economics

A Synthesis of the Economic Values of Wilderness

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Early applications of wilderness economic research demonstrated that the values of natural amenities and commodities produced from natural areas could be measured in commensurate terms. To the surprise of many, the economic values of wilderness protection often exceeded the potential commercial values that might result from resource extraction. Here, the concepts and tools used in the economic analysis of wilderness are described, and the wilderness economic literature is reviewed with a focus on understanding trends in use, value, and economic impacts. Although our review suggests that each of these factors is trending upward, variations in research methods plus large gaps in the literature limit understanding of long-run trends. However, as new data on wilderness use, visitor origins, and spatially referenced features of landscapes are becoming increasingly available, more robust economic analysis of both onsite and offsite wilderness economic values and impacts is now becoming possible.

Keywords: recreation use value, passive use value, ecosystem services, economic impacts

The Wilderness Act (Public Law 88-577), creating the National Wilderness Preservation System (NWPS), was signed into law 50 years ago (1964). Section 2(c) of the Act provides the following definition:

> A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence…

Wilderness, as used in this synthesis, specifically refers to federal land that is designated as such by Congress. Other categories of land use, such as roadless areas or other open spaces, are not included in our use of the term wilderness throughout this article.

A review of the economic values of wilderness was recently published and provided useful background for this article (Bowker et al. 2014). Our synthesis differs from that review in that we examine the suite of historical wilderness economic studies for evidence of long-run societal trends in the use, valuation, and economic impacts of wilderness areas. In doing so, we emphasize that economic models can be used to assess a complementary set of hypotheses that may

reveal broad underlying trends in the evolving role of wilderness in American life. In particular, we are interested in describing how economic analysis can be used to address three fundamental questions:

- Has the public's willingness to pay for wilderness (both individually and in aggregate) changed during the past five decades?
- Have the characteristics of wilderness users shifted over time?
- Has the role that wilderness areas play in community development evolved?

During the 1960s, scholarly and pragmatic interest in wilderness preservation grew rapidly. In his classic treatise, *Wilderness and the American Mind*, Roderick Nash (1967) traced the evolution of American sentiment toward wilderness from a landscape-demanding transformation to a vanishing remnant of the pioneer environment that needed protection. Concepts of the value of wilderness protection were neatly summarized by the Outdoor Recreation Resources Review Commission (1962, p. 7) in three categories: recreational values, which arise from "deep personal revelations and experience of natural beauty," social values, including scientific study; and knowledge that wilderness exists. Subsequently, these value categories were formalized into economic

arguments for wilderness preservation by a team of economists at Resources for the Future, led by John Krutilla (Krutilla and Fisher 1975).

In developing an economic approach to wilderness preservation, Krutilla thought that it was necessary to quantify both the benefits of wilderness preservation and the costs in terms of foregone (or postponed) development of natural areas. In doing so, Krutilla (1967) recognized how the passage of time can influence the computation of the benefits and costs inherent in decisions of whether or not to preserve natural areas of national significance. In particular, he argued that (1) wilderness areas represent unique conditions that, once developed for productive purposes, are largely irreproducible, (2) the supply of natural environments cannot be enlarged but can only diminish, (3) individual and aggregate willingness to pay for direct association with undisturbed natural environments will increase over time due to increasing levels of income, education, and population and (4) over time, technological advancements will decrease the reliance of society on natural resources that may be extracted from pristine natural areas. The interaction of these supply and demand factors led him to predict that the value of wilderness protection, relative to the value of resources that might be extracted from such natural environments, would increase over time. Although this conceptual framework for wilderness preservation was then considered novel (Porter 1982) and was subsequently applied to the empirical analysis of a range of policy issues (Krutilla and Fisher 1975), the fundamental hypothesis that the value of wilderness protection will increase over time has not been rigorously evaluated.

In the next two sections, we describe what is meant by economic value and economic impact and explain why these two economic measures cannot be added together. Then we review the studies that have estimated wilderness economic values, including a relatively new approach that estimates the value of wilderness that is capitalized into nearby residential property values. This is followed by a summary of what is known about the impact of wilderness areas on jobs and income in gateway communities and regional economies. In the final section of the article, we present our conclusions and provide our thoughts on some key unanswered questions in wilderness economics.

Economic Concepts of Value

Wilderness areas are public goods, and the amenity values provided by the preservation of wilderness cannot be purchased in established markets. Consequently, the value of wilderness protection must be measured using nonmarket valuation methods. The conceptual basis for measuring economic values for public goods is found in the theory of welfare economics, and several theoretical measures that describe the economic value, benefits, or willingness to pay for environmental amenities have been developed (Flores 2003). It has been demonstrated that differences between these theoretical measures, when applied to empirical estimates of environmental value, are small and are generally less than the errors incurred by estimation (Willig 1976). Consequently, we use the terms *economic value*, *economic benefits*, and *willingness to pay* synonymously in this article.

An essential concept used to describe the economic value of onsite wilderness activities is known as "consumer surplus" and refers to the difference between the maximum amount a consumer is willing to pay for a consumer good and the amount actually expended (e.g., for a historical review of this concept, see Currie et al. 1971). Consumer surplus traditionally refers to how much better off an individual is by consuming the chosen good rather than allocating the actual expenditure to some other consumer good.

During the second half of the 20th century, welfare economic concepts were refined to include the valuation of natural environments. Based on a suggestion made by Harold Hotelling to the Director of the National Park Service, Marion Clawson and Jack Knetsch (Clawson and Knetsch 1966) developed a method for measuring consumer surplus based on what is known as the travel cost method. This conceptual step forward set the stage for the development of

several variants of the travel cost method in the following decades and allowed economists to measure the economic "use" value of wilderness and other natural areas. As the name implies, use value refers to the onsite value obtained from direct contact with wilderness (Figure 1). Studies of willingness to pay for wilderness use are often holistic and simply focus on the overall onsite value of a recreational trip. However, as we discuss below, economists are also interested in understanding how specific wilderness characteristics contribute to overall willingness to pay, and modern economic methods are well suited to estimating the values of ecosystem characteristics.

The second main category of economic value as applied to natural areas, first articulated by Krutilla (1967), is known as "passive use value." This offsite value category was originally depicted as being comprised of three related concepts (Figure 1). Existence value is the value derived from knowing that natural areas exist, even if one never plans to visit those areas. Option value is the value of maintaining the option to visit a natural area sometime in the future. Finally, bequest value is the value of passing on natural areas to future generations. The sum of use value and passive use value is known as total economic value (TEV). Use values, passive use values, and TEVs have been estimated for US wilderness areas (and are discussed below).

We include a fourth offsite wilderness value in our TEV typology that was not emphasized either by the Outdoor Recreation Review Commission (1962) or by Krutilla (1967). This is the amenity value of wilderness areas that is capitalized into nearby residential property values. The conceptual framework used to derive these values is consistent with welfare economic theory (Taylor 2003) and reflects home buyers willing-

Management and Policy Implications

Economic analysis informs policy decisions within a benefit-cost framework. Although wilderness economics research has generally shown that the economic benefits derived from wilderness activities have increased substantially since the passage of the Wilderness Act 50 years ago, much less is known about the costs of wilderness preservation in terms of foregone jobs and other economic opportunities in wilderness gateway communities. Federal agency planning for existing and potential wilderness areas would benefit from better information on the long-term and recent trends in wilderness use and value. Agency planning for potential wilderness areas would also benefit from a better understanding of the opportunity costs of wilderness preservation. Better information on wilderness value spillovers to nearby gateway communities could also help local planners address emerging trends in rural and exurban economic development.
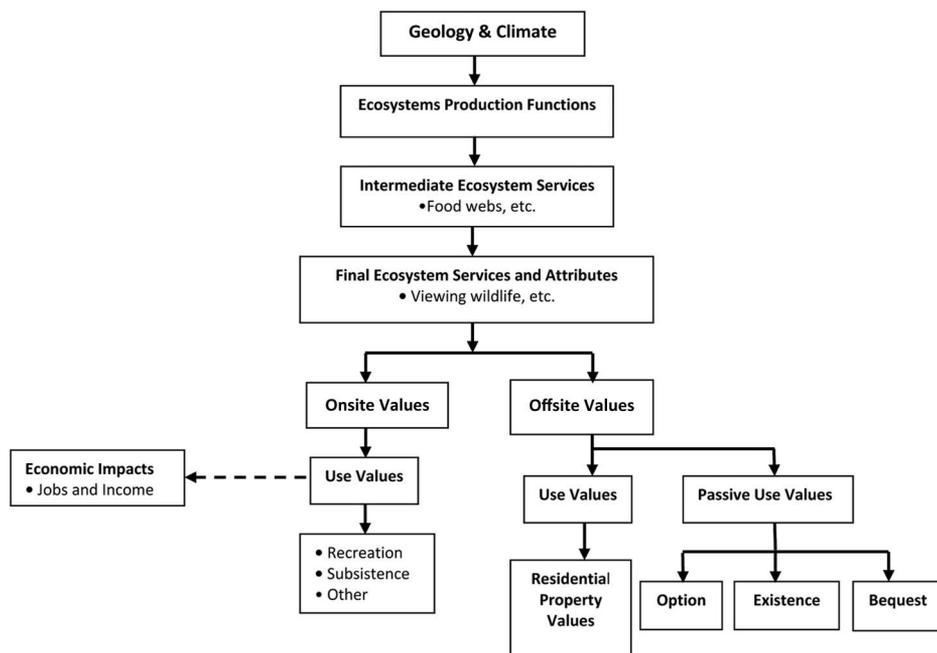
Figure 1. Wilderness economic values and impacts.

ness to pay for wilderness-based landscape amenities near their home (Phillips 2000, 2004, Izón et al. 2010). The fact that wilderness-based enhancement of nearby private property values has not been studied until recently may reflect the changing character of rural community development in some regions of the country and the increasing availability of information on residential property transactions and spatially referenced data on land cover and land uses.

Economic Impacts

Although economic measures are based on the worth of objects used in exchange (such as dollars), units of worth cannot be summed together if the conceptual foundation for the economic measures differs. This distinction applies to the economic contributions wilderness areas make to local communities. Above, we discussed the total economic value of wilderness areas in terms of society's willingness to pay for wilderness preservation. This concept differs from the economic impacts wilderness areas have on local and regional economic activity. Economic impact analysis focuses attention on the expenditures made by visitors to wilderness areas and the degree to which those expenditures are translated into jobs. Consequently, economic impacts are connected to the TEV framework using a dashed line (Figure 1). Estimates of the economic impacts of wilderness areas are discussed further below.

Wilderness Recreation Values and Use

Recreation Value per Trip

Wilderness recreation was the first economic benefit of wilderness to be monetized by economists. Primitive and unconfined recreation is specifically mentioned in the Wilderness Act. It is also one of the purposes of all Federal land management agencies including the National Park Service, US Fish and Wildlife Service and the two multiple use agencies, the US Department of Agriculture (USDA) Forest Service and US Bureau of Land Management (BLM). Techniques for estimating the economic value of recreation to visitors were also well developed and recommended for federal agency use by the US Water Resources Council in the early 1980s (US Water Resources Council 1983). Of course, in the early 1980s there was a common skepticism among federal agency staff (noneconomists and some agency economists) about whether the economic valuation of wilderness recreation could be accurately estimated, and if it could be, whether it should be done. Nonetheless, the USDA Forest Service included wilderness recreation as one of its multiple use "outputs" to be valued in preparing economic values of multiple use resources for the 1985 Resources Planning Act (RPA) program.

In the summer of 1982, Cindy (Sorg) Swanson at the Rocky Mountain Research Station of the USDA Forest Service and John Loomis (then at US Fish and Wildlife Service) conducted a review of the literature on economic valuation of all recreation activities, including wilderness. At that time, it did not take long to summarize the economic value of wilderness recreation as there were only five studies (Sorg and Loomis 1984). However, estimating the economic value of wilderness recreation was an active area of research subsequently, and by 1988 when the USDA Forest Service asked Richard Walsh (Walsh et al. 1992) to update the 1985 RPA values of Sorg and Loomis, his team found 12 separate studies on the economic value of wilderness recreation with an average value of $21.47 per recreation day in 1987 dollars ($45 in 2014). In 1998, Rosenberger and Loomis (2001) were asked to make a further update for the 2000 RPA/Strategic Plan. They located 29 separate estimates of wilderness recreation values averaging $39 a day in 1996 dollars ($59 in 2014). The most recent summary of economic values of wilderness recreation was by Bowker et al., published in 2005. Their analysis documented 31 estimates of the economic value of wilderness recreation, with an average value of $61.47 in 2002 dollars ($81 in $2014).

Given the trend in these summary value estimates (Table 1), it might be concluded that the value of wilderness trips is increasing over time—just as Krutilla (1967) predicted. However, caution is warranted before any firm conclusions are drawn. First, we note that the value of a wilderness recreation trip is likely to be sensitive to the geology, climate, and ecosystem characteristics found at the study sites (Figure 1). Failure to address site heterogeneity across study sites is like mixing apples and oranges. Second, the comparability of economic value estimates depends on the research methods used and the underlying assumptions that are made to conduct a study. For example, some studies use surveys asking respondents how much they are willing to pay for preserving new wilderness areas. These studies assume that descriptions of new wilderness areas provided in the survey are adequate for respondents to provide a reliable willingness to pay amount. Other studies use observations of the number of actual wilderness trips taken to estimate values from travel cost models. These studies often assume that a component of travel cost is the opportunity cost of time, which is computed as some proportion of the recreationist's hourly wage rate.

Table 1. Summary of onsite recreational use values for wilderness.

Study	Year published (data year)	Number of studies	Area	Consumer surplus ($2014)
Summaries of previous studies				
Walsh et al.	1992 (varied)	12	Varied	$45
Rosenberger and Loomis	2001 (varied)	29	Varied	$59
Bowker et al.	2005 (varied)	32	Varied	$81
Individual studies (all but Englin et al. 2008 included in Bowker et al. 2005)				
Smith and Kopp	1980 (1972)	1	Santa Lucia Mountains, California	$30
Hellerstein	1991 (1980)	1	Boundary Waters, Minnesota	$182
Englin and Shonkwiler	1995 (1982)	1	Cascade Mountains, Washington	$54
Englin et al.	2008 (1990–2002)	1	Sierra Nevada Mountains, California	$217

The top half of the table shows average values from previous data summaries that included a heterogeneous set of documented studies. The bottom half of the table shows wilderness values for a more homogeneous set of individual studies that used the travel cost method.

These concerns can be mitigated to some degree by examining only those studies that were published either in refereed journals or book chapters (therefore, readily available for review by the interested reader) and used similar research methods. In the bottom half of Table 1, we list willingness to pay estimates of the value of wilderness recreation (per trip) from a subset of published studies that used travel cost models to estimate onsite recreational use. Although the number of studies available for comparison is reduced from 31 to 4, these studies are quite similar in terms of data sources and research methods. For the three wilderness areas located in Pacific states (California and Washington), we see an upward trend in recreational use values. However, the study from the Boundary Waters Canoe Area, which has unique site characteristics and recreation uses, illustrates the effect of site heterogeneity on value estimates (the value is quite a bit larger than the values for the other studies from that time period). The uniqueness of this area suggests that any evidence of a trend in economic value would require an analysis of historical data collected solely from that wilderness. More generally, historical records (where they could be retrieved) for individual wilderness areas, analyzed with a consistent research approach, would provide a stronger basis for drawing conclusions about trends in wilderness value.

Wilderness Use and Aggregate Recreation Value

Given our tentative conclusion that willingness to pay for a wilderness recreation trip has increased over time, the aggregate value of wilderness recreation will also logically increase if the total number of wilderness trips increase. Up until the mid-1980s, the standard unit for estimating wilderness use was a "visitor-day," defined as one person present onsite for 12 hours. This measure is useful because it accounts for the length of stay, and historical records indicate that visitor-days in USDA Forest Service wilderness areas increased from roughly 4.5 million in 1965 to about 11.2 million in 1986 (Lucas and Stankey 1989) or about 4.4% per year. The current system for estimating wilderness use is the number of "visits" which, while being a useful indicator of use frequency (English et al. 2002), it is less useful for understanding use intensity and, unfortunately, visits cannot be directly compared with visitor-days. The most recent and reliable estimates suggest that Forest Service wilderness visitation increased from about 6.5 to 8.1 million visits per year between 2005 and 2012 (Bowker et al. 2014) or roughly 3.2% per year. During the same period, the overall US population increased by about 0.8% per year suggesting that the per capita rate of Forest Service wilderness use increased during that period.

Although the rate of growth of recreational use of wilderness appears to be less rapid during this later period relative to that for the first two decades after the Wilderness Act was passed, the evidence suggests that the aggregate rate of growth of wilderness value (number of trips multiplied by the average value per trip) on Forest Service land is exceeding the rate of growth of the population. Bowker et al. (2014) estimated that visitation to the entire NWPS was roughly 10.1 million annual visits in 2012. Based on the most recent estimates of average wilderness recreation value ($84 per trip) and wilderness use, then, simple multiplication suggests that the annual use value of the NWPS is on the order of $850 million annually (Bowker et al. 2014). Estimates of the trend in wilderness use throughout the entire NWPS are provided by Cole (1996) for the first three decades after passage of the Act. These data also show that although total visitor-days increased, the rate of increase slowed during this period. Nevertheless, because the average annual change in visitor-days consistently exceeded the rate of growth of the US population, we can conclude that the aggregate rate of growth of wilderness value derived from visits throughout the entire NWPS also exceeded the rate of growth of the population.

To make forecasts of wilderness use and value, it is important to understand how American society is changing. It has been argued, at times, that wilderness preservation primarily benefits the wealthier members of society. For example, the well-known environmental historian William Cronon has argued that

> Ever since the nineteenth century, celebrating wilderness has been an activity mainly for well-to-do city folks…. (E)lite urban tourists and wealthy sportsmen projected their leisure-time fantasies onto the American landscape and so created wilderness in their own image. (Cronon 1996, p. 15)

Although this statement may be apt for historical wilderness advocates such as Theodore Roosevelt (Brinkley 2009), economic analysis can be used to investigate this claim using more recent literature on the demand for wilderness recreation. In particular, by examining factors influencing the demand for wilderness recreation, it is possible to determine how rapidly the numbers of wilderness trips change as demographic characteristics in the population change.

With use of evidence on the relationship between income and wilderness visits

Table 2. Passive use values, per household and per 1,000 acres, for wilderness preservation ($2014 dollars).

Study	Year published (data year)	Wilderness area(s)	Value type	Annual household WTP	WTP per 1,000 ac
Walsh et al.	1984 (1980)	10 million ac (CO)	Option; existence; bequest (sum)	$27; $32; $33; ($92)	($0.01)
Barrick and Beazley	1990 (1983)	Washakie (WY)	Option	$110 onsite; $22 offsite	$0.11 $0.02
Pope and Jones	1990 (1986)	1.9 million ac (UT)	Option; existence; bequest (sum)	($114)	($0.06)
Gilbert et al.	1992 (1990)	Lye Brook (VT)	Option; existence; bequest (sum)	$2; $3; $6 ($11)	($0.61)
Diamond et al.	1993 (1991)	Selway Bitteroot (ID); Washakie (WY); Bob Marshall (MT)	Option; existence; bequest (sum)	($87; $52; $64)	($0.06; $0.05; $0.06)
McFadden	1994 (1990)	Selway Bitteroot (ID)	Option; existence; bequest (sum)	($78)	($0.06)

All values are based on responses to open-ended willingness to pay (WTP) questions. WTP values in parentheses ($) are total preservation values. (Updated and modified from Bowker et al. 2005.)

(specifically, income elasticity) provided in Smith and Kopp (1980, p. 70) and in Englin et al. (2008, p. 203–204), it is reasonable to conclude that the demand for wilderness recreation has increased more rapidly for lower income classes than for higher income classes during the three decades spanned by these two studies. However, a more nuanced story emerges when wilderness use data reported in the National Survey on Recreation and the Environment are evaluated for the influence of demographic characteristics (Bowker et al. 2006). That analysis suggests that race (black), ethnicity (Hispanic), immigrant status, age, and urban dwelling are negatively correlated with wilderness use, whereas education, income, and gender (male) are positively correlated. Using census data to forecast these population characteristics into the future, the authors concluded that although total wilderness use will continue to increase, per capita wilderness use will decline over time.

Wilderness Attribute Values

In addition to the wilderness economic studies described above that focus attention on the overall (or holistic) estimates of recreational use value (Table 1), we note that other methods have been used to estimate willingness to pay for specific wilderness attributes. We can think of wilderness ecosystems as settings for ecological processes (or production functions) that produce intermediate (e.g., food webs) and final (e.g., viewing wildlife) ecosystem services (Figure 1). Economic values are generally ascribed to final ecosystem services (or, equivalently, ecosystem attributes) that people care about (Johnston and Russell 2011). An early example of this approach to wilderness valuation used the hedonic travel cost modeling approach to estimate the value of wilderness attributes such as rock and ice, tree species, and tree size (Englin and Mendelsohn 1991, Pendleton et al. 1998). An alternative

approach is to use choice experiments (Holmes and Adamowicz 2003) to value wilderness characteristics (Lawson and Manning 2003). Although wilderness ecosystems are not generally subject to management interventions, a greater understanding of the value of specific recreational services could help wilderness managers make decisions regarding issues such as where to conduct fire suppression or risk reduction activities (Baerenklau et al. 2009), where to locate trails and campsites, and how to manage access to ecologically sensitive areas.

Wilderness Passive Use Values

Federal agencies were much slower to adopt offsite passive use values such as option, existence, and bequest values of wilderness into their economic analyses. In part this was because passive use values are more controversial since they are not observed in actual behavior and must be measured using stated preference methods such as the contingent valuation method or choice experiments. Despite the critical views of some economists (Diamond et al. 1993), this was an active area of research during the 1980s and 1990s and used to estimate the damages from high profile events such as the Exxon Valdez oil spill in Alaska (Carson et al. 2003).

The study of Walsh et al. (1984) in Colorado represents the first attempt to apply the contingent valuation method to measure option, existence, and bequest values of existing and potential wilderness areas. That study varied the amount of wilderness protection from 1.2 million acres (existing at the time of the study) to 10 million acres. Soon thereafter, Barrick and Beazley (1990) focused attention on a single component of passive use value, option value, for an existing wilderness in Wyoming that was threatened with proposed oil and gas drilling. Pope and Jones (1990), in the only study of potential BLM wilderness, estimated Utah residents' willingness to pay for designation

of alternative quantities of BLM land as wilderness varying from 1.9 million acres (the BLM preferred alternative) to 16 million acres (the Earth First alternative). These authors surveyed both onsite users of the wilderness as well as sampling the general population. The only study of total economic value of eastern US wilderness was conducted by Gilbert et al. (1992), who estimated the value of preserving Lye Brook wilderness (about 18,000 acres) in Vermont. The studies of Diamond et al. (1993) and McFadden (1994) were quite similar in that they estimated passive use values for western wilderness areas that they proposed would be subject to future logging if adequate funds were not obtained to preserve them as wilderness. These wilderness areas ranged in size from about 700,000 acres (the Washakie Wilderness, Wyoming) to more than 1 million acres (the Selway Bitteroot Wilderness, Idaho, and the Bob Marshall Wilderness, Montana).

Table 2 summarizes the passive use value studies of wilderness to date. As can be seen, some studies provided individual estimates of option, existence, and bequest values, whereas other studies simply reported preservation values, which are the sum of the three sources of passive use value. In most of the Western states, passive use values are generally similar, and there does not appear to be any trend, either increasing or decreasing, in passive use value over the time span during which these studies were conducted (1980–1991). However, the data broadly suggest that passive use values increase at a decreasing rate as wilderness size increases (known to economists as "external scope"). For example, the passive use value for the Lye Brook wilderness (18,122 acres) is about $0.61 household^{-1} 1,000 acres^{-1}. In contrast, the passive use value for wilderness areas roughly 1–2 million acres in size range from $0.02 to $0.06 household^{-1} 1,000

acres^{-1}. Furthermore, the passive use value for protecting 10 million acres in Colorado is about $0.01 household^{-1} 1,000 acres^{-1}. We also note that both studies that estimated passive use values for varying amounts of potential wilderness (known as "internal scope") also found that values increased at a decreasing rate as the area of wilderness preserved was increased (Walsh et al. 1984, Barrick and Beazley 1990).

Empirical research focused on estimating passive use values of wilderness has dropped off in recent years, in part perhaps due to fewer politically charged debates regarding high-profile wilderness areas. As can be seen from Tables 1 and 2, the use values (per trip) and nonuse values (per household) associated with wilderness areas are fairly similar, at least to an order of magnitude. However, one aspect of great importance when considering passive use value is that consumers do not compete for them. Everyone can have a passive use value, and those values are additive. If the average household in the United States was willing to pay $1.00 per year to preserve the Boundary Waters Canoe Area Wilderness, for example, then that would amount to roughly $115 million per year in passive use value for a single wilderness area. As such, even the smallest passive use values per household shown in Table 2, when multiplied by the more than 100 million households in the United States, result in estimates of passive use values that are several billion dollars in magnitude. Given the potential contribution that passive use value makes to the TEV of wilderness and that the most recent estimates of passive use value were made more than 20 years ago, we suggest that is time to update estimates of these values.

Wilderness Value Spillovers to Nearby Residential Property Owners

Drawing on a brief passage in Krutilla and Fisher (1975, p. 25), it is clear that these authors understood that living close to a wilderness area may confer positive benefits or externalities:

> The scenery within a tract of wildlands, for example, may represent…a source of private ownership externality as seen from a point outside the boundary of the tract….

Despite the intuitive nature of this concept, the data and economic tools required to estimate the value of these external benefits have only recently become readily avail-

able. In apparently the first study of its kind, using the well-known hedonic property value method, Phillips (2000, 2004) concluded that residential property values are higher in towns with and/or closer to designated wilderness (Big Branch, Breadloaf, Bristol Cliffs, George D. Aiken, Lye Brook, and Peru Peak) in the Green Mountain National Forest (Vermont). Furthermore, he forecasted that, if passed into law, proposed additions to the Green Mountain National Forest wilderness acreage (some 78,870 acres) would add between $1 million and $2 million per year to the value of properties that would be located closer to wilderness.

It is important to note that value enhancement from nonwilderness (but still publicly owned and managed) acreage in the same study region was not found. Specifically, and as indicated from parallel versions of Phillips' model, neither the presence of, amount of, nor distance to undifferentiated national forest acreage was significant in explaining variations in residential land prices. The study does not reveal *why* wilderness has the discernible positive effect (the permanence and degree of protection or the fact that wilderness tends to be designated around charismatic landscape features (e.g., Bristol Cliffs) or popular recreational amenities (Lye Brook Falls), but it does show that designated wilderness influences land prices in a way that simple public ownership does not.

The passage of the New England Wilderness Act of 2006, which added 34,875 acres of wilderness (including the Glastenbury and Joseph Battell wilderness areas) provided a "natural experiment" for testing the hypotheses that, given the initial extent of protected wilderness within a rural landscape, additional wilderness will further enhance nearby property values. The results of subsequent empirical analysis were highly consistent with the previous findings of Phillips' (2000, 2004). Specifically, the presence of wilderness in a town increased the value of residential property by roughly 19% (an increase in implicit price per acre of $20,190 in 2010 dollars). And for every 0.62 mile closer to a wilderness boundary, the market value of residential properties increased by 0.48% ($525 per acre on average).

A second economic study of the benefits of living close to a wilderness area was conducted in New Mexico (Izón et al. 2010). Although that study focused on the economic value of protecting inventoried roadless areas, the authors needed to control

for the presence of wilderness areas so that the two types of land use would not be conflated in their analysis. The authors found that for each percent increase in wilderness land per Census tract, housing prices increased by 0.64–1.19% (depending on the model that was estimated).

Although the empirical results provided by these two studies are suggestive, it would be informative to repeat this type of economic analysis in other diverse landscapes to gain a deeper understanding of the factors that influence, positively or negatively, the value of residential properties that are located near wilderness areas. On the one hand, it is possible (even likely) that proximity to wilderness, in some situations, does not contribute to private property values. This might be the case where open space is abundant and population is minimal. On the other hand, situations such as that reported in the Vermont study suggest that wilderness may contribute substantially to property values where wilderness is relatively scarce and population is relatively dense and affluent.

Economic Impacts and Contributions of Wilderness Areas

Wilderness areas in the United States have a cascading economic impact on surrounding regional economies as wilderness recreation users purchase local goods and services. Wilderness also attracts entrepreneurs, retirees, and businesses looking to improve their quality of life by being closer to the scenic and recreational opportunities provided by wilderness. This type of amenity migration may, in fact, may be a relatively recent social dynamic that enhances residential property values (as discussed above). Economic impacts from wilderness recreation are usually described in terms of jobs and income in local communities.

Wilderness Visitor Expenditures

Wilderness visitors come to enjoy hiking, fishing, and many other recreation activities in wilderness areas. Some visitors are local, whereas others travel from far distances. Some visitors just go in for a day trip, whereas others spend multiple days in a wilderness. Wilderness visitors spend money in the gateway regions on food, fuel, lodging, and gear. Thus, an understanding of wilderness visitor expenditures is needed to know how much money is spent on these activities

and which industries are most affected by this spending. In economic impact/contribution analyses, visitor spending for goods and services in particular sectors (restaurants, fuel, and other expenditures) ripples through local economies to produce economic activity in other economic sectors. These expenditures represent final demand for economic goods known as indirect and induced effects.

To understand wilderness economic contributions, an example of a guiding outfit can be helpful. The direct effect is represented by the wilderness visitor's expenditure to purchase a guided trip. Indirect effects represent purchases made by suppliers of direct services to wilderness visitors (in this case the outfitters and guides) such as food, equipment, and administrative overhead, necessary to provide the overall final service. Induced effects include the recirculation of guides' incomes, as they spend money locally on dining, entertainment, and other expenditures. The calculation of additional indirect and induced effects of economic contributions is known as a multiplier effect.

There has been little empirical investigation of the market contributions of wilderness as a whole (nationwide) or to proximate communities. Although there have been reports of visitor expenditures for recreational activities often pursued in the backcountry (e.g., White and Stynes 2008), we are aware of only a few studies investigating the economic impacts of visitor expenditures for specific wilderness areas (Moisey and Yuan 1992, Keith and Fawson 1995). These studies found modest contributions by wilderness visitors to regional economies, ranging from $50–$65 per visitor per day in 2014 dollars (adjusted for inflation). Loomis and Richardson (2001) provided a brief extrapolation of wilderness visitor expenditures to a national input-output model and found that expenditures were responsible for approximately 27,000 jobs nationally when multiplier effects were included. Rudzitis and Johnson (2000) and Rosenberger and English (2005) both illustrated approaches for estimating employment and income effects stemming from wilderness visitor expenditures and summarized case studies. A common theme identified by these two summary reports is that wilderness visitor expenditures are typically lower, on average, than visitor expenditures for different forms of outdoor recreation outside of wilderness areas, and total visitation to wilderness is

also typically lower than visitation to other public lands. However, as total visits to wilderness have been increasing (as described above), it is reasonable to conclude that aggregate visitor expenditures have been increasing as well.

Wilderness and Regional Economic Development

Wilderness can have a number of community economic impacts beyond just those associated with local visitor expenditures. Power (1992) emphasizes how wilderness can be important to proximate residents and communities and how wilderness can be important in attracting both businesses and population to a particular area (often referred to as amenity migration). Still other economic impacts occur as property values are enhanced and county and local tax bases increase, given the desirability to live near wilderness (Phillips 2000, 2004, Izón et al. 2010). Therefore, Power (1992) urges economists to include these "other" community economic impacts of wilderness when effects are calculated.

There have been general (Rosenberger and English 2005) and empirical examinations of the regional economic effects of wilderness in terms of determining the net effect on the economy (i.e., not tracking the ripple effects of visitor spending but rather seeing if the designation of wilderness had a positive or negative effect on overall regional economies). Duffy-Deno (1997) found no statistical relationship between the amount of wilderness and employment levels for rural Western counties. Holmes and Hecox (2004), on the other hand, found a positive correlation between the presence of wilderness and employment, population, and income growth for rural Western counties from 1970 to 2000 and attributed this growth to increased investment income and self-employed income.

Similar results have been found for all types of protected federal lands in the West (Lorah and Southwick 2003). These findings suggest that along with direct recreation and tourist expenditures from wilderness visitors, communities near (some) wilderness areas also experience increased economic activity from amenity migrants wanting to relocate to their region, bringing investment and business income with them. Likewise, general structural changes in the US economy and particularly in the Western United States have led to dramatic reductions in employment in extractive in-

dustries, with corresponding dramatic increases in services and manufacturing (Power 1996a). These structural changes have had implications in terms of more people seeking environmental amenities in general (Rasker 1993) and specifically for environmental amenities provided by wilderness (Power 1996b).

Conclusions and Future Research Needs

During the first few decades after the passage of the Wilderness Act, a number of contentious environmental issues came to the attention of the American public, such as the proposed development of hydroelectric dams in Hells Canyon along the lower Snake River. These threats to pristine natural environments motivated a cadre of economists to develop a new set of concepts and tools that could be used to quantify the economic benefits derived from preserving amenity resources. Applications of these new economic methods were persuasive and, for example, contributed to arguments that ultimately led to the defeat of the High Mountain Sheep dam proposal in Hell's Canyon. In subsequent decades, these economic tools have been refined and applied to a variety of wilderness settings.

Congressional designation of wilderness causes trade-offs to be made between the benefits and costs of wilderness preservation. Among the costs of wilderness preservation are the losses of traditional activities and livelihoods (Freedman 2002) as well as the foreclosure of potential future employment opportunities that could result from resource extraction (Foley 1998). The balancing of costs and benefits is partly an economic issue and also involves considerations of economic equity and cultural integrity as many wilderness visitors arrive from distant locations.

Our synthesis of wilderness economics literature has sought to discern underlying trends in wilderness use, value, and economic impacts with the intent of identifying future research needs that could better inform decisionmaking. An overall conclusion is that much of the wilderness economics literature is very dated and therefore limits what other specific conclusions might be made about long-term trends. Although new data sources that can help address this shortcoming, such as the USDA Forest Service Visitor Use Permit System and National Visitor Use Monitoring System are becom-

ing available, capacities for monitoring visitor use data by other agencies with wilderness responsibilities are more limited.

Nevertheless, given the evidence presented in the wilderness economics literature, it is apparent that total wilderness use has increased dramatically since the signing of the Wilderness Act. Although the rate of growth of participation in wilderness recreation has slowed during the past decade relative to that in the first two decades after passage of the Act, the growth rate of participation during the past decade has exceeded the growth rate of the US population. Consequently, it is anticipated that wilderness participation will continue to increase into the foreseeable future.

More than 30 studies have estimated the benefits of wilderness preservation in the United States, and scrutiny of these studies demonstrated that the willingness to pay for a wilderness trip has not declined over time and has probably increased. Multiplying the growth in wilderness trips by a constant or increasing value per trip results in an increase in the aggregate value of wilderness recreation over the past five decades. However, the demographic characteristics of wilderness users appear to be changing. Forecasts of future wilderness use strongly depend on who visits wilderness areas and how those segments of the population will change in the future. Some studies have suggested that wilderness visitation per capita will decline in the future.

Our economic synthesis also suggests that wilderness areas stimulate economic impacts within local and regional communities. Although the contribution of wilderness to economic growth in wilderness gateway communities is probably smaller than that for other outdoor activities (such as motorized recreation), the amenity value of wilderness appears to be attracting migrants to residential communities located near wilderness areas. Although not much is known about this phenomenon, a few studies have demonstrated that people are willing to pay more to live in the proximity of wilderness areas. Wilderness amenity migration can influence local taxes as well as expenditures for goods and services. A growing concern in some communities is how amenity migration affects the existing population of local residents who may be negatively impacted by increasing property values.

In conducting this synthesis, several issues deserving future wilderness economic research became apparent. First, an overall increase in future wilderness use will probably increase congestion. Thus, it would be useful to understand the human carrying capacity of wilderness areas, how wilderness visitors' willingness to pay changes as that capacity is approached, and how limits on visitation might be most equitably established by wilderness managers. Second, designation of new wilderness areas might increase visitation to those areas, so understanding this dynamic could help forecast future use. Third, the demographic characteristics of wilderness users are changing, although very little is known about the relationship between user characteristics and how those segments of society are changing. Research in this area would help management agencies better predict future levels of wilderness use. Fourth, although our literature review suggested that the willingness to pay for a wilderness trip has increased over time, more rigorous tests of this hypothesis (especially across heterogeneous landscapes) would help wilderness management agencies gain a better understanding of long-run social trends that may affect agency planning and expenditures. Fifth, evidence is growing that wilderness areas convey offsite benefits to some residents of gateway communities. A better understanding of where these positive spillover effects are occurring and why they are occurring could help planning efforts in gateway communities. Sixth, because ecological processes found in wilderness areas might be dramatically altered by a changing climate, it is essential to understand how wilderness users respond to natural disturbances, which are anticipated to become more severe in the near future. Although the ultimate economic research question concerns the overall level of wilderness protection that is socially optimal, addressing the questions posed here would take us a long way toward finding that answer.

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