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High Mountain Ecosystems: How Much Love Can They Sustain?

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1. Introduction

Mountain ecosystems and high alpine peaks are symbolic of a delicate balance between the human need to use and to protect natural amenities. People spiritually and culturally identify with the serenity and beauty of high peaks (Blake, 1999; Blake, 2002), and are willing to pay a significant amount of money to access and enjoy them (Keske & Loomis, 2007; Loomis & Keske, 2009). However, mountain ecosystems are fragile, even with low level recreation use (McQuaid-Cook, 1978). Mineral extraction and other direct uses such as clear cutting have traditionally been used to drive mountain economies (Loomis, 2002). Although such extraction practices are often characterized as unsustainable, there is emerging evidence to suggest that current levels of recreation use can also be damaging to these ecosystems (Kedrowski, 2006). Even if information about environmental and development tradeoffs was available, preferences of rural mountain residents vary about how to define “sustainable” economic development and about acceptable levels of environmental damage.

This chapter outlines environmental and economic considerations for sustainable economic practices at high elevations, and discusses the economic value that visitors and residents place on high mountain recreation experiences. Recreation interests in mountain ecosystems has grown exponentially in recent years, and has provided relief to overburdened natural resources where it competes financially with more destructive commercial endeavors (Loomis, 2002). Despite the economic development and non-market value of high mountain recreation experiences, even passive use recreation may be considered unsustainable if it is not appropriately managed. That is, people can love these resources to death.

The purpose of this chapter is to examine the delicate, and unique, balance of economic and environmental tradeoffs in high mountain communities in the context of recreation. The question is: how much recreational love can these ecosystems sustain? The chapter proceeds with definitions of “sustainability” and methods for economic valuation. Next is a brief summary of pressing environmental and economic concerns within a case study area, the high elevation Park and Lake Counties, located in central Colorado (United States). The chapter presents results from economic studies conducted from 2006-2010, indicating that both recreators and residents place high value on the high mountain natural resources and lifestyles, even when compared to other natural experiences. Given the high potential for economic development, community residents and visitors to the region must consider trade-

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offs between economic drivers and environmental quality. This requires the use of collaborative conservation techniques, which should be accompanied by setting targets for both conservation and economic development. Suggestions are presented for future policies and research that may balance both environmental and economic goals.

2. Defining sustainable development

A significant challenge for managing ecosystems is determining how to apply definitions of sustainability. To date, the most commonly recognized definition of sustainable development is provided by the World Commission on Environment and Development (1987). This report is often referred to as the “Brundtland Commission’s report” after Norway’s former prime minister Gro Harlem Brundland, who chaired the Commission. The Brundtland Commission’s report defines sustainable development as “development which meets the needs of current generations without compromising the ability of future generations to meet their own needs” (p.43).

The report outlines three critical categories relevant to assessing sustainable economic development: economic, environmental, and social well-being. While the report clearly emphasizes that social and environmental values should not be sacrificed for the sake of improved economic prosperity, the Commission also recognizes that improvements to social and environmental quality are also positively correlated with economic development. In other words, a healthy economy can contribute to a healthy environment in the long run. Therefore, while the Brundtland Commission’s definition of sustainable development is often regarded as ambiguous, many believe that this wide net is necessary in order to allow for communities to define what constitutes an appropriate balance of these three criteria. The difficulty often lies in being able to quantify or measure appropriate economic development (United Nations Economic Commission for Europe, 2010).

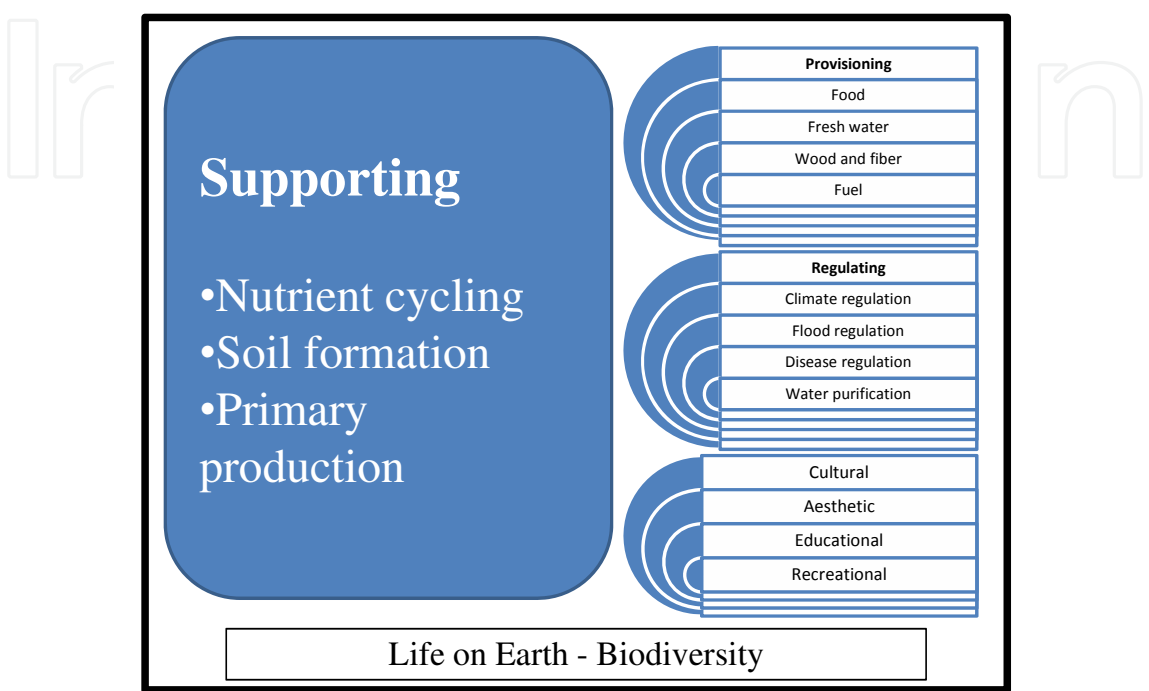
More recent international efforts on sustainable ecosystem management concur that social and cultural dimensions must be balanced with environmental quality, and this may be a difficult balance to achieve. The Millennium Ecosystem Assessment (MA) project was formed in 2000 after a directive by then-United Nations Secretary Kofi Anan to “...to assess the consequences of ecosystem change for human well-being and the scientific basis for actions needed to enhance the conservation and sustainable use of those systems and their contribution to human well-being” (p.3).

As shown in Figure 1, adapted from the MA report, the MA defines four main categories of ecosystem services to support life on Earth and biodiversity. These categories include supporting, provisioning, regulating, and cultural ecosystem services. The MA recognizes that ecosystem services are human driven, and all four of these categories directly affect human well-being. While supporting, provisioning, and regulating ecosystem services reflect the more traditional “environmental goods”, it is noteworthy that the cultural ecosystem services also reflect aesthetic, educational, and recreational opportunities. Thus, the connection has been made that there is a need to balance recreation with supporting ecosystem services such as soils and plants, reflective of high mountain regions.

3. Using economic valuation to measure sustainable development

Economics is the science of measuring trade-offs, and there is an abundance of economic tools that may be used to measure the trade-offs, or different values, humans place on

ecosystem services. Economists rely on prices to indicate whether a market is properly functioning, as price signals whether goods become more or less scarce (Friedman and Friedman, 1962). For example, for a given supply, as the demand for petroleum increases, so does the price, as there are more individuals competing for the same product. Suppliers can review the petroleum prices for feedback and adjust their production accordingly.



Adapted from “Living Beyond Our Means”: Millennium Ecosystem Assessment (2005)

Fig. 1. Ecosystem services

However, economists concur that prices may not always reflect the “true economic value” of a good—particularly an environmental good. Some environmental goods, such as endangered species like panda bears, may not have a price that reflects their true value, as these animals are not traded through an open market. Other environmental goods such as a healthy ecosystem, are only given a price when there is environmental damage, as occurred in the case of the Exxon Valdez oil spill in Alaska’s Prince William Sound.

When valuing environmental goods, economists pull out a special “toolkit” to model the value of environmental goods and ecosystem services. Environmental values consist of both a “use” and “nonuse” components, which are summarized in Figure 2. Use values typically consume the resource, such as hunting deer, while non-use values do not consume the resources, such as photographing deer. Economists use different tools or models to determine the value of environmental goods. For a full accounting of the economic value of a good, both the use and non-use values should be considered.

As shown in Figure 2, the use dimension is divided into two classes: direct use and indirect use. Direct use occurs when humans utilize a resource. Economists value this direct use component when raw materials are extracted, developed, or cultivated for human ends (Laitos et al., 2006). Returns from direct use can be measured rather easily through market activity, such as price and quantity sold, or other financial models. For example, the value of timber harvesting can be measured when the product is sold. Direct uses may also include “non-consumptive uses,” like visiting a national park for wildlife viewing. These values

may be quantified by expenditures made to enjoy an experience. Non-consumptive uses such as recreation are generally thought not to be outwardly destructive, but at large enough levels of use, environmental damage may occur (Millennium Ecosystem Assessment, 2005). Resource use also encompasses “indirect uses” derived from a resource or an ecosystem, such as carbon sequestration, clear air, or clean water. Indirect uses can provide life-giving services and functions to this planet (including its humans) when humans do not directly use the resource (Ruhl, Kraft, and Lant, 2007). The value of indirect uses may be measured a number of different ways, which are not discussed in depth at this time. For example, hedonic modeling teases the value of an environmental good, such as a scenic view, out of the data through statistical regression. The value of trees in home landscaping, for example, can be found by comparing the prices of homes with trees to similar homes without trees.

Use Values	
Direct Use Harvesting plants Extraction of petroleum <i>Non-consumptive uses</i> Wildlife viewing Passive recreation	Indirect Use Carbon sequestration Clean air Clean water
Nonuse Values	
Option Values Conservation of topsoil Grasslands preservation Petroleum reserves Future recreation	Existence Values Natural areas (intrinsic value) Pristine wilderness Natural wetlands Wild and scenic waters Bequest Value Passing a resource to future generations

Fig. 2. Use Values and Nonuse Values

In contrast, nonuse benefits arise when humans want to maintain the option of using a resource in the future (otherwise known as “option value”), or preserve a resource for the sake of its existence, otherwise known as “existence value” (Krutilla, 1997).¹ Nonuse values can produce global ecosystem services that permit sustainable life on this earth, even if there are no humans, or if a resource is untouched by humans. Resource nonuse provisions the

¹There are differences in opinion among economists as to whether “option value” is a sub-category of nonuse or whether it should comprise a third category by itself.

indirect resources that are received and enjoyed by humans (Daily, 1997; Daly and Farley, 2004). People that donate money to save pandas, for example, provide a measure of value for something that they want to have the option to see later, or perhaps will never have a chance to see. A final category of non-use value is the bequest value, when an individual places value on a resource with the hope that the resource will be enjoyed by future generations.

Economists use a number of techniques to quantify nonuse values. Nonuse values are frequently added to the direct use values to determine a more complete picture of the economic value of a natural resource. In this chapter, a specific type of economic modeling, contingent valuation methodology, is presented as an example of a method that can be used to determine the value that visitors place on high mountain recreation experiences and mountain ecosystems.

Contingent valuation can be used to determine the economic value of a resource when there is not a market available to provide price and sales data. Contingent valuation methodology enables researchers to determine the value that individuals would be willing to pay to protect (or even access) a resource in addition to the amount of money that the individual has already paid. This willingness to pay (WTP) is defined by economists as “consumer surplus”. When a proper sample size is obtained, economists can determine the average WTP, or average consumer surplus for that particular resource, and use this information as a measure of “economic value”. Like all methods, contingent valuation has its limitations. For example, contingent valuation measures what an individual states that he or she is willing to pay (rather than what he or she actually does pay). However, contingent valuation methodology is a generally accepted method for valuing environmental goods, particularly when there is not a market for that good. Much of this chapter reflects use of contingent valuation methodology in generating average consumer surplus for recreation in high alpine mountain ecosystems of the state of Colorado, in the western United States. Values obtained from contingent valuation studies of high mountain peaks reflect the value that hikers and recreators place on their mountain experience, in addition to what they have already spend. Both the expenditure and the consumer surplus data inform policy makers about trade-offs that are made between environmental protection and economic development in these high alpine regions.

4. Case study region and challenges to sustainable economic development

The case study area consisted of two rural counties in central Colorado, USA, Park County (population 17,004) and Lake County (Population 7,913). These counties are home to the two highest elevation incorporated towns in the U.S., Alma (Elevation 10,578 feet) and Leadville (Elevation 10,152 feet), respectively, located 120 and 65 miles (193 km and 105 km) from Denver, the state’s population center. While the exact number of visitors to the study area is difficult to ascertain, the recreation and tourism industry is substantial in Colorado, and some inferences may be made about the study region. A 2009 study estimates the state attracted 27.4 million overnight and 23.2 million day visitors (80% from originating from within the state) during 2008, spending a total of \$10.9 billion (Longwoods International, 2009). Since more than half the state’s population is located within the Denver Metropolitan area, there is a proclivity for the Leadville and Alma study region to attract a large number of day trippers. The close proximity to several well-established ski resorts, including Vail and Breckenridge, put the study area in short reach for side trips from what are often considered major destinations.

The impact of mountain-related recreation in these two communities, shown in Figure 3 was tested in both 2006 and 2009. These communities were identified for the study because they reflect economies in transition from traditional extraction to heritage and recreation-based economies. In essence, both communities are in the process of setting goals for sustainable economic development, and are reflecting how to balance the recreational industry with their mining and extraction heritage in a sustainable manner. For example, the Park County government has been proactive in obtaining a National Heritage Area designation for parts of the region by offering tours of old mine sites and historic ranches.

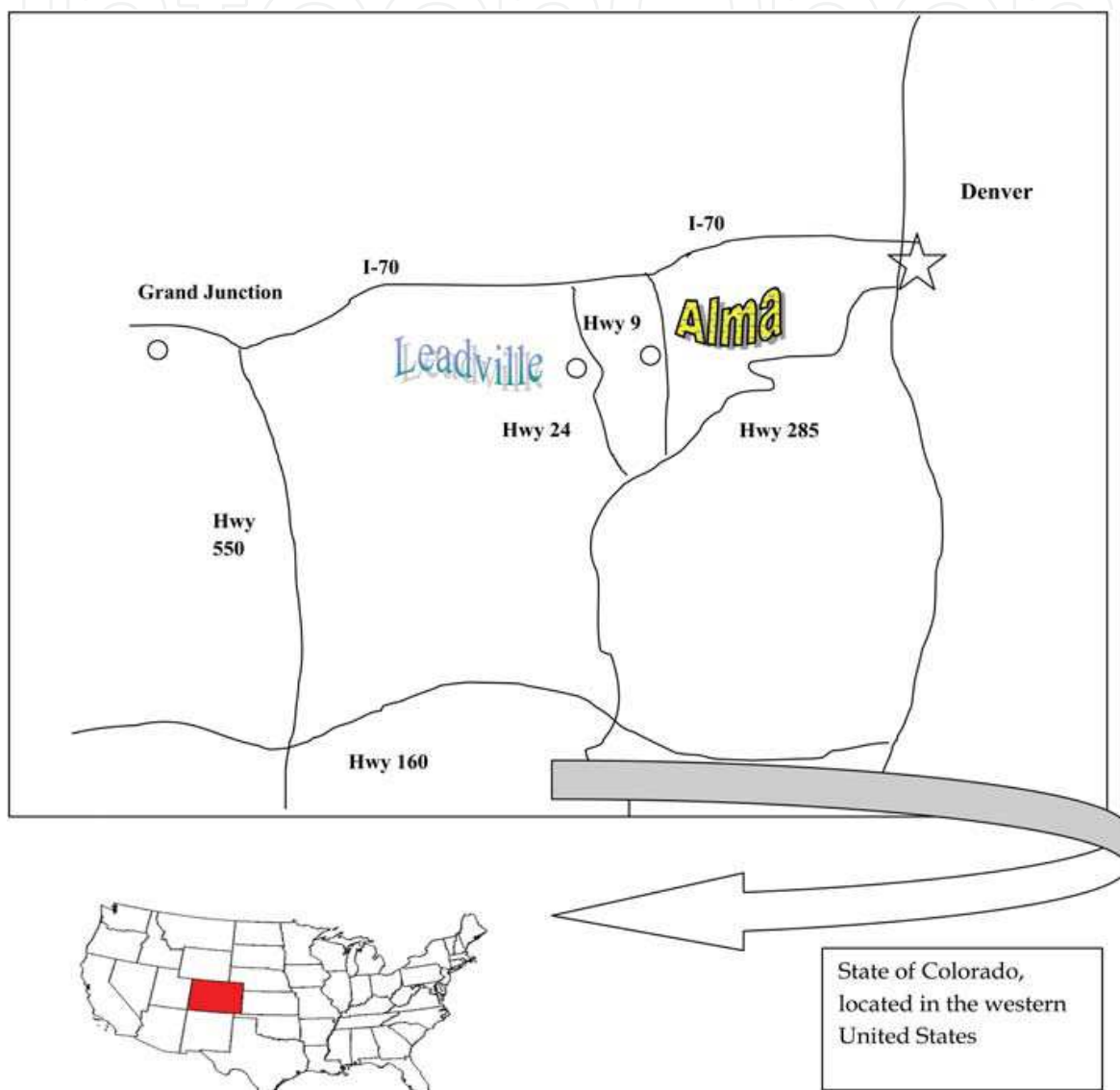


Fig. 3. Map of Study Area

Both Park and Lake Counties also provide unique high alpine recreation experiences, most notably associated with the presence of Colorado "Fourteeners", peaks which rise above 14,000 feet in elevation. There are 54 Fourteeners in the state of Colorado. Outside of Colorado, the states of Alaska, California, and Washington have one or more 14,000 foot peaks, but the majority of the Fourteeners are in Colorado. The valuation studies of the high mountain recreation experience on Fourteeners indicate that these rural communities receive a large economic boost from the visits. While exact numbers for recreational visitor

use can be challenging to obtain (English et al., 2002), data collected by the USDA Forest Service and affiliate groups allow us to estimate that a minimum of 100,000 people from within the state and all across the country specifically seek recreation at Colorado Fourteeners each year (Colorado Fourteeners Initiative, 2007; Frazier, 2006; Kedrowski, 2006). Fourteener recreation activities include day hiking, camping, off road vehicle trails, wildlife viewing and photography opportunities. Other government data support the notion that visitors continue to visit public lands at a similar rate during times of economic decline and economic prosperity. For example, according to National Park Service data, visitors to Rocky Mountain National Park in 2009 numbered roughly 3 million, which is a stable visitation rate since 1991 (Magill, 2010).

However, environmental damage may also result from crowding (particularly on weekend days) and the high value and demand for the recreation experience. In a systematic study that documents environmental damage on Fourteeners, Kedrowski (2006) found that popular Fourteeners have wider trails to accommodate high hiker volume, and more switchbacks were needed to reduce damage due to soil erosion. The ecological damage also presents temporal considerations, as damage to alpine tundra environments often requires decades to regenerate (Summer, 1980; Summer, 1986; McQuaid-Cook, 1978). Similar problems have been noted in climbing areas of the United Kingdom (Hanley, et al., 2003).

At low levels of use, the publicly owned peaks are non-rivalrous and non-exclusive. However, at high levels of use, such as weekends and holidays, these peaks become “congestible public goods”. Congestible public goods are often considered public goods with a consumption externality. That is, there is over-consumption of the goods because consumers ignore the external costs that they impose on each other and on the environment (Weimer and Vining, 1999). In this case, crowding reduces the experience for everyone. Unlike a privately provided market good where increased use brings about increased revenues to maintain the resource, most publicly owned Fourteeners lack access fees, thus compounding over-use and under-funding for trail restoration.² While most of the 54 Fourteeners fall on public property, approximately 10 Fourteeners are at least partially privately owned, including a few cases of a split mineral estate, where the surface owner is separate from the sub-surface owner, who may own mineral or energy rights. This distinction between the public and private lands has an interesting affect on environmental quality. Culebra Peak, one Fourteener which is entirely privately owned, requires an entrance fee for access. Thus, it is not surprising that it has one of the most pristine environments, according to the Kedrowski study.

To put the congestible public good in perspective, Figure 4 illustrates a long line of recreators hiking up Mount Bierstadt, located approximately 20 kilometers west of Alma. This photo, taken on a weekend morning, is a reflection of the typical weekend foot traffic, and that solitude is not necessarily part of the Fourteener experience. Figure 5 is a photo of a trail on Mount Elbert, which is approximately 25 kilometers south of Leadville and is the highest summit in Colorado. Figure 5 documents trail widening and erosion which result from Fourteener hiking. Findings in the next section indicate that individuals place much

² There is evidence that the USDA Forest Service may begin charging access fees at popular Fourteener trailheads for trail management. At this writing, the San Carlos Ranger District, which manages the Pike & San Isabel National Forests, has proposed an access fee to the South Colony Basin. The proposed fee area pertains to access to at least three Fourteeners, although the South Colony Basin is not in the current study area presented in this chapter. The fee proposal is currently under the public comment period. <http://www.fs.fed.us/r2/psicc/sanc/>

higher value on their high alpine Fourteener recreation experience compared to a “typical” hiking experience, and may be unwilling to substitute their Fourteener recreation. This may lead to considerable environmental and policy making challenges.



Fig. 4. Illustrates the high volume of hikers climbing Mount Bierstadt, a Fourteener, approximately 20 km east of the community of Alma. As can be seen, Fourteener climbing can be more of a social experience than a solitary one. Photo courtesy of Kelly Loomis.



Fig. 5. below, is the photo of a trail from Mount Elbert, located 10km south of the town of Leadville. This particular trail illustrates widening and erosion due to high visitor use. Photo courtesy of Loretta McElhiney of the USDA Forest Service, Leadville Ranger District.

5. Economic values of high mountain recreation

5.1 Expenditure data and willingness to pay during times of economic expansion versus times of economic recession

This section compares an economic valuation of high alpine Fourteeners, conducted in summer 2006, when the U.S. economy was at its peak to an economic valuation conducted

during 2009 when the economy was considerably depressed. This comparison provides some perspective about how income from recreation compares to other financial sectors when the economy is depressed. In addition to declines in consumer confidence in 2009, the U.S. GDP declined four consecutive quarters during 2008-2009, marking the longest U.S. recession in 60 years (Bureau of Economic Analysis, 2009). Some writers have dubbed this recession the “Great Recession,” attempting to draw parallels with the Great Depression of the 1930’s (Isidore, 2009). Obviously, a recession means that economic prosperity is diminished, but the results from Keske and Loomis (2007) and Loomis and Keske (2007) indicate that recreators will continue to place high value on their mountain recreation experience, in spite of the decline in economic conditions. That is, recreation may be more recession proof than other economic sectors. In order to assess the value that recreators contribute to the economic development of the study region, the following hypotheses were tested:

1. Do visitor expenditures change before and after the recession?
Ho: $\text{Expend}_{i2006} = \text{Expend}_{i2009}$ vs. Ha: $\text{Expend}_{i2006} \neq \text{Expend}_{i2009}$
2. Does visitor willingness to pay (WTP) change before and after the recession?
Ho: $\text{Mean WTP}_{2006} = \text{Mean WTP}_{2009}$ vs. Ha: $\text{Mean WTP}_{2006} \neq \text{Mean WTP}_{2009}$

Sampling for both 2006 and 2009 was conducted at Quandary Peak, a recreation area that is southwest of Denver, Colorado. Quandary Peak is approximately 15 kilometers miles directly south of the resort town of Breckenridge, and 10 kilometers north of Alma. A photo of Quandary Peak is presented in Figure 6. In 2006, surveys were distributed over three days, on two separate non-holiday weekends during August and September 2006. The mail back survey booklet was designed in accordance with Dillman’s Tailored Design Method (Dillman, 2000). The 2006 mail back surveys were distributed by two volunteers trained on survey distribution procedures. Hikers were approached at trailheads and in parking lots at the conclusion of their recreation activity. There were no refusals to take the survey in 2006. After providing the visitors with the survey and a postage paid return envelope, names and addresses were also collected so that a second survey could be mailed to non-respondents. Of the 199 mail back surveys handed out, 129 surveys were returned, for a response rate of 65%. Based on a comparison of group sizes from our survey data collected during these three weekend days to group sizes from U.S. Forest Service data collected by a non-government organization during the majority of weekends, it appears as though the 2006 data was representative of the summer season.



Fig. 6. Quandary Peak, located 15 km north of Alma, Colorado, Leadville Ranger District. Photo courtesy of Loretta McElhiney of the USDA Forest Service.

The 2009 data collection process, including trailhead location and survey distribution procedures, mirrored the 2006 data collection process. In 2009, two individuals were trained in the distribution of surveys: a graduate student, and one of the same volunteers instrumental in the distribution of the surveys in the 2006 study. As with the 2006 study, visitors were provided with the mail back survey and a postage paid return envelope. Three weeks later, replacement surveys were mailed to non-respondents. A total of 345 surveys were distributed over five weekend days during July and August, 2009. A total of 248 surveys were returned for a response rate of 72%.

The survey included separate sections, described as follows:

Information regarding the specific trip: Seven questions regarding trip purpose and recreational activities.

Trip expenditures: Five questions addressing trip expenditures on the trip in Colorado. Respondents were asked to report the amount that they and members of their parties (e.g., family, companions) spent in each category. To put expenditures on a per visitor basis, these expenditures were divided by the number of people in the group. Asking for expenditures from the entire party and then dividing by group size is the preferred approach to avoid overestimating per person expenditures (Stynes and White, 2006).

Dichotomous Choice Contingent Valuation Question. *The WTP question was: As you know, some of the costs of travel such as gasoline, campgrounds, and hotels often increase. If the **total cost** of this most recent trip to the recreation area where you were contacted had been \$X **higher**, would you have made this trip to **this** Fourteener?*

Circle one: YES NO

The \$X bid amount had values ranging from \$2 to \$950, randomly varied across all surveys distributed.

There was no statistical difference between visitor expenditures in 2006 and 2009 at the 5% level of significance, with the exception of gasoline purchases which is significantly different at the 10% level. The decreased expenditures on gasoline may be attributable to the fact that visitors, on average, traveled fewer miles to the recreation site in 2009 compared to 2006. Therefore, Fourteener recreation was unaffected by the recession. This is summarized in Table 1, and presented in 2007 dollars to correct for inflation.

We fail to reject the null hypothesis that visitor expenditures were the same in 2006 and in 2009.

Category	2006 Mean	2009 Mean	T-Statistic (P-value)
Miles Driven	264	214	1.12 (.267)
Gasoline Purchases	\$61.04	\$42.00	1.69 (.092)
Retail Supplies	\$13.24	\$15.85	-.363 (.717)
Equipment Purchases	\$25.14	\$28.28	-.441 (.659)
Hotel	\$81.62	\$129.40	-1.29 (.196)
Food in Restaurants	\$78.32	\$80.48	-.401 (.689)

Table 1. Comparison of 2006 and 2009 Per Trip Hiker Expenditures in Colorado (\$2007)

Longitudinal USFS data indicate that visitor use did not decline between 2006 and 2009. Data reveal that, if anything, visitor use increased from 2006 to 2009. In 2006, 121 contacts were made over 2 non-holiday weekend days, (for an average of 60.5 climbers observed per day). Expanding and projecting this data over 32 non-holiday weekend days from June to

September (optimal Fourteener climbing months, due to weather), the estimated weekend use data were roughly 1,932 visitors. In 2009, there was reported contact with 500 recreators over 6 days, for an average of 83.3 climbers observed per day, or 2,666 visitors over 32 non-holiday weeks. These observations show an increase in visitor contacts, compared to 2006. These numbers are also consistent with our sampling frame, which showed a consistent distribution of approximately 65 surveys per day for 2006 and 2009.

5.2 Contingent valuation (WTP) test results

Table 2 presents the WTP estimates obtained from the 2006 data and the 2009 data to calculate mean WTP and the associated 90% confidence intervals. In 2006 dollars, the mean WTP per person per trip in 2009 is \$139 which is 9% below the WTP per person in 2006 (\$152). However, as shown in Table 3, the 90% confidence intervals in 2006 overlap the mean WTP in 2009 and vice versa. This indicates there is no statistical difference between the WTP per person per trip in 2006 and 2009. This is further illustrated in Figure 7, which demonstrates no significant different in the mean willingness to pay, and the overlapping confidence intervals. Thus we fail to reject the null hypothesis of no difference in mean WTP between the two time periods. This implies that visitors place the same value on their recreation experience when the economy is struggling, in general, compared to times when the economy is doing well.

	Mean WTP	90% Lower CI	90% Upper CI
2006 data	\$152	\$123	\$190
2009 data	\$139	\$119	\$167

Table 2. Mean Willingness To Pay, Per Person Per Trip, and 90% Confidence Intervals

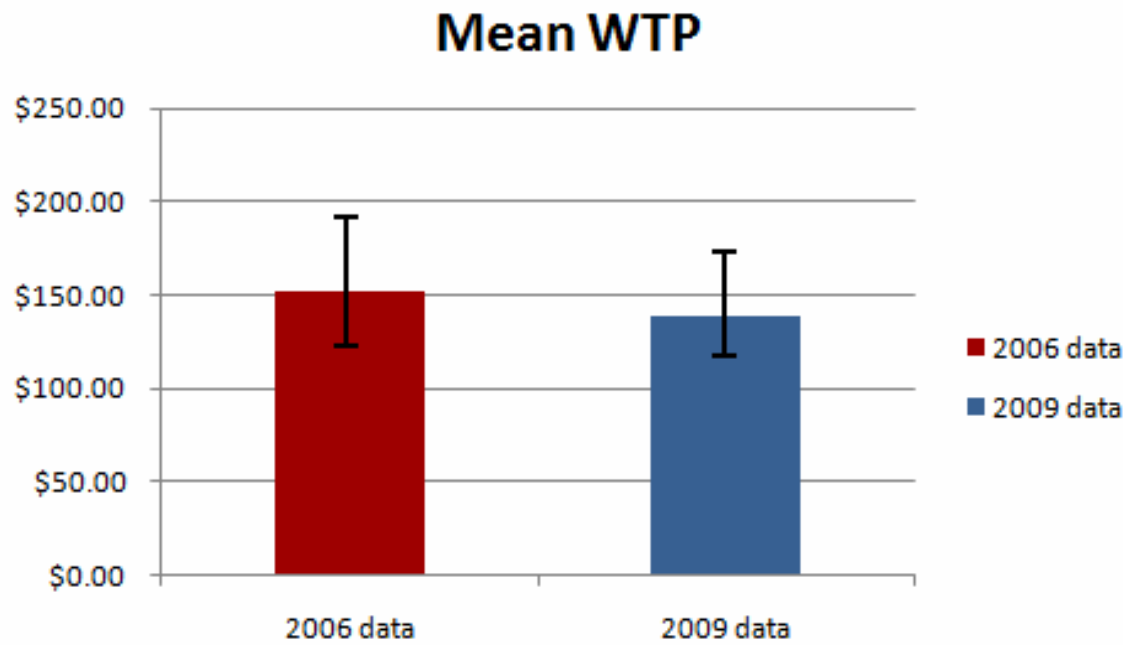


Fig. 7. Illustrating results from contingent valuation modelling, and the non-overlapping confidence intervals in 2006 and 2009. This indicates that recreators have a similar consumer surplus between 2006 and 2009.

The seemingly “recession proof” nature of high mountain recreation reveals that visitors expend as much money during hard economic times as they are willing to spend during vibrant economic times, and that they are willing to spend even more. The values that recreators place on high alpine recreation, by comparison, is more than that of other hiking and rock climbing studies. Several rock climbing studies serve as comparison, including one in Colorado by Ekstrand (1994). He asked rock climbers at Eldorado Canyon outside of Boulder, Colorado what they would pay to do similar climbs but at remote wilderness locations. His value of \$27.95 per day in 1991 is equivalent to \$40 when adjusting for inflation to 2006. Grijalva and Berrens (2003) estimated a value of rock climbing in Texas at between \$47 and \$56 per day trip. More comparable to our study is the study by Grijalva, et al. (2002) that involves climbing in USDA U.S. Forest Service designated wilderness areas. These authors found a WTP of only \$20 to \$25 per person to avoid closing several climbing sites in several National Forest, National Park and Bureau of Land Management (BLM) Wilderness areas. Using a count data model for climbing in the Italian Alps, Scarpa, Tempesta, and Thiene (2003) estimated (in Euros, which have been converted to dollars), consumer surplus of \$23 to \$38 per day trip. However, Scarpa, et al. (2003: 118), notes that their consumer surplus figures are probably underestimates due to not accounting for travel time in the travel cost variable.

It is believed that the remarkably high consumer surplus can be attributed to the fact that Fourteeners are considered “special” environmental icons that provide place attachment to Colorado visitors and tourists alike. There are no close substitutes. Place attachment theory, developed in sociology (Cross, 2001), environmental psychology (Kyle et al., 2004), and geography (Manzo and Perkins, 2006), postulates that there can be a psychological connection between a community and a natural resource. Research by Blake (1999, 2002, 2008) suggests that Fourteeners are synonymous with Colorado’s identity, and that Fourteener references are ubiquitous—appearing on everything from Chamber of Commerce information and local festivals to print advertisements and postcards. Blake (2002) indicates that more easily recognizable Fourteeners such as Long’s Peak in Rocky Mountain National Park and Pikes Peak in Colorado Springs also provide a state identity. Thus, our economic findings are consistent with other disciplines that have recognized that there is something unique about both specific and the collection of Fourteeners, and in the minds of some visitors, there may not be substitution between peaks.

This yields concerns for environmental sustainability for high alpine soils and vegetation. Visitors have already demonstrated that they are willing to pay a relatively high amount of money to hike these high alpine peaks, and further research validates that visitors may not be willing to substitute to these high mountain ecosystems, even with substantial cost increases. This seemingly inelastic demand for high mountain recreation brings interesting management implications needed to reduce visitor use to levels that are necessary for achieving environmental targets.

5.3 Visitor willingness to substitute high alpine experiences

An expanded study of the Colorado Fourteener project examined the willingness for hikers to substitute their recreation experience. During the summers of 2006 and 2007 a total of 939 surveys were distributed to hikers visiting a stratified sample of Fourteener peaks throughout Colorado. Approximately half the surveys were distributed at several of the popular Fourteeners along or nearby the Front Range dominated by Denver, Colorado Springs and the peaks nearby several resort towns (e.g., Breckenridge and Aspen). There

were 18 refusals to take the survey, all of which took place at the Maroon Bells in Aspen. After providing the visitors with the Fourteener survey and a postage paid return envelope, volunteers collected follow-up information for the second round of survey distribution to follow Dillman's (2000) repeat mailing recommendation. In total 560 surveys have been returned, for a response rate of 60%. The primary valuation question was:

1a. As you know, some of the costs of travel such as gasoline, campgrounds, and hotels often increase. If the total cost of this most recent trip to the recreation area where you were contacted had been \$X higher, would you have made this trip to this Fourteener?

Circle one: YES NO

The \$X bid amount had values ranging from \$2 to \$950. In order to ascertain if hikers would switch to another Fourteener to avoid the increase in cost, hikers were asked:

1b. If the total cost of this most recent trip to the recreation area where you were contacted had been \$_____ higher, would you have made this trip to a different Fourteener where you would not have these higher costs?

Circle one: YES NO

In order to ascertain if hikers would switch to a lower elevation Thirteener to avoid the increase in cost, hikers were asked:

1c. If the total cost of this most recent trip to the recreation area where you were contacted had been \$_____ higher, would you have made this trip to a Thirteener (one of Colorado's 13,000 foot summits) where you would not have these higher costs?

Circle one: YES NO

The three-part dichotomous choice contingent valuation survey questions were presented separately, and were not made contingent upon the answer to the first question. The rationale behind this decision was based upon feedback provided by USDA Forest Service wilderness managers and non-profit organizations like the Colorado Mountain Club and the Colorado Fourteeners Initiative, whose qualitative research revealed that there would be different patterns of substitutability in Fourteener hikers. In summary, the field research conducted by these organizations revealed that there were people who were simply drawn to hike or climb a single Fourteener, or simply a high peak, like a Thirteener (and it often doesn't matter which Thirteener they hike). However, there were other hikers for whom there were no substitutes. These three questions were designed to detect whether there were substitutes for the Fourteener at which the subject was contacted.

In order to classify visitors that would and would not substitute for their current Fourteener, the response patterns to questions 1a, 1b and 1c were analyzed and grouped as follows:

Group One: Visitors who would not substitute another Fourteener or Thirteener:

This group consists of two types of response patterns: 44% of the total respondents said YES they would pay more for their current Fourteener (1a=YES), and NO to avoiding the increase in cost by visiting a different Fourteener (1b=NO) and/or a Thirteener (1c=NO). A second category of visitors who did not indicate willingness to substitute are those that said NO to paying the increase (1a=NO) not only at their current Fourteener, but also NO at the substitute Fourteener (1b=NO) and Thirteener (1c=NO). This response pattern indicated to us that if they could not go to their current Fourteener, they did not want to go a different Fourteener or Thirteener either (i.e., they would stay home or do something quite different). This second category represented about 16% of the total sample. Thus, approximately 60% of the total visitors reported no substitutes to their current Fourteener at the bid amount they were asked to pay.

Group 2: Visitors who would substitute another Fourteener or Thirteener:

This group also consists of two categories of respondents with a willingness to substitute as follows: The first category consisted of visitors who stated NO to question 1a on willingness to pay the increase cost for their current Fourteener, and YES on 1b and/or 1c to avoid the cost increase and therefore visit a different Fourteener or a Thirteener. This represented about 27% of the sample. However, the substitution group also included some visitors who initially said they would pay the cost increase to visit their current Fourteener, but then indicated they would switch to another Fourteener (YES on question 1b) or a Thirteener (YES on question 1c) to avoid the cost increase with visiting their current Fourteener (13% of the sample). Thus, overall the substitution group represents about 40% of the total visitors. Table 3 summarizes the mean WTP and 90% confidence intervals for the Substitute Group and the No Substitute Group. The \$294 mean trip value for those not willing to substitute another Fourteener is more than triple the \$88 trip value for those willing to substitute another Fourteener or Thirteener. This suggests substantial differences in valuations. As can be seen in Table 3, the 90% confidence intervals do not overlap suggesting that these mean WTP amounts are statistically different (the same is true of the 95% confidence intervals, not shown).

Group	Substitute Group	No Substitute Group
Mean	\$88	\$294
Upper 90% CI	\$122	\$397
Lower 90% CI	\$67	\$232

Table 3. Mean WTP per person per trip and 90% Confidence Intervals (CI)

It should be noted that no questions were asked in the survey booklet inquiring whether consistent refusals to pay the bid amount were protests to some feature of our constructed market. However, we systematically reviewed the written comments visitors were encouraged to write on the back of the survey for indication of protest responses to the WTP question. In the first review phase, the qualitative data (entered by ID number), were reviewed for potential protest information. If the comments indicated a potential protest, then the responses to the three contingent valuation questions were examined. Based upon review of the written comments, approximately 17 responses were categorized as having the potential to be protest responses. The majority of these respondents wrote on either the importance of maintaining public access to Fourteeners, the potential for environmental damage due to crowding, or the effect of crowds on their “natural” experience. Interestingly, responses to the contingent valuation questions for these individuals were distributed fairly evenly, and there were not indications of response bias or protest responses in these 17 responses.

In the second phase of the protest investigation, surveys were screened for individuals who answered “no” to all three dichotomous choice WTP questions in order to examine whether there were any qualitative patterns to their responses. Unfortunately, the majority of these individuals did not provide an explanation for their responses. However, a general review of all written comments indicates that a majority of respondents that did comment focused on the effect of increased costs on their willingness to either substitute (or to not substitute) to other locations. This indicated that respondents understood the WTP questions, and answered accordingly to their preference of whether to substitute.

Clearly, there is a rather large number of individuals for whom there appears to be no substitutes for their high mountain alpine recreation experience. Based on statistical analysis of responses of Fourteener recreationists, it was determined that there were two statistically different groups of hikers. A logistical regression was tested on the effects of charging a \$70 entrance fee to reduce use:

- a. The first group consists of dedicated recreators. 89% will pay a \$70 fee rather than substitute. Using a dichotomous choice contingent valuation question, the consumer surplus or net WTP of this group was \$294 with a 90% confidence interval of \$232-\$397.
- b. The second group are more casual recreators that are likely to substitute to another Fourteener or lower elevation Thirteener to avoid a cost increase at their current Fourteener. This group has a consumer surplus of \$88, with a 90% confidence interval of \$67-\$122. This group would reduce their use of the current Fourteener by 40% at a \$70 fee.

Separate WTP curves were estimated for dedicated and casual recreators to quantify the rate at which each would substitute other peaks for the Fourteener where they were intercepted. This was done by estimating separate logit regression models for each of these two groups in order to determine their WTP for the current Fourteener and to allow for a likelihood ratio test to determine if their logit coefficients are statistically different. The separate logit regressions allowed for calculating separate logit WTP curves, illustrating the relationship between the percentages of each type of visitor that would pay different fee increases (Figure 8).

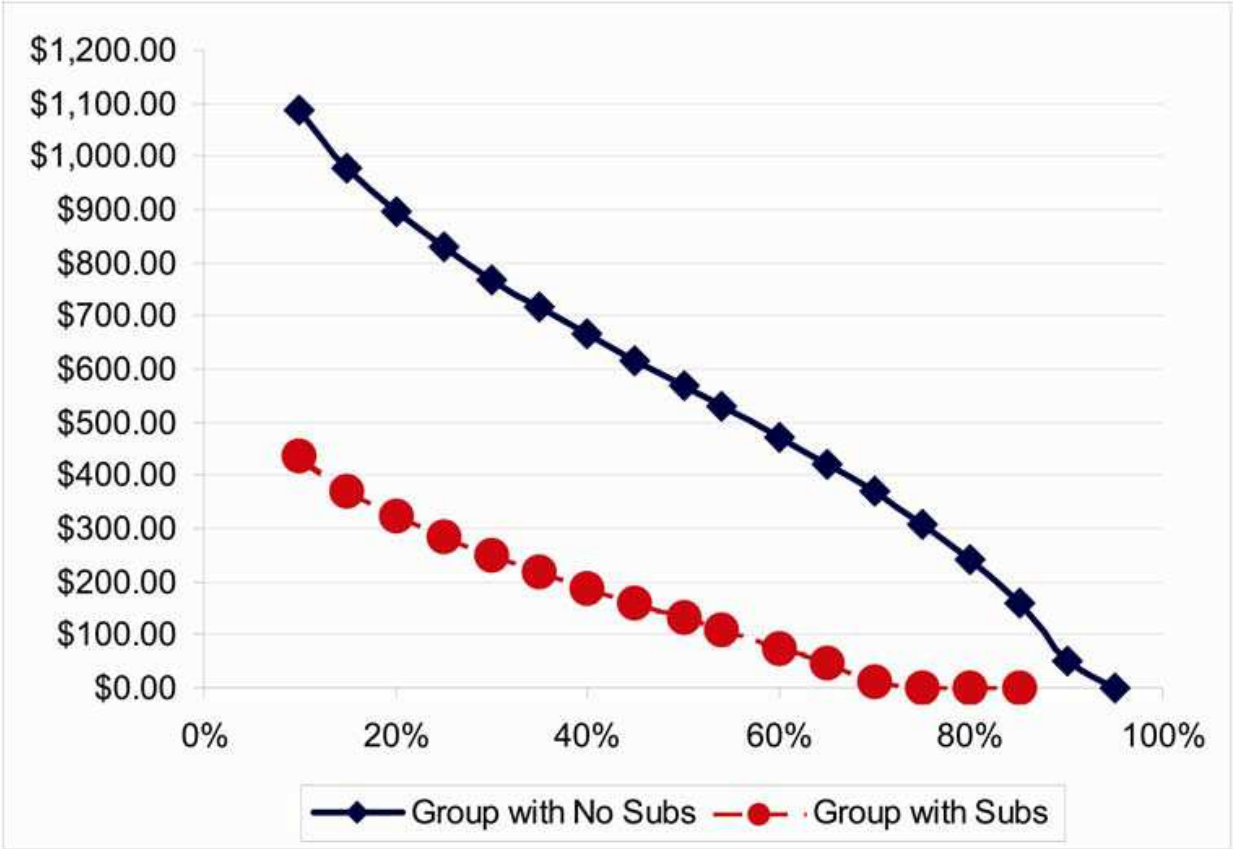


Fig. 8. Logit WTP Curves for No Substitute Group and the Substitute Group

Given that 60% of the hikers were dedicated, and 40% of hikers were casual, a \$70 fee would result in an overall 22% reduction in visitor use to the current Fourteeners. This magnitude of reduction in visitor use may be sufficient to reduce the rate of trail erosion and loss of vegetation so as to stabilize the alpine environment surrounding these peaks. Also, the funding provided by the \$70 fee could yield substantial revenue for replacement of the multiple social trails scarring the many popular Fourteeners with a single carefully located and maintained trail. While precise estimates of Fourteener use are not available, the public land management agency and volunteer groups estimate roughly 100,000 Fourteener visitors per year. Given the 22% reduction in use with the \$70 fee, the remaining 78% of visitors paying the \$70 fee would produce \$5.4 million revenue if the fee was applied per person or \$2.73 million if the fee was charged per vehicle, as the National Park Service does. Taken together, the reduction in use, and funding for better management could allow for more sustainable visitor use, and the avoidance of the need to impose daily quotas or caps on visitor use.

Although the findings indicate that introduction of fees at public Fourteeners may have desired effects on Fourteener use, practical implementation of the policy is another matter. There was not a clear pattern of protest responses in our survey; more than one dozen respondents provided written comments on the need to maintain unrestricted access to Fourteeners. Interestingly, these comments were counter balanced by individuals who also urged a small fee to enhance trail maintenance and to mitigate environmental damage, including damage due to crowding. Although those “tuned in” to the issue of access fees may represent a minority, it is evident from blogs and USDA Forest Service qualitative studies that this group is likely to present fierce opposition to such a policy.

6. Community preferences for use of high mountain ecosystems

Results of the expenditure and contingent valuation studies on Colorado’s high mountain peaks indicate that there are significant economic development opportunities stemming from the mountain ecosystems. However, as noted by the MA report, the connection between natural ecosystems and cultural ecosystem services such as recreation and aesthetics is an important part of sustainability. Thus, as part of this project, community preferences for recreation and ecosystem management were also assessed as part of two stakeholder meetings within the case study region in order to determine the cultural fit and community preferences for high mountain recreation.

6.1 Stakeholder meetings

Meetings were held on two consecutive weekdays in the respective communities, at centrally located, established community meeting halls, the Alma Town Hall and the Leadville Mining Museum. In order to generate support for the meetings, community flyers were posted in local businesses, ads were posted in the respective newspapers, e-mails were distributed to key public officials such as the mayor’s office and the county commissioners. Community meetings also were advertised by word of mouth, which was revealed to be a common and effective means of information transfer in these rural communities.

The 90-minute stakeholder meetings were organized into four parts. The first 10-minutes allowed for introductions and a review of the project objectives and phases, including future

community-level surveys and soils field work to evaluate the carrying capacity of recreational lands. The overview was presented by the lead project investigator, who provided insight into how the results would be integrated into future study phases. The introduction was limited to 10 minutes, in order to balance the objectives of obtaining stakeholder input, ensure adequate attendance, and facilitate an efficient meeting. The introductions were followed by a brief question and answer session to ensure that participants understood the purpose of the study and their own role in providing valuable information. Despite the limited introduction time, all stakeholders were introduced to project investigators prior to the beginning of the stakeholder meeting and had ample opportunity to have questions addressed following the meeting.

This study implemented an alternative design for a public meeting to facilitate public involvement. The introductions were followed by a 50-minute session where the stakeholders presented input, and reviewed instantaneous results, using an Audience Response System (ARS) system. ARS was used in a public forum to facilitate more efficient information exchange among citizen stakeholders and promote critical thinking and dialogue. The ARS technology enabled stakeholders to reveal their preferences anonymously in a group setting, thereby providing information to the entire group in real time (Keske and Smutko, 2010).

ARS technologies that actively poll participants and show immediate responses have been in existence for decades. Declining costs for such systems during the past ten years have made the technology affordable for university, as well as primary and secondary educational settings (Banks, 2006). Recent technological advancements have also improved transportability and ease of use. There are several ARS systems currently available.

Most commercial systems consist of three components: a receiver, software, and hand-held transmitters ("the clickers"). Most systems utilize a small, wireless receiver that plugs into the facilitator's USB computer port. The facilitator polls the audience with a set of pre-determined questions, which can be projected onto a large screen using a computer with Microsoft Office-compatible software and projector. Respondents transmit their answers with the small, lightweight, hand-held remote controlled clickers, and results are shown immediately after the brief (usually 15-45 seconds) polling period. The facilitator can choose to present the results in numerous ways. For example, polling may be active, which allows respondents to observe (and therefore become influenced by) the votes and decisions of others while they are still deciding how to vote. Another option is for the facilitator to cast a "revote" after more information is provided in order to measure the change in response.

Two ARS practice questions were instituted to ensure that stakeholders were comfortable with the system. After the ARS voting, there were 20-minutes of small group discussion, where participants provided validation to the responses, and elaborated upon other key issues that emerged during the ARS presentations. The last 10 minutes were spent on the stakeholder meeting evaluations. Both communities received information about the other stakeholder events. Results were also disseminated through the local newspapers, *The Fairplay Flume* and the *Leadville Herald Democrat*, by journalists who attended the meetings. Further validity was provided by comparing ARS results from the Region 8 United States Environmental Protection Agency, who followed up our results with Internet surveys and a "Virtual Forum" chat room (United States Environmental Protection Agency, 2010).

6.2 Results

ARS results for each of the stakeholder meetings are presented in Table 4. The results are arranged according to each of the three themes (trade offs, distribution of costs and benefits, and cultural fit), with the response percentages rounded to the closest whole number. Participants also reflected long-term residents, and statistics were nearly identical for both communities. More than 20% of participants resided in the community between 5-10 years. More than 55% of residents resided in the community greater than 10 years. The majority (72%) of Leadville attendees actually worked in Leadville. In contrast, not quite half of the Alma attendees reported working within the county.

Stakeholders in both communities expressed that they felt that traditional Old West industries could co-exist with recreation and heritage economic development in their communities to some extent. 75% of the Park County stakeholders agreed with the statement that “an expanded heritage and recreation economy will have a positive impact on our existing farm and ranch enterprises”, while the remaining 25% believed that there would be no effect. By way of explanation, during the break-out sessions, several attendees felt that Park County was already successful in encouraging agri-tourism, and that it should continue on this path. With high elevation ranching far more prevalent in the meadows of the Park County, Lake County residents were asked: “What would be the most important thing that could be done to make the Mineral Belt Trail biking trail a keystone attraction for Leadville?” There was high amount of variation in the responses, with the majority (54%) preferring to emphasize the Mineral Belt Trail as a biking destination, 29% of the respondents preferring to highlight the Trail’s historic mining aspects, and 17% wishing to improve the retail and concession opportunities.

There was an interesting difference in the community attitudes towards extraction. Almost exactly one-third of the Alma residents felt that mining could not coexist in a recreation and heritage economy and one-third felt that mining would compromise heritage and recreation tourism. One-third of Alma residents felt that the mining and heritage/recreation economic sectors could coexist. In Leadville, where the reopening of a mine may be a possibility in the near future, the numbers were almost exactly reversed. Two-thirds of the Lake County residents felt that “Mining can coexist very well with an expanded heritage and recreation economy”, while 25% felt that there would be trade offs between the two sectors. Only 9% of Lake County residents felt that “mining is not at all compatible with an expanded heritage and recreation economy.”

In contrast, responses to other trade off questions were similar for the communities. While the questions were worded slightly differently, approximately 75% of respondents expressed that there would be positive benefits to their land and community from a transition to a recreation and heritage economy. Another similarity is that a majority of residents of both communities felt that their safety would remain unaffected by an increase in heritage and recreation economic development; however, a considerable number (45% in Alma and 23% in Leadville) believed that their safety would decrease, citing recent murders at remote mountain recreation sites.

Stakeholders were generally optimistic that benefits from an expanded heritage and recreation economy would accrue to local residents, both financially and in other ways. When asked whether an expanded heritage and recreation economy would bring more jobs for local residents, 92% of Lake County respondents, and 74% of Park County respondents

agreed with that statement. Although most respondents believed more jobs would result, more than half – 60% in Lake County and 52% in Park County – thought that overall incomes in their respective counties would remain the same. This perceived separation of job numbers from total income may stem from a belief voiced among some stakeholders at the two meetings that wages in the tourism industry are generally lower than wages in other economic sectors.

Respondents in Lake County overall were more positive than Park County respondents about the potential financial benefits of heritage and nature-based tourism. When asked if they would realize personal financial gain from an expanded heritage and recreation economy, 69% of Lake County respondents indicated that they would be much better off or slightly better off financially compared to only 39% in Park County. However, perceptions of non-financial benefits resulting from heritage- and nature-based tourism were more evenly matched between the two counties. When asked if they would gain more than just financial benefits from an expanded heritage and recreation economy, 88% of meeting participants from Park County agreed or strongly agreed with that statement compared to 78% of respondents from Lake County.

Differences between the two counties with respect to expectations for financial gain may be a reflection of the differences in meeting participants' employment and occupation status. Nearly 43% of the people attending the Lake County meeting were employed in the retail/service or building/utility sectors, compared to just 17% of Park County participants. Moreover, 28% of the Park County participants were retired as compared with just over 8% of the Lake County participants.

Commensurate with their optimism about potential financial gains from an expanded heritage and recreation economy, Lake County residents were more sanguine about how wealth and benefits would be spread among county residents. Most (56%) Lake County respondents believed that benefits would be dispersed among a wide range of people in their county, compared to only slightly more than a third (37%) of Park County respondents. Nearly half (48%) of the Park County residents thought that benefits would accrue to a small subset of people in the county, and another 15% believed that outsiders would gain the most. In Lake County, 36% and 8%, respectively, believed that wealth would be accumulated by a small subset of people or outsiders.

The third line of inquiry in the ARS stimulus questions was that of cultural fit. We were interested in learning how stakeholders perceive heritage- and nature-based tourism and tourists with respect to their own sense of cultural identity. Cultural compatibility is an important consideration in developing a tourism economy in a locality for the principal reason that local residents are essentially inviting people into their communities and sharing the experiences and amenities that are important and valuable to them. Cultural fit even blends into perceptions of cultural, economic, and environmental sustainability and the trade offs that must be made to accommodate growth in this economic sector.

We began with a question about the perceived status of the existing tourism infrastructure. We asked participants whether the quality and quantity of motels, restaurants, shops and attractions in each county was sufficient, was somewhat lacking but still could support an expanded heritage and recreation based economy, or was sorely lacking and needed improvement in order to support an expanded heritage and recreation economy. The responses were surprisingly different in each county, despite similarities in the number and

variety of retail services between the communities, and proximity to resort communities. In Park County, 97% of the respondents considered their county's tourism infrastructure to be sufficient or only somewhat lacking. In Lake county, only 54% thought so well of the quality and quantity of their motels, restaurants, shops, and attractions. This is despite the fact that both counties feature approximately an equal number of accommodation and food service establishments. According to 2002 census data (U.S. Census Bureau, 2002), Lake County had 12 hotels, motels and inns and Park County had 15; and Lake County had 27 eating and drinking establishments while Park County had 24. Although these numbers say nothing about the quality of those establishments, both communities' accommodation and food service sectors are comprised almost exclusively of small, locally owned establishments.

Next, we asked stakeholders whether they believed an expanded heritage and recreation economy would be compatible with the lifestyle of their community, would change the lifestyle of their community to some degree, or would have a significant negative effect on the lifestyle of their community. The question was worded differently in each meeting locality. In Lake County we asked the question with respect to Leadville (e.g., compatible with *Leadville's* lifestyle), by far the largest of two incorporated municipalities in the county. All but two Lake County respondents resided in Leadville. For Park County, which contains nine incorporated towns, we phrased the question so that respondents answered with respect to their community of residence (e.g., compatible with *your community's* lifestyle). All Park County respondents were from one of three towns: Alma, Fairplay, or Como.

A total of 68% of Lake County respondents believed that an expanded heritage and recreation economy would be compatible with Leadville's lifestyle, while 27% thought that it would change the lifestyle of Leadville to some degree, and 5% said it would have a significant negative effect. All Lake county respondents agreed or strongly agreed with the statement, "An expanded heritage and recreation economy is a good fit for Leadville." Nearly all (95%) agreed or strongly agreed that expanded heritage- and nature-based tourism would be a good fit for the Twin Lakes area and northern Lake County.

In Park County, respondents were evenly split (48% and 48%, respectively) between the statements that an expanded heritage and recreation economy would be compatible with the lifestyle of their community, or would change the lifestyle of their community to some degree. A small minority (3%) believed that expanding tourism would negatively affect the lifestyle of their community. 96% of respondents believed that an expanded heritage and recreation economy would be a good fit for central Park County (Alma, Fairplay and Como), 88% believed that it would be a good fit for southern Park County (the Lake George, Hartsel area), and a small majority, 52%, felt the same about the cultural fit with eastern Park County (Bailey, Shawnee and Grant).

When we asked stakeholders about the type of heritage and recreation activities that they thought would provide the most economic benefit to their county, answers differed significantly between the two counties. In Lake County, backcountry recreation such as mountain climbing, hiking, and cross-country skiing was considered by most people (59%) to be the most promising economically, followed by heritage and historic tourism, wildlife viewing, and birding at 23%. ATV riding and snowmobiling came in a distant third at 14%. Park County respondents were nearly evenly split among backcountry recreation (34%), heritage and historic tourism (34%), and fishing, hunting and shooting (28%). One Park County participant ranked All-Terrain Vehicle (ATV) and snowmobiling as having the

Theme: Tradeoffs	
Park County	Lake County
An expanded heritage and recreation economy in Park County... 1. Will have a positive impact on our existing farm and ranch enterprises (74%) 2. Will have no affect on our existing farm and ranch enterprises (22%) 3. Will have a negative impact on our existing farm and ranch enterprises (3%)	What would be the most important thing that could be done to make the Mineral Belt Trail a keystone attraction for Leadville? 1. Make enhancements to highlight it as an historic mining destination (29%) 2. Make enhancements to highlight it as a bicycling destination (54%) 3. Make enhancements to include more retail, restaurants and lodging (17%)
If mining were to make a comeback in Park County... 1. Mining can coexist very well with an expanded heritage and recreation economy (31%) 2. Mining can coexist with an expanded heritage and recreation economy, but with some losses to tourism and recreation (34%) 3. Mining is not at all compatible with an expanded heritage and recreation economy (34%)	What is your opinion about mining and a heritage-recreation economy in Lake County... 1. Mining can coexist very well with an expanded heritage and recreation economy (65%) 2. Mining can coexist with an expanded heritage and recreation economy, but with some losses to tourism and recreation (26%) 3. Mining is not at all compatible with an expanded heritage and recreation economy (9%)
An expanded heritage and recreation economy in Park County will have a negative effect on the land and my community 1. Strongly Agree (0%) 2. Agree (17%) 3. Disagree (75%) 4. Strongly Disagree (8%)	An expanded heritage and recreation economy in Lake County will have a positive effect on the land and my community 1. Strongly Agree (24%) 2. Agree (43%) 3. Disagree (24%) 4. Strongly Disagree ((10%)
An expanded heritage and recreation economy in Park county will... 1. Make me feel safer (0%) 2. Have no effect on how safe I feel (57%) 3. Make me feel less safe (43%)	An expanded heritage and recreation economy in Lake County will... 1. Make me feel safer (0%) 2. Have no effect on how safe I feel (77%) 3. Make me feel less safe (23%)
	Significant environmental clean up in Lake County is necessary to expand the heritage and recreation economy here 1. Strongly Agree (25%) 2. Agree (17%) 3. Disagree (50%) 4. Strongly Disagree (8%)

	<p>An expanded heritage and recreation economy in Lake County will have a positive effect on water quality</p> <ol style="list-style-type: none">1. Strongly Agree (5%)2. Agree (25%)3. Disagree (70%)4. Strongly Disagree (0%)
Theme: Distribution of Costs and Benefits	
Park County	Lake County
<p>If Park County expands its heritage and recreation economy...</p> <ol style="list-style-type: none">1. There will be more jobs for local residents (74%)2. There will be about the same number of jobs for local residents (22%)3. There will be fewer jobs for local residents (4%)	<p>If Lake County expands its heritage and recreation economy...</p> <ol style="list-style-type: none">1. There will be more jobs for local residents (92%)2. There will be about the same number of jobs for local residents (8%)3. There will be fewer jobs for local residents (0%)
<p>If Park County expands its heritage and recreation economy...</p> <ol style="list-style-type: none">1. Overall, incomes in the county will increase (45%)2. Overall, incomes in the county will remain about the same (52%)3. Overall, incomes in the county will decrease (3%)	<p>If Lake County expands its heritage and recreation economy...</p> <ol style="list-style-type: none">1. Overall, incomes in the county will increase (40%)2. Overall, incomes in the county will remain about the same (60%)3. Overall, incomes in the county will decrease (0%)
<p>An expanded heritage and recreation economy in Park County will likely make me:</p> <ol style="list-style-type: none">1. Much better off financially (4%)2. Slightly better off financially (33%)3. Unaffected financially (59%)4. Slightly worse off financially (0%)5. Much worse off financially (4%)	<p>An expanded heritage and recreation economy in Lake County will likely make me:</p> <ol style="list-style-type: none">1. Much better off financially (26%)2. Slightly better off financially (43%)3. Unaffected financially (30%)4. Slightly worse off financially (0%)5. Much worse off financially(0%)
<p>I would gain more than just financial benefits from an expanded heritage and recreation economy</p> <ol style="list-style-type: none">1. Strongly agree (21%)2. Agree (57%)3. Disagree (18%)4. Strongly disagree (4%)	<p>I would gain more than just financial benefits from an expanded heritage and recreation economy</p> <ol style="list-style-type: none">1. Strongly agree (46%)2. Agree (42%)3. Disagree (13%)4. Strongly disagree(0%)

<p>If Park County expands its heritage and recreation economy...</p> <ol style="list-style-type: none">1. Benefits will be dispersed among a wide range of people in Park County (37%)2. Benefits will accrue mostly to a small subset of people in Park County (48%)3. Benefits will accrue mostly to outsiders (15%)	<p>If Lake County expands its heritage and recreation economy...</p> <ol style="list-style-type: none">1. Benefits will be dispersed among a wide range of people in Lake County (56%)2. Benefits will accrue mostly to a small subset of people in Lake County (36%)3. Benefits will accrue mostly to outsiders (8%)
<p>An expanded heritage and recreation economy in Park County will have a negative effect on me</p> <ol style="list-style-type: none">1. Strongly Agree (0%)2. Agree (18%)3. Disagree (57%)4. Strongly Disagree (25%)	
Theme: Cultural Fit	
Park County	Lake County
<p>The quality and quantity of motels, restaurants, shops and attractions in Park County...</p> <ol style="list-style-type: none">1. Is ready to support an expanded heritage and recreation economy (45%)2. Is somewhat lacking, but there is enough to support an expanded heritage and recreation economy (52%)3. Is sorely lacking and needs to be improved before we can expand a heritage and recreation economy (3%)	<p>The quality and quantity of motels, restaurants, shops and attractions in Lake County...</p> <ol style="list-style-type: none">1. Is ready to support an expanded heritage and recreation economy (9%)2. Is somewhat lacking, but there is enough to support an expanded heritage and recreation economy (45%)3. Is sorely lacking and needs to be improved before we can expand a heritage and recreation economy (45%)
<p>An expanded heritage and recreation economy in Park County...</p> <ol style="list-style-type: none">1. Will be compatible with the lifestyle of my community (48%)2. Will change the lifestyle of my community to some degree (48%)3. Will have a significant negative effect on the lifestyle of my community (3%)	<p>An expanded heritage and recreation economy in Leadville...</p> <ol style="list-style-type: none">1. Will be compatible with Leadville's lifestyle (68%)2. Will change the lifestyle of Leadville to some degree (27%)3. Will have a significant negative effect on the lifestyle of Leadville (5%)
<p>An expanded heritage and recreation economy is a good fit for [name of Park County community] (3 questions)</p> <p>Answers varied according to community</p> <ol style="list-style-type: none">1. Strongly Agree2. Agree3. Disagree4. Strongly Disagree	<p>An expanded heritage and recreation economy is a good fit for [name of Lake County community] (3 questions)</p> <p>Answers varied according to community</p> <ol style="list-style-type: none">1. Strongly Agree2. Agree3. Disagree4. Strongly Disagree

<p>What type of heritage and recreation activities will provide the most economic benefit to Park County?</p> <p>1. Backcountry recreation such mountain climbing, hiking, x-c skiing, etc. (34%)</p> <p>2. Fishing, hunting, and shooting (28%)</p> <p>3. Heritage and historic tourism, wildlife viewing, birding, etc. (34%)</p> <p>4. RV camping (0%)</p> <p>5. ATV riding and snowmobiling (3%)</p>	<p>What type of heritage and recreation activities will provide the most economic benefit to Lake County?</p> <p>1. Backcountry recreation such mountain climbing, hiking, x-c skiing, etc. (59%)</p> <p>2. Fishing, hunting, and shooting (5%)</p> <p>3. Heritage and historic tourism, wildlife viewing, birding, etc. (23%)</p> <p>4. RV camping (0%)</p> <p>5. ATV riding and snowmobiling (14%)</p>
<p>Which type of people would you most like to attract to Park County? People who...</p> <p>1. Stay for a day or two, then go back home (32%)</p> <p>2. Stay for a week or two, then go back home (57%)</p> <p>3. Have a second home here and visit regularly (7%)</p> <p>4. Want to settle here (4%)</p>	<p>Which type of people would you most like to attract to Lake County? People who...</p> <p>1. Stay for a day or two, then go back home (18%)</p> <p>2. Stay for a week or two, then go back home (55%)</p> <p>3. Have a second home here and visit regularly (23%)</p> <p>4. Want to settle here (5%)</p>
<p>Which type of people would you most like to attract to Park County? People who...</p> <p>1. Spend most of their time in the back country (0%)</p> <p>2. Split their time between the outdoors and town (79%)</p> <p>3. Spend time at a recreation area or ranch (10%)</p> <p>4. Pass through on a day trip (10%)</p>	<p>Which type of people would you most like to attract to Lake County? People who...</p> <p>1. Spend most of their time in the back country (0%)</p> <p>2. Split their time between the outdoors and town (95%)</p> <p>3. Spend time at a recreation area or ranch (0%)</p> <p>4. Pass through on a day trip (5%)</p>

Table 4. Results of Stimulus Questions (Organized by Thematic Category and County) Rural Community Preferences for Extraction and Recreation, Park and Lake Counties, Colorado, USA. Due to rounding, the sum of some values will be slightly greater than or less than 100%.

greatest economic potential. Interestingly, no one from either meeting site ranked Recreational Vehicle (RV) camping as potentially providing the most economic benefit. When asked about the type of people, in terms of duration of stay, they would most like to attract to their county, most respondents in both counties preferred those would stay for a week or two and then go back home (Lake County = 55%; Park County = 57%). Lake County stakeholders wanted visitors to stay longer (only 18% wanted people who stay a day or two versus 32% in Park County), and were more tolerant of second-homeowners (23% in favor versus 7% in Park County). We were also interested in stakeholder preferences about where visitors should spend time while in the county. Nearly all respondents (95% in Lake County and 79% in Park County) preferred tourists who split their time between the outdoors and in town. No one stated a preference for tourists who spend most of their time in the back country. A small minority of respondents (5% in Lake County and 10% in Park County) most wanted to attract visitors who pass through on a day trip.

7. Conclusions

This chapter reflects upon sustainability issues associated with the delicate, and unique, balance of economic and environmental tradeoffs in high mountain communities. How much recreational love can these ecosystems sustain? Much of this chapter is devoted to definitions of “sustainability” and methods for economic valuation. Economic studies conducted from 2006-2010 indicate that both recreators and residents place high value on the high mountain natural resources and lifestyles, even when compared to other natural experiences. Given the high potential for economic development, community residents and visitors to the region must consider trade-offs between economic drivers and environmental quality. This requires the use of collaborative conservation techniques, which should be accompanied by setting targets for both conservation and economic development.

Findings from an economic valuation study of Colorado’s high mountains indicate that visitors are willing to spend significantly more money for a high mountain recreation experience compared to a typical hiking experience, and that there may be an unwillingness to substitute their unique high elevation experiences for other natural experiences. In order to manage these delicate high alpine regions, environmental targets should be created that consider how to manage high volumes of visitor use, particularly in times of peak demand, where crowding may result in trail widening or other environmental damage that may lead to erosion. However, implementation of policies designed to reduce overuse of environmental resources may be difficult. Visitors place a great deal of value on these experiences, and the connection between visitors and these high mountain regions yield questions about income distribution and environmental equity, to ensure that visitors of varied income levels have access to these public lands. Imposing a fee to redirect hikers to using the public lands during off-peak timing may generate considerable resistance among lower income populations.

With regards to sustainable economic development in the high mountain regions, it is important to reflect upon the four pillars of ecosystem services that promote biodiversity and life on earth: supporting, provisioning, regulating, and cultural ecosystem services. From a cultural perspective, evidence from community focus groups in the study region indicates that high mountain recreation is part of the community culture, and extends beyond economic development. Furthermore, these high mountain communities view mineral extraction (often not viewed as a “sustainable” practice) and historic tourism as important components of the culture of these mountains. While high alpine regions of the world may have an ecological vulnerability that accompanies concerns of overuse, the cultural aspects of high mountain recreation should also be considered in assessing sustainability and the overall quality of mountain ecosystems.

The next phase of our work measures the carrying capacity of the high alpine soils with the visitor use in order to determine the balance between sustainable use and economic development. While it will be useful to compare trade-offs between soil condition and economic goals, decisions about what constitutes sustainability will come down to the preferences of those who live in the community and those who use the mountain ecosystem services.

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There has been a steady increase in anthropogenic pressure over the past few years due to rapid industrialization, urbanization and population growth, causing frequent environmental hazards. Threats of global environmental change, such as climate change and sea level rise, will exacerbate such problems. Therefore, appropriate policies and measures are needed for management to address both local and global trends. The book 'Environmental Management' provides a comprehensive and authoritative account of sustainable environmental management of diverse ecotypes, from tropical to temperate. A variety of regional environmental issues with the respective remedial measures has been precisely illustrated. The book provides an excellent text which offers a versatile and in-depth account of management of wide perspectives, e.g. waste management, lake, coastal and water management, high mountain ecosystem as well as viticulture management. We hope that this publication will be a reference document to serve the needs of researchers of various disciplines, policy makers, planners and administrators as well as stakeholders to formulate strategies for sustainable management of emerging environmental issues.

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