Introduction

Of the 100 million acres of designated wilderness in the United States, about half is located in the lower 48 states. Most of the economic benefits provided by wilderness can be classified by where those benefits are realized: on-site versus off-site or downstream (Loomis 1993). The most obvious on-site benefits provided by wilderness are recreation use and the protection of fish and wildlife habitat. Off-site or downstream benefits include protection of water quality for downstream cities, biodiversity, and passive-use values such as existence values to people who may never visit wilderness, but who still receive enjoyment and satisfaction from knowing it exists and is protected for them and future generations (Krutilla 1967). We now turn to a summary of the eight categories of benefits (also see table 1), using standard economic methods used by federal agencies in the United States.

Recreation Benefits

The available visitor use data from the four federal land management agencies that manage wilderness in the United States (Forest Service, National Park Service, Fish and Wildlife Service, and Bureau of Land Management) suggest a conservative estimate of 16 million recreation visits to designated wilderness in the lower 48 states. The benefits to visitors is estimated by their willingness (and ability) to pay over and above their current trip costs. This net willingness to pay (WTP) has been measured for wilderness recreation using both of the federally approved valuation methods, the Travel Cost Method (TCM) and Contingent Valuation Method (CVM). TCM uses variation in visitors’ travel costs and trips to trace out a demand curve. From the demand curve, net WTP can be calculated. CVM uses surveys to simulate what visitors would pay if there were a market for access to wilderness for recreation. (See Loomis and Walsh 1997 for more details on the two methods.) The average economic value per visitor-day from studies that used these methods is U.S. $40.
Thus, the 16 million visitor-days has an estimated total recreation value of $634 million annually. The designation of an additional 10,000-acre roadless area in the West as wilderness would yield about 3,875 additional visitor-days per year, providing a $153,500 recreation value to visitors each year in the western U.S. The same 10,000 acres in the eastern United States is estimated to yield approximately 11,000 visitor-days per year with an annual recreation value to visitors of $435,700.

**Community Effects**

A review of the economic literature indicates visitor expenditures per day of wilderness use averages to $30. To calculate the direct and indirect economic impact of such spending, we multiplied this value by the estimated wilderness visitation of 16 million, and entered the product into an input-output model to correct for leakage when calculating the multiplier effects of the visitor spending on the U.S. economy. The resulting estimate suggests the level of total expenditures directly or indirectly supports 26,820 jobs. While development is restricted within wilderness, visitor spending on gasoline, hotels, restaurant meals, and so forth supports economic development outside wilderness. Designation of an additional 10,000 acres of wilderness translates into an additional U.S. $443,740 of personal income and 18 jobs from wilderness visitor spending in the eastern U.S. and $156,318 of income and 6 jobs in the western U.S. In addition, protection of wilderness may promote economic development in the adjacent counties through attraction of new residents and businesses which value the amenities protected by wilderness. Surveys indicate that in counties containing wilderness, 45% of current residents and 60% of recent migrants see wilderness as an important reason for living there.

**Passive-Use Values**

Existence values (knowing wilderness exists and is protected), as well as bequest values (providing this resource for future generations), were quantified using contingent valuation surveys. Generalizing passive-use values (e.g., existence and bequest values) for wilderness in the western United States, we estimate annual values at $6.72 per acre, yielding annual passive-use values of $287 million for 42.7 million acres. For eastern wilderness, we estimate a passive use value of $4 per acre, yielding annual passive use values of the 4.5 million eastern acres to be $19 million. Thus, total passive-use values are estimated to be $306 million. More studies of passive-use values, particularly in Alaska, are needed to improve our rough empirical estimates.

**Scientific Values**

Wilderness provides a natural benchmark or control area for judging the effects of human development on natural systems and understanding of unfettered ecological processes. Wilderness has also been the source of study for more than 400 scientific journal articles in the natural and social sciences. There

<table>
<thead>
<tr>
<th>Use</th>
<th>Economic Value (Millions)</th>
<th>Economic Impact</th>
<th>Other Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recreation Value</td>
<td>$634</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passive-Use Value</td>
<td>$306</td>
<td></td>
<td></td>
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<tr>
<td>Ecological Services</td>
<td>$2,000 to 3,400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientific</td>
<td>$5</td>
<td></td>
<td>+400 journal articles</td>
</tr>
<tr>
<td>Biodiversity</td>
<td></td>
<td></td>
<td>+1 million acres protected</td>
</tr>
<tr>
<td>Community (recreation related)</td>
<td></td>
<td>26,822 Jobs</td>
<td>1/3 of U.S. Ecoregions</td>
</tr>
<tr>
<td>Off-Site (gain in local property values)</td>
<td>13%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1—Summary of annual economic values of wilderness in the lower 48 states.
are several hundred agency research publications on wilderness as well. Journal articles contribute to scientific progress, which in turn often contributes to productivity improvements and therefore increased human well-being. Using a rough estimate of the annual value per journal article, these wilderness-based articles yield an estimated economic benefit of $5 million annually. The methodology for estimating scientific benefits needs substantial improvement before this estimate can be considered as any more than a rough approximation.

**Biodiversity Values**

Wilderness designation provides one of the strongest levels of protection of biodiversity available to policy makers. Using the Bailey-Kuchler ecosystem classification system, we calculated that more than 10% of the land in the Everglades, American Desert Province and Coniferous Forest-Alpine Meadow provinces are protected by wilderness (Loomis and Echohawk 1999). Altogether, wilderness designation of a million acres or more protects about one-third of the 35 ecoregions of the continental United States. While CVM could potentially be used to estimate an anthropocentric value of biodiversity, economic valuation methods do not allow for the measurement of the intrinsic value.

**Off-Site Benefits**

Just one of the off-site benefits of wilderness, the increase in value of private property adjacent to wilderness, provides a gain of 13% in per acre values in the Green Mountains of Vermont (Phillips 1999). With about 47 million acres of wilderness nationwide, there are probably hundreds of millions of dollars in property value enhancement on private lands adjacent to or nearby these areas.

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**Wilderness provides a natural benchmark or control area for judging the effects of human development on natural systems and understanding of unfettered ecological processes.**

**Ecological Services**

Ecological services provided by wilderness include watershed protection, carbon storage, nutrient cycling, and fish/wildlife habitat. Wilderness watershed protection yields a cost savings to several small towns' water treatment plants and highway departments from avoiding sedimentation associated with logging. This benefit is estimated to range from at least $130,000 to as much as $260,000 annually from just one small national forest of 631,000 acres (Loomis 1988). Given the 47 million acres of wilderness, between $9 and $18 million in cost savings could be realized if this case study is generalized to wilderness throughout the United States. In terms of climate regulation, an acre of forest has an estimated value of $65 a ton for storing carbon, and thereby helps to moderate climate change (Morton 1999). An estimated 29.5 of the 44 million acres of wilderness are forested (Loomis and Echohawk 1999). A rough estimate of the value of carbon stored in wilderness forests is $2.4 billion annually. Costanza et al., in their article in Nature, estimated that benefits of climate regulation from temperate forests could be valued at $35 per acre per year. This yields a value of about $1 billion annually in climate regulation benefits from wilderness forests.

These same authors indicated that temperate forests also provide waste treatment services by recovering mobile nutrients and cleansing the environment. The authors then estimated another $35 per acre from waste treatment benefits of forests. Thus, wilderness forests would provide another $1 billion in benefits per year from this ecosystem service. Therefore, the annual economic benefit from watershed protection, carbon storage for climate regulation, and nutrient cycling for waste treatment are estimated to be between $2 billion and $3.5 billion. This estimate is conservative, as it does not account for numerous other ecological services provided by the protection of wilderness.

**Educational Values**

Wilderness often provides a natural laboratory for many high school and college courses. Wilderness has also been used by various organizations to help teenagers and adults develop self-reliance, teamwork, and coping skills they can use in everyday life. There is a growing health industry that uses wilderness as an integral part of its treatment program. The potential economic value of these benefits is difficult to measure, but may be in the millions of dollars, while the economic impact in terms of employment may be even greater.

**Conclusion**

Wilderness provides many values to humans through on-site recreation use and fish and wildlife habitat, as well as off-site benefits in terms of protecting water quality, sequestering carbon, and providing an environment for scientific research and the rehabilitation of the
human condition. While economic techniques can currently estimate monetary values for some of these benefits, many of them, such as protection of biodiversity, will only be monetized in the future. A concerted effort between natural, physical, and social scientists will be necessary to more fully develop methods to accurately reflect the economic benefits society receives from wilderness preservation. Additional research is especially needed in Alaska, where a great deal of wilderness exists but few benefits have been quantified. While economic benefits are not the primary justification for wilderness protection, they do provide a very important defense.

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REFERENCES

Wilderness Loses Icons
David Brower and Bing Lucas

U.S. conservation legend David Brower has died. An accomplished mountaineer, Brower made over 70 first ascents. He applied the same kind of courage and resolve he used in mountaineering to his work in conservation; he did what had never been done before. Brower launched new organizations (Friends of the Earth, the League of Conservation Voters, and Earth Island Institute) and conservation campaigns (Glen Canyon, Kings Canyon, North Cascades, Dinosaur Monument, the Redwoods) throughout his long career. His aversion to compromise was legendary. In the 1950s and 1960s he transformed the Sierra Club from a regional hiking group into a potent national political force. He was later fired for taking unflinching, extreme positions. He returned to serve on the Sierra Club’s board of directors many times, until leaving once more in the last year of his life over yet another disagreement of principle. Nonconforming to the end, he cast his vote for Ralph Nader the day before he died. David Brower blazed new paths for wilderness conservation. He was 88 years old.

Bing Lucas, New Zealand wilderness conservation icon, has also died. As famous for his cooperative spirit as Brower was for his lack of compromise, Lucas literally died with his boots on, walking his beloved New Zealand mountains. As his country’s first director of parks and reserves, Lucas created one of the world’s most envied systems of walking trails, created new national parks, and crafted some of the best conservation policies in the world. Lucas retired as director general of lands in 1986. He continued working with the World Conservation Union (IUCN). In 30 years of voluntary service with the IUCN, he led the Parks Commission, was vice-chair for World Heritage, represented the IUCN at countless international meetings, including the World Wilderness Congress, and led many missions to study and protect wild and cultural heritage.

Go well, dear friends. You have made our work possible.