognized to be intrinsically valuable. Non-anthropocentric theorists who have posited the criterion of "having interests" for ascribing intrinsic value thus limit it to individual organisms. In traditional Judeo-Christian thinking, those who thought that intrinsic value should be based on the property of being created in the image of God also effectively limit intrinsic value to human beings. In the Dreamtime worldview of the peoples indigenous to Australia, although landscape-level features have intrinsic value, individual plants and animals usually do not (except those associated with a person's own totem). Aldo Leopold (1949) thought that the things deserving of human "love and respect" had intrinsic value. Theoretically someone can love and respect anything at all, but Leopold argued that among other things, "biotic communities" commended themselves to human capacity for love and respect.

The Interactions of Political and Market Metrics

Parallel to using the market or its surrogates to measure economic value, in democratic societies the modern social domain for the ascription of intrinsic value is the parliament or legislature (Sagoff 1988). In other societies a sovereign power ascribes intrinsic value, although this may less accurately reflect the actual values of citizens than parliamentary or legislative acts and regulations do. The metric for assessing intrinsic value is the severity of the social and legal consequences for violating laws prohibiting a market in or otherwise compromising that which is recognized to be intrinsically valuable. In western societies long influenced by the Judeo-Christian worldview and Kantian moral philosophy, the highest intrinsic value is attributed to human life. Thus the severest of consequences are prescribed for murdering human beings.

Each kind of value—utilitarian, ecological, sociocultural, and intrinsic—is played out on a common and not always level playing field. Thus the various kinds of value intersect and interact in various ways. One common effect of socially recognizing and legally institutionalizing something's intrinsic value is to take it off the open market, to insist that it has a dignity and therefore should have no price. The clearest and most obvious example is human beings themselves. In most modern societies, there is no legal market in human beings; there is no open slave market. With the advent of human organ transplants, some societies have decided that there should be no legal market in human organs either; these are, by implication, thus accorded intrinsic value.

A black market often emerges in entities that are sufficiently well recognized as having a dignity to register a signal in the political intrinsic value metric. Depending on the strength of that signal—for instance, the social and legal consequences of pricing and trafficking in that entity—the supply of such entities declines and the price rises. So one effect of the political intrinsic value metric on the market metric is analogous to the effect of an excise tax or tariff.

Some things may arguably have both a dignity and a price—human labor, for example. Society may protect the recognized intrinsic value of things that also have utility by assuring, among other things, that their price is right. This may be the ethical rationale for minimum-wage laws, legally mandated health insurance, and retirement benefits in societies that have provided such protections by law. Society may also constrain the use of human labor with regulations designed to protect workers' health and safety.

Laws and regulations recognizing the intrinsic value of such things as endangered species, biodiversity more generally, and ecosystems such as wetlands have created a regulatory environment to which market forces are beginning to respond. A legal market in conservation "credits" is emerging. The red-cockaded woodpecker, for example, is a "listed" species protected by the U.S. Endangered Species Act (ESA), administered by the U.S. Fish and Wildlife Service (FWS). An agreement between International Paper (IP) and the FWS permits the company to consolidate at one location the breeding pairs of red-cockaded woodpeckers on its properties in several southeastern states and intensively manage that location as habitat for the endangered species. The agreement permits IP to harvest timber on the vacated sites and to sell credits to other owners of red-cockaded woodpecker habitat as the species recovers and the number of breeding pairs increases beyond a specified threshold (U.S. Fish and Wildlife Service 1999). Similarly, a company wishing to convert a wetland to a shopping mall faces regulatory constraints prohibiting wetland destruction. It can comply with those constraints by purchasing a credit from a distant landowner whose property contains a comparable wetland that will be protected (Fernandez 1999). This provides a market incentive to wetlands owners to conserve them.

Another effect of the political intrinsic value metric on the market metric is to shift the burden of proof away from those who would protect something with socially recognized and legally sanctioned intrinsic value and toward those who would commercially exploit it. The debate about human embryonic stem-cell research in the United States is a case in point. As aspects of human being, human embryonic stem cells are alleged to have a dignity and therefore should not be commercially exploited by the pharmaceutical industry, some have argued (with ambiguous political success). To overcome this argument, the pharmaceutical industry and its scientific allies must successfully counterargue that the aggregate utility of human embryonic stem-cell research is so great as to warrant overriding the putative dignity of this aspect of human being (Orkin and Morrison 2002).

Just because something has publicly recognized intrinsic value does not mean that its value is absolute or inviolable. Even human beings can be "converted" in deference to other values. Soldiers, for example, are often placed in harm's way to advance a country's perceived national interests or even aggregate economic welfare. In such cases, the intrinsic value of human beings seems sacrificed in favor of other values. But when intrinsic values are in zero-sum conflict with utilitarian values, the burden of proof rests with those advocating the latter.

Perhaps the most interesting and relevant case in point of legislative ascription of intrinsic value to some aspect of nature—and of the meeting of utilitarian and intrinsic value metrics—is the U.S. Endangered Species

Act enacted in 1973. In giving absolute legal protection to listed endangered species, the ESA, in effect, gave them a dignity comparable in strength to the dignity accorded individual human life. As noted, even the dignity of human life can be legally overridden, but the burden of proof falls on those who would do so. The ESA was amended in 1978 to create a Cabinet-level Endangered Species Committee empowered to decide whether opportunity cost (measured on the market metric) of protecting a listed species was high enough to warrant overriding its dignity (measured on the political metric).

This interaction between the political metric of intrinsic value and the market metric (and its surrogates) of utilitarian value has an analog in economic valuation called the safe minimum standard (SMS). Approaching the task of economically valuing ecosystem services by means of the SMS is practically equivalent to socially recognizing their intrinsic value and protecting them by law. Whereas benefit-cost analysis approaches each case and builds up a body of evidence about the benefits and costs of preservation, the SMS approach starts with a presumption that the maintenance of the healthy functioning of any ecosystem is a positive good (lumping together economic, ecological, sociocultural, and intrinsic values). The empirical economic question is, How high are the opportunity costs of satisfying the SMS? The SMS decision rule is to maintain the ecosystem unless the opportunity costs of doing so are intolerably high. The burden of proof is thus assigned to the case against maintaining the SMS (Randall 1998).

The quantitative threshold to which the opportunity costs must rise to warrant violating the SMS is left as an open empirical question. In practice, such thresholds are set by the political metric. The economic threshold for violating the SMS for ecosystem health will depend in part on how successful its advocates are in persuading voters that ecosystems have a dignity—not necessarily instead of, but as well as a price—and should be protected unless the opportunity costs of doing so are intolerably high. The question of how high is high enough will be indicated in part by the strength of laws and regulations enacted to protect ecosystems. In this case, however, the intrinsic value (assessed on the political metric) is augmented by the considerable utilitarian value of ecosystem services; their psycho-spiritual utilitarian values; their option, bequest, and existence utilitarian values; and their ecological and sociocultural values.

Conclusion

Human societies face important choices in how they manage ecosystems, affecting their conditions and the services they provide and thus ultimately human well-being. How decisions are made will depend on the systems of value endorsed in each society, the conceptual tools and methods at their disposal, and the information available. Making the appropriate choices requires, among other things, reliable information on actual conditions and trends of ecosystems and on the economic, political, social, and cultural consequences of alternative courses of action.

The MA will provide decision-makers with relevant information to aid them in making appropriate ecosystem management decisions. The impact that these decisions will have on human well-being is of particular interest. In some cases, these impacts can be assessed with indicators, such as the impact on human health. When there are multiple impacts and well-being is affected in many different ways, however, such unidimensional indicators will not be sufficient. In these cases, economic valuation will provide an important tool, as it will allow for different impacts to be compared and aggregated.

Of course, the importance of ecosystems goes beyond their role for human well-being. Non-utilitarian sources of value must also be taken into consideration in order to make appropriate management decisions.