Valuing Values

A History of Wilderness Economics

BY J. M. BOWKER, H. KEN CORDELL, AND NEELAM C. POUDYAL

Abstract: Prior to the U.S. Wilderness Act of 1964, economics as a science was hardly considered applicable to the types of human values set forth in this pathbreaking legislation. Economics was largely confined to the purchasing and labor decisions of households and firms as well the functioning of markets and economies. However, around this time, John Krutilla (1967) in his seminal paper entitled "Conservation Reconsidered" recognized the economic importance of benefits from nature that were not traded or valued by conventional markets. During the next 50 years, economists developed theoretical and methodological tools that allowed economic values, or dollar metrics, to be estimated for wilderness and other protected nature. In this article, we review the conceptual basis for an economic understanding of wilderness benefits and values. This review is followed by a brief summary of empirical studies about economic values of wilderness. We then use this information to derive rudimentary dollar metrics for the National Wilderness Preservation System.

Introduction

This article describes advancements in understanding wilderness benefits and their economic valuation. We use the current state of the art in nonmarket valuation to demonstrate these advancements by applying them to estimating the economic value of the National Wilderness Preservation System (NWPS). Economic value refers to "dollar" values accruing to American society from protection through designation of federal lands as areas in the NWPS. Currently the NWPS consists of 757 distinct land areas totaling 109,511,966 acres (44,317,920 ha), 52% of which are in Alaska (Wilderness.net 2014). When we refer to wilderness, we mean statutory or designated wilderness as defined by the U.S. Wilderness Act of 1964. The classes of benefits we describe are linked with dollar values brought to light through a review of empirical studies. Based on these empirical studies, we apply the current state of the art by estimating a value per acre of the NWPS. The article concludes with comments on the use of economics in the wilderness debate, including limitations and suggestions for further examination.

Benefits and Values

Conceptualization of the multiple values of wilderness has been advanced over the last 50 years through the work of a number of social science disciplines. Scientists have sought

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to better understand whether the NWPS provides values in addition to those identified in the U.S. Wilderness Act of 1964 (Haas et al. 1986) and how these values compare to less protective designations. Evolution of the science of economic valuation of natural resources, and more specifically, valuation of wilderness, was reviewed through numerous papers presented and published for the Economic Value of Wilderness conference (Payne et al. 1992). The culmination of the thinking and empirical work of these scientists was reviewed and further advanced through a number of published works, including Cordell, Bergstrom, and Bowker (2005) in *The Multiple Values of Wilderness*.

Morton (1999) summarized seven categories of benefits defining the total economic value of wilderness. These benefits include *on-site recreation, community, scien-*

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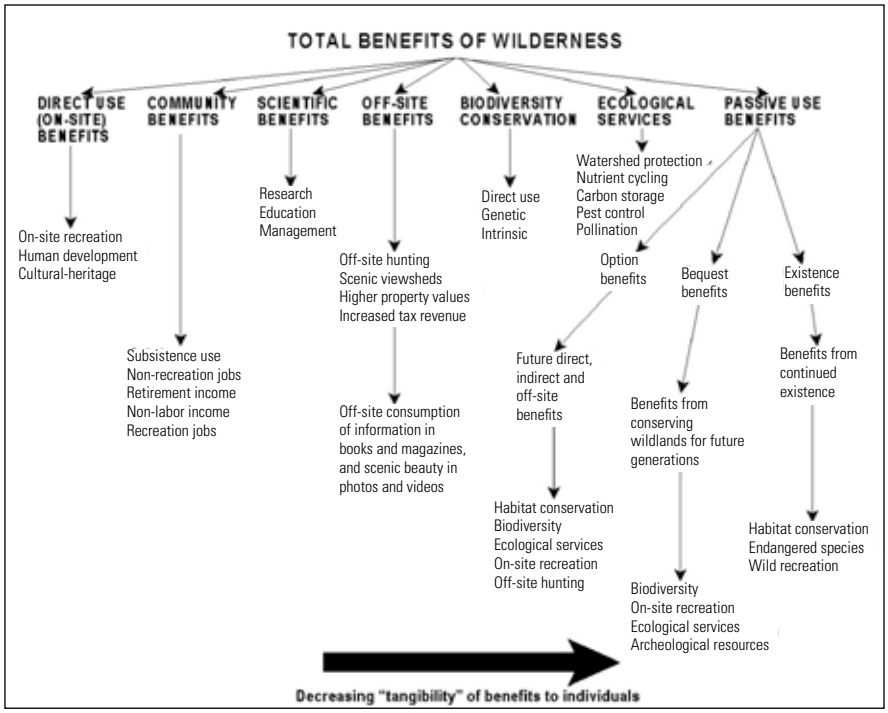

Figure 1 – The total economic benefits of wilderness (adapted from Morton 1999).

tific, off-site, biodiversity conservation, ecological services, and passive use (see Figure 1). Most of the empirical research preceding identification of these seven benefits focused on on-site recreation and passive use.

On-site recreation benefits derive from activities in wilderness such as backpacking, bird-watching, camping, fishing, hiking, hunting, and rafting (see Figure 2). Morton (1999) referred to on-site recreation or in situ wilderness benefits as direct-use benefits because they occur on-site.

Passive-use benefits, also called non-use benefits (Freeman 1994), are less tangible and occurrence on-site is not required. Krutilla (1967) originated the concept of non-use benefits, which is easily adapted to wilderness as a protected natural resource. For example, passive-use benefits reflect the individual's utility gained from knowing wilderness is preserved, even if they neither have, nor ever plan to, visit the area. Thus, passive-use benefits are considered a form of off-site benefits. Passive-use benefits include (1) option, (2) bequest, and (3) existence benefits. Option benefits refer to knowing that preservation ensures an opportunity to visit wilderness areas in the future. Bequest benefits come from knowing that wilderness will be available to one's heirs or future generations. Existence benefits derive from simply knowing wilderness exists. There is some debate among economists over the precise definitions for the various components of passive-use benefits, and even more debate over how to estimate their economic value. However, economists generally agree with the concept of passive-use benefits (Freeman 1994).

Morton (1999) conceptually identified five other benefits of wilderness, including *community, scientific, off-site, biodiversity conservation, and ecological service benefits*. These benefits affect the individual indirectly and have proven enigmatic to economists attempting to assign dollar values.

Community benefits include jobs and income created and supported through local spending by wilderness visitors (see Figure 3). Rosenberger and English (2005) described the

Figure 2 – On-site wilderness recreation benefits are obtained from activities such as backpacking, hiking, hunting, and rafting. Photo by Colin Bowker.

Figure 3 – Spending by wilderness visitors on guided rafting trips provides economic impacts to local communities. Photo by Alan Watson.

state of knowledge for community economic impacts of wilderness recreation, focusing on local communities and regional economies. Holmes and Hecox (2004) found that "wilderness counties" in the West experienced significantly increased employment, income, and population.

Morton identified three types of *scientific benefits* – research, education, and management (Morton 1999). Wilderness can be recognized as a living laboratory and benchmark for evaluating the impacts of development elsewhere (Loomis and Richardson 2000). Educational benefits include development of wilderness skills, clearing the mind, and creative thinking (Morton 1999). Wilderness also acts as a model for understanding and restoring natural forest ecosystems.

Off-site benefits of wilderness occur because it provides habitat for fish, wildlife, and a wide variety of other species. However, species depending on this habitat do not necessarily have to be enjoyed by visiting a wilderness area. A golden eagle soaring beyond the boundary becomes an important off-site benefit. Similarly, wilderness contributes natural and scenic views for the burgeoning resort and second-home communities (McCloskey 1990). "In both time and space, wilderness benefits are not limited to actually setting foot in wilderness" (Morton 1999).

Biodiversity conservation is highly important to policy makers and scientists (Ando et al. 1998). It is a growing consideration in wilderness legislation and management to assure protection of representative ecosystems, species, and genetic diversity (Loomis and Richardson 2000). Wilderness also plays a role in sustaining the ecological processes comprising our global life support system, including watershed protection, carbon storage, and natural pest control (Morton 1999). Cordell, and others (2005) further describe the ecological values of wilderness, while Gudmundsen and Loomis (2005) address the more abstract, and often debated, concept of intrinsic values that differ from the values humans place on wilderness.

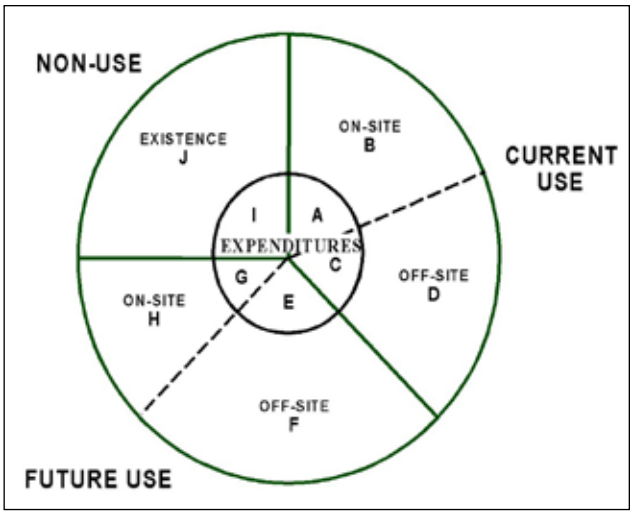

Figure 4 – Total economic value of wilderness-based recreation (adapted from Bergstrom et al. 1990).

Economists have advanced theory and methods for empirically studying the benefits of wilderness over the last 50 years. Monetary measures of wilderness benefits can be partitioned into two components: expenditures and consumer surplus. Expenditures are what an individual is required to pay for wilderness benefits (see Figure 4: Areas A, C, E, G, and I). Consumer surplus, or net economic value, is the value measure for the same wilderness benefit, above and beyond expenditures. In Figure 4, consumer surplus is represented by the amount of remaining area of the entire circle after the inner circle is subtracted (Areas B, D, F, H, and J). It may be more or less than actual expenditures.

Passive-use value can also be demonstrated. Consider the Okefenokee Wilderness in southeastern Georgia. Suppose someone enjoyed visiting the area, but does not intend to visit again – yet they derive benefits from knowing this wilderness exists and will be protected. By paying $25 annually to a fund supporting this wilderness, the individual demonstrates a passive-use value of at least $25.

Application of Economic Value Research to Wilderness

During the past 20 or more years, a number of studies have estimated individual consumer surplus for on-site wilderness recreation. Fifteen of these studies used either travel cost or contingent valuation methods. These studies yielded 31 estimates, of which 27 were from wilderness areas west of the Mississippi River. Fourteen of these 27 were from California, Oregon, Washington, or Alaska. The majority of the wilderness areas studied were on national forests.

Each observation represents dollar value (i.e., net economic value or consumer surplus) for either a single-day or multiple-day trip to wilderness (see Table 1). The consumer surplus values per person per wilderness visit ranged from $6 to $372, with the median being $24 (all dollar values in this article are inflated to 2013 dollars.). The consumer surplus per person per trip averaged across studies equaled $84. With an average duration of 3.5 days per trip, average consumer surplus per person per day was $24. The most recent value, by Weber, Mozumder, and Berrens (2012), was $30 per person per

Table 1 – Wilderness on-site recreation use empirical literature: Individual consumer surplus for day use and multi-day use (2013 dollars).

Author	Year	State(s)	Single-day use consumer surplus	Multi-day use consumer surplus
Brown and Plummer 1981	1979	OR & WA		4 estimates between $537 and $725
Smith and Kopp	1980	CA		$83
Walsh and Gilliam	1982	CO	$40	$240
Walsh et al.	1984	CO		$122
Leuschner et al.	1987	NC	$16	$21
Prince and Ahmed	1988	VA	$18	
Walsh et al.	1989	MN		$79
Barrick and Beazley	1990	WY		$21
Halstead et al. 1991	1990	NH		$9
McCollum et al.	1990	9 USDA Forest Service regions	$28	8 estimates between $16 and $372
Hellerstein	1991	MN		$43
Englin and Shonkwiler 1995	1994	WA		$35
Baker	1996	CA		6 estimates between $82 and $2,470
Richer and Christensen	1999	CA		$6
Weber et al. 2012	2011	AZ	$30	

trip for a Sonoran Wilderness visit. Values from Brown and Plummer (1981) were treated as outliers.

Eight studies provided estimates of passive-use values (see Table 2). These studies used contingent valuation to estimate willingness to pay to protect wilderness, mostly in western states. It is difficult to compare studies of household willingness to pay for passive use due to different sampling frames and base populations. No study has estimated passive use for the entire NWPS. Moreover, each study presented somewhat different development scenarios as alternatives to preservation. Several studies presented multiple passive-use values, as more than one wilderness area in different portions or combinations were valued.

An average across studies can serve as an initial approximation of household annual willingness to pay for wilderness protection. As each study focused on a subset of the NWPS, one can assume that each provides, at most, a conservative estimate of household passive-use value for the whole NWPS. If a household would pay $93 annually for passive-use benefits from just the designated wilderness areas in Colorado (Walsh et al. 1984), it is logical to pay at least that much for the entire NWPS. Estimates of annual household values of passive-use benefits from the studies reported in Table 2 range from $25 to $1,115. All but Keith and others (1996) reported annual household values of less than $115. Thus, their estimate of $1,115 is considered an outlier. The average annual passive value for households across studies is $87.

While a number of published studies focused on recreation and passive use, studies advancing the theory and methods for estimating other wilderness values (see Figure 1) were under way. Scientific values were studied by Loomis and Richardson (2000), who found 422 journal articles based on studies done in wilderness. They used an estimate from Black (1996) to calculate the monetary value of these articles. Black estimated the economic value of one journal article to society as $15,540 per year. Using Black's approach, the 422 articles were estimated to yield a value to society of $6.6 million annually.

Few researchers have attempted to estimate the value of wilderness education programs. However, there are organizations that provide

Table 2 – Empirical literature, year, state, and annual household willingness to pay from study for passive use (2013 dollars)

Study	Year	State(s)	Annual household willingness to pay (consumer surplus)
Walsh et al.	1984	CO	$93
Aiken	1985	CO	$127
Barrick and Beazley	1990	WY	$98 and $113
Pope and Jones	1990	UT	$104
Gilbert et al.	1992	Eastern U.S.	$25 and $27
Diamond et al.	1993	CO, ID, MT & WY	$49, $61, and $83
McFadden	1994	CO, ID, MT & WY	$79 and $124
Keith et al.	1996	UT	$1,115

these programs with wilderness as a backdrop (Friese et al. 1998). These programs facilitate adaptation skills, problem solving, emotional development, and a greater awareness of wilderness. Russell, Hendee, and Cook (1998) examined the economic benefits and costs of the Wilderness Discovery program for at-risk youth. They found evidence of a reduction in early terminations of Job Corps Center at-risk youth and an increase in employability equating to social benefits per student of $1,206 for each $578 in program costs.

Proximity to wilderness can be considered a valuable amenity benefit. Using a hedonic model of land price, Phillips (2004) estimated that parcels of land near wilderness in the Green Mountain area of Vermont sold at prices 13% higher than comparable land not near wilderness. A similar study in New Mexico found that property located in or adjacent to a census tract containing Inventoried Roadless Areas would sell for 3.5% higher than an identical house located elsewhere (Izon et al. 2010). Alternatively and others (2011) found evidence that wilderness designation was negatively related to county household income, total tax receipts, and total payroll. This suggests that disparities between locals and nonlocals are an important reality when considering the distribution of benefits from wilderness.

A major study aimed at advancing the economic valuation of natural assets was done by Costanza and others (1997). Such studies are rare for wilderness per se, but we can draw conclusions from studies of other wild areas serving as a proxy for wilderness. Costanza's team estimated the benefits for climate regulation services from temperate forests to be $45 per acre per year. They also estimated benefits from waste treatment services of $45 per acre per year from these forests. Loomis and Richardson (2000), using Costanza and others estimates, calculated benefits from 42 million roadless acres in the United States at $1,269 million annually, or $30 per acre. Applying this estimate to the current 109.7 million acres in the NWPS yields an ecological value of about $3.5 billion annually. We note that this estimate is probably conservative given wilderness's capacity for carbon storage and its trend toward increasing in value (Lubowski et al. 2006).

Toward a Total NWPS Economic Value

Applying theory and methods advanced during the last 50 years to the monetary value of the wilderness benefits identified in Figure 1 remains controversial. Nevertheless, using available literature, a conservative estimate of these economic benefits can be derived by combining values from the literature with the latest on-site use, acreage, and population estimates.

The most scientifically valid estimate of wilderness visitation is provided by the Forest Service's National Visitor Use Monitoring (NVUM) system. NVUM is a system designed to provide statistically reliable estimates of recreation visitation on national forests and national grasslands, with wilderness being one of five sample strata (English et al. 2002). Between 2005 and 2012, visits to national forest wilderness ranged from 6.5 to 8.1 million visits per year (English 2014, personal communication). This 24% increase reflects a trend identified by Bowker et al. (2006). Currently, NVUM results indicate that wilderness visits are distributed about 75% and 25%, respectively, to single-day and multiple-day visits, while Cole (1996) found that 26% of the visits were for single-day use and 74% for multiple-day use.

Cole (2003, personal e-mail communication) estimated that 82% of all NWPS visitation is on national forests, 15% in national parks, with the remaining 3% split among other federal agencies. Applying these shares to the most recent NVUM visitation estimate yields 10.1 million annual visits to the NWPS. This use estimate can be combined with the average consumer surplus per trip of $84 to yield an annual net economic value of recreation access to the NWPS of about $850 million, or an estimated annual value of recreation access of $8 per acre.

The annual passive-use value for the NWPS depends on the relevant population of passive users. The passive-use values reported in Table 2 are based on household sampling. Therefore, aggregation across U.S. households becomes necessary. Using an average 50% response rate across studies, and an estimate of 115 million U.S. households in 2011 (Vespa et al. 2013), a conservative estimate of annual passive-use value for wilderness is about $5 billion, or $46 per acre.

Combining totals in the preceding paragraphs yields $5.85 billion in benefits annually accruing to the U.S. public from the NWPS, or about $54 per acre. To this total we reasonably add an annual value of $3.5 billion in ecological services and estimate a total yield of approximately $9.4 billion per year in benefits to the U.S. public from the NWPS, or $85 per acre. Of course, the present value, however discounted, would be substantially larger.

Conclusions

Some claim that economics did not underlie either the Wilderness Act

or subsequent legislation leading to additions to the NWPS. Rather, some have asserted that "wilderness is established for emotional, ecological, and cultural purposes" (Steed et al. 2011). Forgetting about nonmarket values as established earlier, this is a very narrow view of economics, focusing only on jobs and income in the neighborhood of NWPS areas. Others view the role of economics in the wilderness debate as important and perhaps growing, recognizing that benefits extend beyond local jurisdictions and market transactions.

The advancement of identifying, defining, and applying money metrics to wilderness benefits has left no question that the NWPS provides many valuable benefits, with some harder to measure because of their indirect nature. These benefits lead to conceptually valid, albeit empirically elusive, estimates of the net economic value of wilderness. While some choose to visit wilderness and obtain direct benefits, the majority of people do not visit wilderness. Yet, numerous studies have shown that even for those with no intention to ever visit the NWPS, benefits derived from passive use are nontrivial, outweighing the value of recreation benefits. The indirect economic value of ecological services, if not double-counted with passive use, adds considerably more to the net economic value of the NWPS. Of course, economic logic would also dictate that these economic values derived from wilderness are only truly relevant when compared to values associated with alternative land use designations.

There is also no question that while the net economic benefits of wilderness are positive, they must be included with, or balanced against, equity considerations. Phillips (2004) demonstrated that local areas can be positively impacted through increased property values. Alternatively, Steed and others (2011) present evidence that wilderness designation can, in some cases, lead to costs in the form of lost jobs and impaired growth and development in local economies.

As Rasker (2005) pointed out, "Passing Wilderness legislation these days is very hard work because it also needs to pass the test of being economically beneficial." In essence, future designation will face increasing economic scrutiny as values put forth for various wilderness benefits will have to be carefully weighed against opportunity costs from forgoing other types of land uses. This is particularly true as more complex accounting approaches are developed to increase the efficiency of conservation and public wildland investments and acquisitions (Withey et al. 2012). Moreover, given the political climate, equity questions concerning the spatial distribution of benefits and costs between local and nonlocal residents will be important. Thus, as roadless acres equaling more than double the acreage of the NWPS are debated for alternative land designations (Campaign for America's Wilderness 2003), including wilderness, economics and economists will continue to have a seat at both sides of the table, or at least be advising those that do.

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