The Economic Value of Open Space: A Review and Synthesis

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ABSTRACT / Communities increasingly face development pressures that can irreversibly alter open space lands. While the monetary costs and benefits of development are typically known, the corresponding values of natural lands are complex and difficult to measure. This paper reviews different concepts of economic value in relation to open space, describes methods for quantifying these values, and presents examples of each from published literature. Open space benefits accruing to citizens as market values or consumers' surplus include market and enhancement values, production values, natural systems value, use and nonuse values, and various intangible values. Economic impacts that open space lands have on local communities and economies include fiscal impacts on municipal budgets, expenditures from open space-related activities, and impacts from employment and tax revenues. These values are not universally present within a given community, nor are they quantitatively additive. However, a comprehensive consideration of the multiple values of open space will better inform community decisions about land conservation and development.

Governments have long recognized the need to preserve certain natural areas because they provide important public goods and services, or because they possess rare geologic or biological features. Such efforts are likely to continue and expand for several reasons. For example, urban growth dominated by unbounded, low-density development on the metropolitan fringe will increasingly erode the availability of accessible open space and sensitive environmental areas (Downs 1994, US Congress 1995). As open space within metropolitan regions decreases, its value and efforts to preserve that value will increase.

Global economic change and the telecommunications revolution will also impact open space protection efforts by making it increasingly possible for high-income households to live in rural and semirural areas, subjecting nonurban areas to urbanlike influences. While the amount of land developed as a result of such changes may be small, the resulting land use and socioeconomic impacts on specific communities may be significant. For example, land fragmentation or political pressure may make traditional land uses such as forestry, farming, or ranching uneconomical or infeasible. Over the next few decades, significant agricultural and forest areas in the United States will be particularly susceptible to fragmentation and development pressure since many rural landowners are over 55 years of age and face increased taxes on rising land values, and estate tax pressures (Small 1996).

Finally, the concept of ecosystem management is being advanced as an approach to better land use and the protection of endangered species, as well as the reconciliation of economic, social, and ecological objectives (Wheeler 1996). Implementation of this approach will require the coordinated management of large, contiguous blocks or networks of open space.

Open space preservation decisions will increasingly be made at the local level due to the general trend of devolution of governmental responsibility (with accompanying fiscal responsibility) and the development of local institutional capacity to carry out conservation projects. Nationwide, there are now more than 1100 private land trusts that have preserving open space as their primary mission (Hocker 1996). Increasingly, these land trusts are developing the capacity and expertise needed to protect and manage open space, supplementing services provided by state and local governments.

Since local governments operate within an increasingly tight fiscal environment and are heavily dependent on property taxes for operating revenue, the fiscal and economic implications of open space preservation

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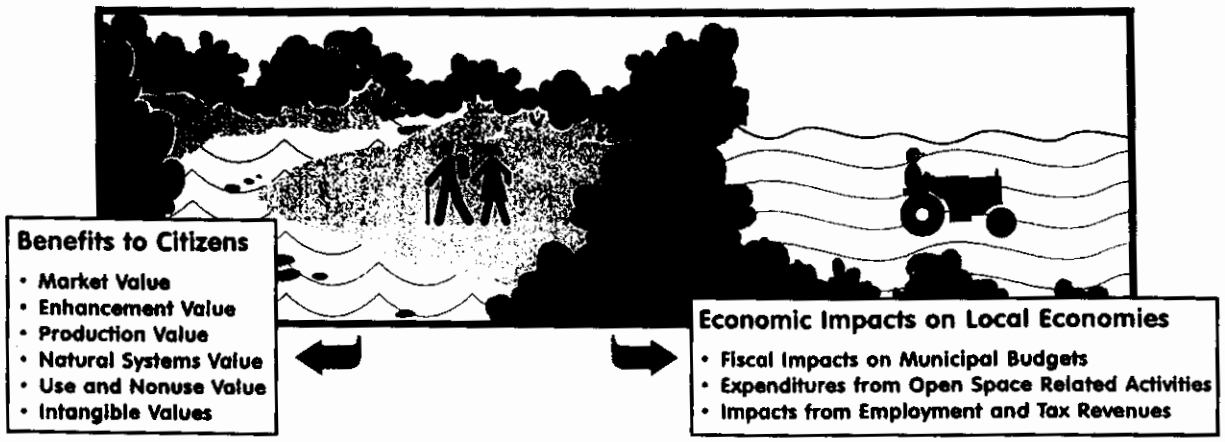

Figure 1. Open space values accruing to citizens and local economies.

decisions are paramount. Conservationists are increasingly called upon to demonstrate the economic value to the community of open space preservation. While much has been written about the economic value of the environment in general and of open space in particular (see, for example, Propst and Schmid 1993), the literature is segregated by discipline or methodology, limiting its utility in comprehensively assessing the economic value of open space. It is even more difficult to apply what is known in a public policy context.

This paper establishes an economic framework to guide open space protection efforts by reviewing and synthesizing published research findings on the various ways to conceptualize and measure the economic value of open space. Discussion includes the intangible values of open space that cannot be expressed in monetary terms. For our analysis, we broadly define open space to include undeveloped land that retains most of its natural characteristics. Within this definition we include forest, grazing and agricultural lands, and recreational areas such as parks.

A Framework for Analysis

Estimating the economic value of open space presents many challenges. First, open space typically provides several functions simultaneously. For example, the same wetland that buffers the impact of peak storm flows may also provide important habitat for wildlife and enhance the property values of adjacent homes and neighborhoods. Moreover, different types of value are measured by different methodologies and expressed in different units. Converting to a standard unit such as dollars involves subjective judgments and is not always possible. In addition, many open space values are not additive, and "double counting" is an ever-present problem. Finally, some would argue that it is morally wrong to try to value something that by definition is invaluable. At a minimum, open space will always possess intangible values in addition to any monetary values that may be estimated.

Figure 1 presents a framework that separates direct open space values accruing to citizens from indirect values impacting local communities and economies. In general, direct open space benefits to citizens are measured as market values, or, in the case of nonmarketed goods and services, consumers' surplus. In contrast, indirect open space values such as expenditures and jobs have a broader, less obvious impact that is often overlooked. Within this framework, there are a number of approaches to measuring or conceptualizing these values. Below we describe these approaches and provide examples of each from the published literature.

Direct Benefits to Citizens

Market Value

The most direct measure of the economic value of open space is its real estate market value—the cash price that an informed and willing buyer pays an informed and willing seller in an open and competitive market. In rural areas where the highest and best use of land is as open space, this is easily determined by examining market transactions. In urban or urbanizing regions, however, where highest and best use is typically development, the open space value of land must be separated from its development value. Such a separation is in fact required when land is placed under a conservation easement, which is a recorded land-use agreement, generally granted in perpetuity, in which the property owner conveys to a governmental unit or charitable organization certain rights (such as the right to develop) to be enforced for the public benefit (Land

Trust Alliance and National Trust for Historic Preservation 1990).

Determining the market value of land preserved as open space under a conservation easement is difficult since such easements are a relatively recent protection tool, and there are likely to be few if any comparable sales. Moreover, individual land parcels and the terms of the easements themselves are infinitely variable. For example, in Concord, Massachusetts, a suburban Boston community with a relatively high number of conservation easements (54 of 6000 properties), the effect of a conservation easement on market value ranged from a 5%–100% reduction in value (Closser 1994).

As more open space lands are preserved, important policy questions arise over the land's value. For example, Adams and Mundy (1991) suggest that as a significant market in high-amenity natural land emerges (i.e., there are more comparable sales of land preserved for open space), it will be possible to apply the standard concept of highest and best use (i.e., the use that yields the highest return to the landowner) in appraising the value of the property. In fact, the open space value may well be the highest and best economic use value.

Similarly, Vicary (1994) suggests that as conservation easements become more prevalent, the preferred method for appraising their value should shift from the traditional before-and-after method (i.e., value of easement equals the market value of property before easement is applied minus the market value after) to the direct comparison of sales of comparable easements. Instead of valuing the easement from the perspective of a developer, this approach adopts the perspective of a conservation organization or government agency—institutions that comprise the market for conservation easements. While such an approach would capture more of the open space values discussed elsewhere in this paper, it may also make open space preservation more expensive (Roddewig and Papke 1993).

Whether the market value of open space is limited to its highest and best economic use is being questioned by some (Fay and others 1996). The Appraisal Institute's response is that if an appraisal is to estimate market value, then the highest and best use of the property must be an *economic* use (Hanson 1996). The Institute has also stated that preservation and conservation are *not* economic uses, and transactions involving purchasers whose intent is to protect privately-owned natural lands are not reliable indicators of market value.

Enhancement Value

The existence of open space may affect the value of adjacent lands. In 1919 the landscape architect Frederick Law Olmstead, Jr. said:

> *. . . it has been fully established that a well-located school and play-ground, or even a site for the same, . . . adds to the value of all the remaining land in the territory to be served by the school more than the value of the land withdrawn for the purpose, just as a local park . . . adds more to the value of the remaining land in the residential area which it serves than the value of the land withdrawn to create it* (as cited in Weiss 1987).

Evidence of such "enhancement value" is commonly found in real estate advertisements that feature proximity to open space amenities. It is also explicitly recognized by federal income tax law. US Treasury regulation Sec. 14(h)(3)(I) requires that the value of a conservation easement be offset by any resulting increase in the value of other property owned by the donor of the easement or a relative. Section 14(h)(4) cites as an example a landowner who owns ten one-acre lots and donates an easement over eight of them: "By perpetually restricting development on this portion of the land, [the landowner] has ensured that the two remaining acres will always be bordered by parkland, thus increasing their fair market value . . ." (Small 1990).

Empirical studies have sought to measure the enhancement value of various types of open space such as neighborhood and large urban parks, greenbelts, waterbodies and wetlands. Some examples are given below.

- An early study of a 4 ha (10-acre) neighborhood park in Lubbock, Texas, found that within a 2½ block area around the park, land values declined with distance from the park (Kitchen and Hendon 1967). The study did not find a significant correlation between distance from the park and property (i.e., house and land) sales prices, perhaps, as the authors suggest, because only the land values were sufficiently homogeneous for the correlations to be significant.
- A study of five parks in Columbus, Ohio, found a 7%–23% increase in property value for properties that faced open space (Weicher and Zeibst 1973). Between 1965 and 1969, properties facing a park sold for $1130 more than similar properties one block away. Moreover, properties backing onto a park sold for about the same, and those facing intensively used recreational facilities sold for about $1150 less.
- A 1974 study of land values surrounding 524-ha (1294-acre) Pennypack Park in northeast Philadelphia, Pennsylvania, found a statistically significant rise in land value with proximity to the park, when controlling for other factors (Hammer and others 1974). The park accounted for 33% of the land value at 12 m (40 ft), 9% at 305 m (1000 ft), and 4% at 762 m (2500 ft). The authors concluded that each

hectare of parkland generated $6425/ha in enhancement value.

- Correll and others (1978) found that in Boulder, Colorado, the existence of greenbelts (i.e., trails or stream corridors) had a significant impact on adjacent residential property values. While controlling for other variables, they found that properties adjacent to greenbelts in the three neighborhoods studied were worth an average of 32% more than those 975 walking-meters away (3200 ft). The relationship was linear: a $13.75 decrease in the price of residential property for each meter away from the greenbelt ($4.20/ft). In one of the neighborhoods the aggregate property value was approximately $5.4 million greater than it would have been without the greenbelt, resulting in significant additional property tax revenues.
- Nelson (1985) examined how greenbelts influence regional land values in urban, greenbelt, and exurban areas. He found empirical evidence in the literature that greenbelts increase the value of urban land in proximity and theorized that this effect also extends to the exurban land market where people will locate and commute through the greenbelt to jobs in urban areas. Within the greenbelt itself, land values are reduced where the greenbelt is created by large-lot zoning, as opposed to the purchase of development rights or conservancy zoning, and also reduced along the urban fringe as restrictions on agricultural practices reduce farm value.
- Parsons (1992) found that land use restrictions in Maryland designed to protect Chesapeake Bay caused a considerable increase in housing prices. This ranged from 14% to 27% for houses 305 m (1000 ft) inland from the bay and major tributaries, to between 4% and 11% for houses up to 4.8 km (3 miles) away. Unfortunately, his analysis was not able to distinguish enhancement value from price increases due to limited availability of land for development.
- Thibodeau and Ostro (1981) utilized two methods to estimate the enhancement value of 3454 ha (8535 ac) of wetlands in the Massachusetts Charles River Basin. A multivariate regression analysis found that properties abutting the basin's wetlands were worth $400 more than nonabutting properties and that each hectare of wetland added $371/ha ($150/ac) in value to adjacent properties. A survey of 15 appraisers and realtors yielded the estimate that each hectare of wetlands contributes $1186/ha ($480/ac) to the value of abutting parcels.
- Lacy (1990) analyzed property value appreciation rates (as measured by resales over time) for open space or cluster subdivisions in Concord and Amherst, Massachusetts. In Concord, properties in an open space subdivision appreciated 167.9% between 1980 and 1988, compared to 146.8% for the town as a whole. In Amherst, houses in an open space subdivision appreciated 462% between 1968 and 1989, while houses of similar size and price in a conventional subdivision appreciated 410% during the same period.

At least one study suggests that the effect of open space on neighborhood property values depends on how well the open space is integrated into the neighborhood (Correll and others 1978). Open space had a greater positive effect on property values in the neighborhood where it was purchased prior to house construction and included in the neighborhood design than it did where it was purchased after construction and separated from the neighborhood by a major limited access highway.

The relationship between the market and enhancement values of open space depends upon land scarcity and the perceived risk of development. In rural areas where most land is open space and likely to remain so, both market and enhancement value will be low. However, in urban or urbanizing areas where open space is scarce or diminishing, market and enhancement value will be high. Finally, for open space advocates, enhancement value is important since it can at least partially offset reduced tax revenues from open space lands removed from the tax rolls or placed under special reduced-tax designations.

Production Value

Lands valued for open space are seldom idle, but rather are part of a working landscape vital to the production of goods and services valued and exchanged in markets. Often, the economic value resulting from these lands is direct and readily measured, as with produce from agricultural lands and wood products supplied by forests. The returns from production accrue directly to the landowner and are important in that these returns, in relation to alternative land uses like development, often determine current and future land use. Some examples are given below.

- Over 121 million ha (300 million ac) of agricultural lands are harvested each year in the United States, producing a combined value of over $170 billion (American Almanac 1993–1994). Although there has been a steady decline in the number of farms and acres under cultivation, the food and fiber sector of the economy produces 16% of the econo-

my's total value-added (American Almanac 1993–1994). In addition, agricultural exports generate a significant trade surplus, and accounted for 10% of the value of all US exports in 1991 (American Almanac 1993–1994).

- Nearly 1.4 million ha (3.5 million ac) of fruit and nut orchards provide open space in the United States (American Almanac 1993–1994). About half of this area is planted to major deciduous fruits such as apples, cherries, and plums, with citrus and nut orchards comprising much of the balance. Specialty crops such as cranberries, kiwis, and berries are grown on 67,583 ha (167,000 ac), and provide locally important open space. In fact, cranberry bogs in New England and the Great Lakes states provide both direct and indirect open space, since for every hectare of bog under cultivation, several hectares of undisturbed wildland are needed to provide clean water.
- Nearly one third of the United States, or roughly 300 million ha (730 million ac), is forested (Davis and Johnson 1987). Two thirds of this area is commercial, producing wood for commercial use. The wood products industry includes logging operations, sawmills, pulp and paper mills, and fuelwood producers. Secondary manufacturers produce furniture and fixtures, millwork, flooring, pallets, and panels. In 1991, these wood-based industries processed an estimated 225 million m^3 of lumber (40 billion board feet) (American Almanac 1993–1994). Nearly 60% of commercial forestland is privately held by farmers and other miscellaneous small owners, mostly located in the eastern United States (only 14% is controlled by forest industries, and 18% is located within national forests). While the area of forestland has increased 10% since 1952, the amount available for harvest has actually declined 5%.
- In addition to traditional extractive forest uses, a growing number of nonextractive "special forest products" are being harvested from forests. These products include food, herbs, medicinal products, decoratives, and specialty items such as aromatic oils (USDA Forest Service 1990).
- Pasture and rangelands cover 525 million acres in the United States and supply meat, diary products, and fiber (Georges 1996).

The production of some market-valued goods indirectly depends upon privately owned open space. In such cases, the economic returns to production may accrue to others besides the landowner. An important example is the role of privately owned wetlands in fish and shellfish production. Wagenaar Hummelinck (1984) estimates that roughly two thirds of the world's fish harvest is hatched in tidal areas.

The aggregate production value of open space wildlands within particular states and regions can be significant, and the New England states have been at the forefront of recognizing the important economic contribution open space lands make to their economies. For example: (1) The Northeastern Forest Alliance (1993) estimated that New England landowners received $300 million from timber harvests. (2) In Maine, total combined sales from farm products and fish were $700 million, with a processed export value of $1.1 billion (Benson 1994). (3) Maine's forest products industry generated $4.3 billion, 43.5% of the state's production (Irland 1994).

Natural Systems Value

Open space lands support natural ecosystem functions that provide direct and indirect benefits such as groundwater recharge, climate moderation, flood control and storm damage prevention, and air and water pollution abatement (Costanza and others 1997, de Groot 1994). While assigning a value to such benefits requires one to resolve difficult philosophical and empirical issues, it is apparent that the total value of ecosystem benefits is infinite since human life could not be sustained without them. See Daily (1997) for a recent and comprehensive assessment of the value of ecosystem services.

One way to estimate the value of ecosystem benefits is to calculate the monetary damages that would result if the benefits were not provided, or calculate the cost of public expenditures required to construct infrastructure to replace the functions of the natural systems. Several examples illustrate these concepts:

- Costanza and others (1997) conservatively estimate that the total value of the world's ecosystem services and natural capital ranges between $16 and $54 trillion/yr (all figures are US dollars), with an average of $33 trillion/yr. For comparison, global gross national product is estimated to be only $18 trillion/yr.
- The US Army Corps of Engineers, the Commonwealth of Massachusetts and local governments acquired 3440 ha (8500 ac) of wetlands in the Charles River Basin to serve as a natural valley storage area for floodwaters. The cost of acquiring the wetlands was $10 million, while the cost of the alternative approach—constructing dams and levees—was estimated to be $100 million (as cited in Kusler and Larson 1993).

- Thibodeau and Ostro (1981) found that each hectare of wetland in the Charles River Basin had a present value conservatively estimated at $82,457 for flood prevention ($4942/yr), $41,908 for pollution reduction, and $248,904 for water supply (present value at 6% in 1978 dollars).
- The Minnesota Department of Natural Resources has estimated that the cost of replacing the natural floodwater storage function of wetlands is $4288/$m^3$/ha ($300/ac-ft) of water (Floodplain Management Association 1994, as cited in Rivers and Trails Conservation Assistance 1995).
- de Groot (1994) estimated that the total value of Dutch Wadden Sea coastal wetlands for flood prevention, storage and recycling of human waste, aquatic nursery, aquaculture, recreation, food production, education and scientific uses exceeded $6200/ha/yr.
- Costanza and others (1989) estimated the storm protection value of coastal wetlands in Louisiana to be $4732/ha (present value at 8% in 1983 dollars).
- One third of the typical US city is covered by tree crowns. The American Forestry Association estimates that a 50-yr-old urban tree provides the following benefits (in 1985 dollars): $73/yr in air conditioning; $75/yr in stormwater and soil erosion control; $75/yr in wildlife shelter; and $50/yr in air pollution control (Ebenreck 1988).

Many of the values presented above are highly dependent upon the interest rate used to discount future environmental benefits. Present value calculations are well suited to capital equipment with a measurable life of 50 years or less. However, when applied to the benefits provided by natural systems (which continue indefinitely), positive discount rates should be used with caution. To the extent that the use of a discount rate cannot be avoided, however, a low rate should be utilized. de Groot (1994) has suggested a range of 1%–6%, depending on how long it takes for the ecosystem in question to reach its climax stage. He notes that a preferred approach would be to consider annual value as interest on the capital stock of natural systems. With such an approach there are no time limits to the benefits derived and therefore the present value of the capital is infinite.

Farber and Costanza (1987) have developed an alternative approach to measuring the value of natural systems that calculates the gross primary production (biomass) of the system and converts it to a fossil fuel equivalent. Using this method, they found that the present value of coastal wetlands in Louisiana ranged from $15,814/ha to $24,710/ha ($6400/ac to $10,000/ac) depending on the type of habitat. For comparison, a willingness-to-pay method (see below) for the same wetlands resulted in a total discounted value of $1458/ha ($590/ac) for commercial fishing and trapping, recreation and storm protection functions. The market value of the wetlands was $494/ha ($200/ac). The authors noted that the willingness to pay figure is probably low because it did not include all functions, while the energy analysis value is high because it includes wetland products that are not economically valued. Another reason why Farber and Costanza arrived at such large dollar values for wetlands using the energy analysis approach is that this approach is very different from the way markets and most humans value goods and services.

Use and Nonuse Values

Open space is often an important provider of public goods such as scenic vistas, solitude, wildlife, and the community character embodied in traditional working landscapes. Since public goods are nonexcludable (i.e., once they are produced, it is impossible or very costly to exclude anyone from use) and nonconsumptive (i.e. one person's enjoyment of the good does not diminish its availability for others), markets for public goods fail to develop, and, without the prospect of compensation, landowners have little if any incentive to provide such goods. The resulting underproduction of public goods by the private sector is the main reason for public ownership of wildlands (Loomis 1993).

The lack of a market for public goods also means that easily observed measures of value, such as those expressed through market prices, do not exist. As a result, economic values are typically estimated by determining the subjective value that people place on the resource or activities related to it.

The subjective value people place on open space-related recreational activities can be broken into two broad categories: "use value" and "nonuse value." Use value represents the value people place on a current use of the resource. Three types of use value are recognized (Bishop 1987): (1) consumptive uses, such as hunting and fishing; (2) nonconsumptive uses, such as hiking, camping, and wildlife photography; and (3) indirect uses, such as reading books or watching programs on open space-related resources or activities.

In contrast to use value, nonuse values consider an individual's possibility for future use, or their altruism. Two broad types of nonuse value are recognized: option value and existence value (Weisbrod 1964, Krutilla 1967). Option value represents an individual's willingness to pay to maintain the option of utilizing a resource at some time in the future. Existence value represents an individual's willingness to pay to ensure that some

resource exists. Part of the motivation for existence value may be the desire to bequeath the resource to future generations (Bishop 1987). Many economists agree that under certain situations (e.g., unique or significant resources without close substitutes, or a resource facing irreversible harm), nonuse values across society can be very large and, as a result, should be considered in decision making.

Use and nonuse values are extensively discussed in the economics literature, largely fueled by the increased importance society places on these activities. For example, Duda and Young (1994) estimated a 63% increase in participation in nonconsumptive, nonresidential wildlife viewing and diversity programs between 1980 and 1990. The President's Commission on Americans Outdoors (1987) found natural beauty was the single most important factor in deciding tourist destination. In addition, New England's governors have recognized open space as an important factor in the region's quality of life and tourism industry (New England Governors' Conference, Inc. 1988). Other examples include: (1) a USDA Forest Service (1995) report found that 13 million Americans canoe, 58 million fish, and 54 million camp—the fastest growing activities are hiking, backpacking, and primitive site camping; and (2) the National Fish and Wildlife Foundation (1994) estimated that in 1991 more than 24 million Americans took trips to watch wild birds. For comparison, 14 million Americans hunted, and 35 million Americans fished. Expenditures on nongame wildlife appreciation totaled more than $19 billion in 1991.

Considerable debate surrounds the precise definition of use and nonuse values and their estimation (Freeman 1993). The concepts of consumer surplus and willingness to pay (WTP) underlie most methods used to estimate socially meaningful values for nonmarket resources. Consumer surplus is the maximum dollar amount above the actual market price (if any) that a buyer would be willing to pay to enjoy a good or service. Summing consumer surplus across all users with the actual market price determines the total WTP (Samuelson 1973).

Estimating consumer surplus first requires the specification of a demand function for the resource or service. Economists typically use one of two methods to do this—either the contingent valuation or the travel cost method (CVM and TCM, respectively). In CVM, a hypothetical market is created through use of a questionnaire. Respondents are then asked what they would be willing to pay (or the amount they would need to be compensated) to use (or lose) the resource or activity. In TCM, the cost of travel to a site is viewed as an entry or admission price, and a demand function is derived based on visitation from various origins with different travel costs.

Numerous studies have reported economic values for nonmarketed goods and services using CVM and TCM. While the methodologies are widely debated (see, for example, Anonymous 1992, Stirling 1993), some comprehensive reviews of the literature have found consistency across estimates once studies are standardized to consider inflation and site and methodological differences (Smith 1993, Sorg and Loomis 1984). In fact, the National Oceanic and Atmospheric Administration (NOAA) commissioned a panel of experts to evaluate the use of CVM in determining nonuse values for the assessment of damages resulting from oil spills under the Oil Pollution Act of 1990 (33 USC 2701). The panel's comprehensive report, while recognizing that CVM often overestimates WTP, concluded that the method was suitable for estimating the value of nonmarket resource damage caused by oil spills and other toxic substances, and recommended standardized procedures and future areas of research (58 CFR 4601).

Many studies have sought to estimate WTP associated with various recreational activities:

- Using CVM, Sorg and others (1985) estimated that the gross value of a cold water fishing trip in Idaho was $80. This included $37 per trip in expenditures (e.g., transportation, food, lodging, tackle), plus $43 per trip in consumer surplus (i.e., the amount the typical angler would be willing to pay over and above actual expenditures).
- The net WTP in addition to actual expenditures for elk hunting in Idaho ranged from $52 to $100 per trip in 1982 and 1983 (Sorg and Nelson 1986).
- Walsh and Gilliam (1982) estimated WTP for recreationists in the Indian Peaks Wilderness Area of Colorado. Under noncongested conditions (i.e., 10 persons encountered per day) WTP for hikers and backpackers was $15.68/day and $20.81/day, respectively. Under congested conditions (i.e., 50 persons encountered per day) these values dropped to $8.72 and $11.27, respectively. The study showed that under conditions of excess demand, newly created wilderness areas would enhance values at existing sites by relieving congestion.
- Stevens (1990), using CVM, estimated that average WTP for maintaining populations of bald eagles, wild turkeys, and Atlantic salmon were $19, $12, and $8, respectively, for survey respondents. Respondents were roughly split between willing to pay $5 to either protect or control coyotes.
- Walsh and others (1984) estimated Colorado residents' consumer surplus under four scenarios of

wilderness designation in the state: 4856 km^2 (1.2 million ac); 10,522 km^2 (2.6 million ac); 20,234 km^2 (5 million ac); and 40,469 km^2 (10 million ac). The researchers divided total consumer surplus between the traditionally used recreation use and preservation value (this second category included option, existence, and bequest value). Under the largest wilderness designation scenario of 40,469 km^2, the total annual recreation use value across all households was estimated to be $58.2 million. The preservation value to Colorado residents was estimated to be an additional $35.0 million—for a total wilderness value of $93.2 million. Preservation value was evenly broken down between its three component values: option value ($10.2 million), existence value ($12.3 million), and bequest value ($12.5 million).

Intangible Values

Earlier sections focused only on open space values of interest to humans, and of those, only values that could be expressed in monetary terms. However, it is also important to note some of the intangible values of open space. Rolston (1988) presented an exhaustive list of such values, ranging from scientific and aesthetic value, to the value of preserving genetic diversity and our natural heritage.

Another way to think about the value of open space is to consider whether open space, or nature in general, has rights. Nash (1989) described how the concept of rights has developed through time to include an ever-expanding group of recipients, from various classes of humans, to animals, plants, ecosystems, the environment, the planet, and beyond. Each extension of rights, including those now widely accepted, was thought to be a radical idea when first proposed.

Legal scholars have also begun to address the topic. Stone (1974) introduced the idea that natural objects such as forests, oceans, and rivers should have legal standing in courts of law. More recently, Rose (1994) has suggested that a proper measure of restraint on our use of common property environmental resources could be achieved by thinking of such resources as a gift to be passed on to others rather than a resource to be used and controlled.

As Nash (1989) points out, appreciation for the intrinsic value of nature has been aided by advances in the science of ecology. An emerging (at least in Western culture) biocentric view, expressed best by Leopold's (1949) "land ethic," holds that human beings are part of their environment, rather than separate from it. Under this view, the entire biotic community is more important than any individual component, including humans.

An individual's appreciation of the intangible value of open space depends on where one's views lie along the continuum of thought that stretches from believing that nature is to be exploited and wisely used, to believing that nature has value independent of any utility to humans. Summed across society at large, the intangible value of open space will likely increase with continued advances in ethical thought and ecological knowledge.

Indirect Economic Impacts on Local Economies

Fiscal Impact Analysis

Since about 1970, there has been a growing awareness that local population growth and real estate development do not necessarily provide net fiscal benefits to local governments; in other words, providing infrastructure and other services to accommodate new development may cost more than the development generates in property tax and other revenues, especially in rapidly growing communities (Altshuler and others 1993, Ladd 1992, RKG Associates 1989). This, combined with decreased intergovernmental transfers of financial aid and increasing citizen resistance to taxes, has led local officials to scrutinize the fiscal consequences of land-use decisions.

The primary analytic tool available to policy makers for this purpose is fiscal impact analysis, where the direct, current, public costs and revenues associated with residential or nonresidential growth are projected to determine the net fiscal impact of development in the local jurisdiction(s) in which the growth is taking place (Ad Hoc Advocates 1990, Burchell and Listokin 1978, 1980, Burchell and others 1985, Freedgood and Wagner 1992, Tischler 1988). By examining only direct and current impacts, fiscal impact analyses rarely if ever measure spillover effects, such as when growth is displaced to a neighboring town, or long-term effects such as residential growth spawned by new commercial or industrial development.

Variously referred to as cost-revenue analysis or cost of community services analysis, fiscal impact analysis has been in use for 60 years. Burchell and Listokin (1992) trace the evolution of the technique from its use in analyzing the early public housing programs in the 1930s, to recent applications justifying the preservation of open space. These latter studies typically compare the net effects on municipal budgets of open space (including lands used for agriculture and forestry) to other forms of land use and are often performed by or with support from organizations that advocate open

space protection. Although typically used in larger communities on the metropolitan fringe that are experiencing growth pressures, the technique offers promise in assisting rural governments to develop responses to economic, social, and demographic change (Kelsey 1993).

Burchell and Listokin (1992) reviewed the general conclusions of such studies and summarized the results: (1) residential development typically incurs a net fiscal deficit; (2) nonresidential development generates a fiscal surplus, but attracts residential development; and (3) open space is fiscally preferred to residential development, and equal to or better than nonresidential development. Examples of findings include the following:

- The Northeastern Office of the American Farmland Trust, which has pioneered the cost of community services approach, studied six rural towns in Connecticut, Massachusetts and New York State and found that on average residential development required $1.13 in municipal services for every $1 of revenue generated. Open space lands required only $0.29 in services per dollar of revenue (Freedgood and Wagner 1992).
- The Commonwealth Research Group (1995) studied 11 southern New England towns using the American Farmland Trust methodology and found that on average, for every dollar of revenue raised, the towns spent $1.14 in services for the residential sector, $0.43 for the commercial/industrial sector, and $0.42 for open space.
- Tischler & Associates (1989) studied the projected fiscal impacts of seven non-site-specific land uses in Groton, Connecticut. The study found that a prototype open space tract of 40 acres, with 60% of the area devoted to passive recreation and 40% to active recreation, would incur an annual municipal deficit of $211,951/yr. These findings, which conflict with the two studies cited above, are likely due to the fact that the publicly owned parcel would generate no tax revenue and incur the costs of land acquisition, debt service over 20 years, development, and maintenance.

Drawing on their own extensive experience and reviewing the literature on fiscal impact analysis generally and its application to open space in particular, Burchell and Listokin (1992, 1995) have developed a hierarchy of land uses and fiscal impacts ranging from research office parks at the top (net fiscal surplus) to mobile homes at the bottom (net fiscal deficit). In this hierarchy, open space and undeveloped or unimproved land falls in the middle, just above the break even line for municipal budgets.

Fiscal impact analyses must be carefully evaluated since the choices of methodology and assumptions greatly influence the findings. It has been noted, for example, that "the results of most fiscal impact analyses conform with the policy inclinations of the governments or organizations that sponsored them" (Altshuler and others 1993). Burchell and Listokin (1992) also note that few fiscal impact analyses are tested for reliability by comparing actual costs and revenues after development with predevelopment projections. Finally, since specific circumstances vary considerably from community to community, generalizations should be made with caution.

Nevertheless, as its application spreads and methodologies improve, fiscal impact analysis is becoming an increasingly powerful planning tool for guiding land-use decisions at the community level. Its greatest benefit may be in prompting a reassessment of the conventional wisdom about the economic consequences of development and conservation. Fiscal impact analysis will not by itself answer the question of whether a particular parcel of land should be preserved as open space or developed. However, it can help frame the discussion and lead to more informed decisions by policy makers, conservationists, and the public.

Expenditures from Open Space-Related Activities

Activities directly or indirectly associated with open space may generate significant expenditures and provide an important source of revenue for businesses and state and local governments. For example, revenues from hunting and fishing license sales are a major source of funding for state wildlife agencies. The fish and wildlife populations these activities depend upon often rely at least in part on habitat provided by open space. Less direct but perhaps more important from an overall economic perspective are expenditures from open space-related activities such as hiking, hunting, fishing, bird watching, nature photography, snowmobiling, skiing, and mountain biking. Such expenditures include the purchase of equipment, travel costs, lodging and accommodations, guide services, meals, groceries, etc., as well as attendant service jobs. These expenditures also have income and job multiplier effects (see below), and often occur in rural areas with limited economic activity.

Many studies have estimated the economic impact of open space-related activities, yet few are found in the peer-reviewed literature. Typically, expenditure studies are conducted by tourism offices, industry trade groups, and increasingly, conservation groups seeking to in-

crease the recognition of the economic contribution of wildlands. Due to the potential for conflict of interest, these studies should be interpreted with caution. Nevertheless, the studies demonstrate that open space-related expenditures can make significant contributions to economic activity at all levels—local, state, national, and international. Some examples are given below.

- Tourism accounts for 7% of global trade in goods and services and generates $195 billion/yr in domestic and international receipts (Harms 1994). There were an estimated 370 million international tourists in 1987, up 20% from the previous year. Adventure tourism, including ecotourism, comprised 10% of the market in 1989 and was increasing at 30% per year.
- In 1991, almost 110 million Americans participated in wildlife-related activities and spent an estimated $59 billion. Anglers spent $24 billion, hunters spent $12 billion, and nonconsumptive participants spent $18 billion (US Department of the Interior 1993).
- In the United States, tens of millions of birders spend over $20 billion each year on seed, travel, and birding equipment. Active birders spend between $1500 and $3400/yr on birding, mostly for travel (Kerlinger 1993).
- The National Fish and Wildlife Foundation (1994) estimates that in 1991, expenditures on nongame wildlife appreciation totaled more than $19 billion in 1991.
- Kerlinger (1995) estimated that the direct expenditures by birders visiting eight selected national wildlife refuges in the United States ranged from $0.5 million to $14.4 million/refuge/yr. In another study, 53,000 birders visiting Pennsylvania's Hawk Mountain Sanctuary were estimated to contribute $2.4 million/yr to the local economy (Kerlinger and Brett 1995).
- McElvany (1995) estimated that snowmobilers in Vermont during the 1993–1994 season generated $165 million in revenues, including multiplier effects.
- The Northeastern Forest Alliance (1993) conservatively estimated that the forests of Maine, Vermont, New Hampshire, and New York generated over $7 billion in 1987 from forest-based tourism and recreation. State revenue from these activities totaled an estimated $204 million (includes state taxes on meals and lodging, but no property taxes).

Impacts from Employment and Tax Revenues

In addition to providing market-valued goods and services, open space lands support jobs and related income that are valuable to local, regional, and national economies: (1) Nearly 3 million people were employed on farms in 1992, not including indirect employment from expenditures and services. State and federal payments to farms totaled $8.2 billion in 1991 (American Almanac 1993–1994). (2) The food and fiber sectors of the economy directly or indirectly employ nearly 20% of all US workers (American Almanac 1993–1994). (3) In 1987, an estimated 74 million jobs were based on tourism worldwide (Harms 1994). (4) In 1987, the forests of New England supported the employment of 226,630 people with a combined payroll of $3.3 billion (Northeastern Forest Alliance 1993). (5) In Maine, natural resource-based industries supported 40% of goods-producing jobs, or 20% of all Maine employees (Benson 1994). (6) In 1992, US wood-based industries employed 1.7 million people (American Almanac 1993–1994).

Discussion

Communities increasingly face difficult choices regarding open space. Rural areas distant from urban centers may face significant development pressures, and many are realizing that existing open space may be lost without active intervention. At the same time, suburban communities on the metropolitan fringe are realizing that the loss of open space is not necessarily a consequence of growth. A growing array of new policy instruments and institutions such as conservation easements, private land trusts, and cluster subdivision regulations enable growing communities to exercise much greater control over development. Even center cities and inner suburbs are finding new opportunities for public open space through the redevelopment of former industrial "brownfields" and other vacant land.

In each case, a deeper understanding of the value of open space will better inform land-use decisions and help to dispel the conventional wisdom about the economic consequences of land development and conservation. What land should be preserved for open space and why? What level of public resources should be applied to the preservation effort? If we cannot protect all significant areas, then what are the priorities?

The different types of open space values described in this paper will help communities, decision makers, and planners answer these questions. The determination of values most relevant to the local situation and any attempts to describe or quantify those values more completely will clearly be community-specific.

As communities consider these issues, several important points should be considered. First, it is not possible to completely calculate the economic value of open

space, nor should it be. Certain intangible values lose significance when attempts are made to quantify them. In the long run, these intangible values may be the most significant. In addition, methods for determining and comparing value vary widely in level of sophistication and reliability. Some are based on long-established professional standards, while others continue to evolve. Given the inherent subjectivity of the term, any discussion of value must encompass a variety of disciplines, methodologies, and approaches.

The methods of determining open space value also have the potential of misuse if they are too narrowly construed. For example, it would be inappropriate to conclude from a fiscal impact analysis that open space should be used to block residential development because the open space alternative is fiscally preferred. Clearly, an area that is comprised entirely of open space is no more a successful community than one that is composed entirely of industrial, commercial, and high-end residential land uses. Open space should be preserved for its own intrinsic values, rather than for the purpose of precluding other land uses, particularly if the net effect is to displace development to other, even more inappropriate sites or communities.

Valuation methods are appropriate, however, to justify the preservation of significant open space values as development proceeds in a given area. In fact, as noted elsewhere in this paper, open space that is thoughtfully integrated into a community's land use mix creates an enhancement value that further complements the fiscal impact equation.

Open space valuation can have unintended consequences. For example, if a convincing case is made that the value of a particular parcel as a public good exceeds its value for alternative economic purposes, then the costs of preserving that parcel through acquisition may be increased, unless the owner is particularly conservation-minded or public-spirited (and many are). If that acquisition is then used as a benchmark ("comparable sale" in appraisal terms) for determining the fair market value of subsequent open space acquisitions, the effect will be multiplied, increasing the overall cost of conservation. This raises interesting questions of creating and capturing value that are beyond the scope of this paper. Similarly, emphasizing the value of open space-related activities such as tourism may have negative impacts on the destination community as perceived by the residents (Allen and others 1988, Pizam 1978).

Open space typically possesses many values simultaneously, some of which may be negative. Intensively utilized and poorly managed urban parks, agricultural practices such as pesticide spraying, and mosquito-breeding wetlands are examples of situations where open space may detract from the value of adjacent properties. Valuation exercises should account for both positive and negative values, as well as the net overall effect.

The value of open space also depends in part on its protection status. Permanently preserved open space is a nondepreciating asset with increasing benefits over time (Krutilla and Fisher 1975), whereas open space that is not permanently protected has value in preserving land-use options for future growth and development. In contrast, development is typically irreversible and can depreciate in value over time.

Finally, open space values are dynamic and must be considered comprehensively. For example, as open space is converted to developed uses within a region, production value (e.g., agriculture and forestry) may diminish while land development values rise, leading to increased pressure for additional development. At the same time, however, the wildlife and recreation value of remaining open spaces will likely increase. Hence, as the public value of open space increases, its value to the private landowner decreases relative to alternative uses. This dilemma is at the heart of the property rights debate and drives the development of innovative mechanisms such as habitat conservation plans which seek to reconcile public and private objectives.

Open space provides many types of value to landowners, private individuals, and society at large. Determining these values is important for raising public awareness, promoting the conservation of lands meriting protection, and allocating scarce resources. It is hoped that the synthesis of different concepts presented in this paper will broaden the understanding of the many values associated with open space, informing planners, conservationists, local officials and citizens as they make important decisions regarding these lands.

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